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Elevate Prep \_\_\_\_\_  
**ISEE**<sup>®</sup> UPPER  
LEVEL

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**2500+ PRACTICE QUESTIONS**  
\_\_\_\_\_ **2023 EDITION** \_\_\_\_\_

**ANSWER EXPLANATIONS**

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# ISEE Upper Level 2500+ Practice Questions

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## Answer Explanations

These answer explanations cover all 2500+ questions in our 2023 edition book. We do not have answer solutions for our previous editions, but if you need help with any problems from our earlier editions, please contact us at [info@elevateprep.com](mailto:info@elevateprep.com).

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# Verbal Course

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## Verbal Course

### Synonyms Set 1

1. **Oblivious** means unaware of something. For example, if you have headphones in, you might be **oblivious** to someone trying to talk to you. This is closest in meaning to answer choice (A) **ignorant**.
2. **Hinder** means to delay or make something more difficult. For example, if you are trying to drive in a snowstorm, the slippery conditions may **hinder** your ability to travel. This is closest in meaning to answer choice (C) **obstruct**.
3. **Apprehensive** means anxious or fearful that something bad is going to happen. For example, if you have a fear of heights, you would probably be **apprehensive** about skydiving. This is closest in meaning to answer choice (B) **uneasy**.
4. **Abide** means to accept or follow a rule or recommendation. For example, if you don't **abide** by the rules your parents set, you might get in trouble. This is closest in meaning to answer choice (C) **heed**.
5. **Amicable** means friendly or agreeable. For example, after a disagreement with someone you love, you try to come to an **amicable** solution. This is closest in meaning to answer choice (A) **cordial**.
6. **Pester** means to annoy or bother. For example, many times younger siblings like to **pester** their older brothers and sisters. This is closest in meaning to answer choice (C) **aggravate**.
7. **Adversity** means difficulty or challenge. For example, losing someone close to you would probably create emotional **adversity** in your life. This is closest in meaning to answer choice (B) **misfortune**.
8. **Confiscate** means to take or seize with authority. For example, your teacher might **confiscate** your cell phone if you use it in class. This is closest in meaning to answer choice (B) **commandeer**.
9. **Preserve** means to keep something in its original state. For example, putting food in the refrigerator helps to **preserve** it. This is closest in meaning to answer choice (D) **maintain**.
10. **Contravene** means to break a rule or law. For example, using someone's music in a YouTube video without their permission would probably **contravene** copyright laws. This is closest in meaning to answer choice (B) **violate**.
11. **Obligatory** means required by law or rule. For example, wearing a seatbelt while driving is **obligatory** under the law. This is closest in meaning to answer choice (D) **mandatory**.

12. **Glib** means smooth talking or superficial. For example, a car salesman could be described as being **glib** when selling you a new car. This is closest in meaning to answer choice **(B) insincere**.
13. **Verbose** means using too many words. For example, many times it is hard to understand overly technical books because the writing is so **verbose**. This is closest in meaning to answer choice **(B) wordy**.
14. **Vigilance** means keeping a careful watch. For example, if you are a security guard your job might require long hours of **vigilance**. This is closest in meaning to answer choice **(D) observation**.
15. **Ominous** means giving the impression that something bad is going to happen. For example, in a movie, rain clouds and darkness are often an **ominous** sign. This is closest in meaning to answer choice **(A) portentous**.
16. **Replete** means well supplied with something. For example, many children's books are **replete** with pictures. This is closest in meaning to answer choice **(B) filled**.
17. **Languid** means lacking speed or quickness in movement. For example, most turtles move at a **languid** pace. This is closest in meaning to answer choice **(D) relaxed**.
18. **Insolent** means showing an arrogant lack of respect. For example, if you are **insolent** with your teacher, you will probably get detention. This is closest in meaning to answer choice **(B) rude**.
19. **Archaic** means very old or old-fashioned. For example, cavemen used very primitive and **archaic** tools compared to what we have today. This is closest in meaning to answer choice **(C) ancient**.
20. **Profound** means very great or intense. For example, many of Albert Einstein's ideas were considered **profound**. This is closest in meaning to answer choice **(C) intense**.
21. **Perfunctory** means something done with minimal effort. For example, a soccer player jogging slowly up and down the field during a game would be giving a **perfunctory** effort. This is closest in meaning to answer choice **(B) halfhearted**.

### Synonyms Set 2

1. **Empathetic** means being able to understand and share the feelings of someone else. For example, if you recently went through a break up, you would probably be **empathetic** towards a friend who is going through the same thing. This is closest in meaning to answer choice **(B) compassionate**.
2. **Flawless** means without any blemishes or imperfections. For example, many makeup companies promise that their products will give you **flawless** skin. This is closest in meaning to answer choice **(B) unblemished**.

3. **Original** means first or earliest version. For example, the **original** Mona Lisa is one of the most expensive pieces of art in the world. This is closest in meaning to answer choice **(C) authentic**.
4. **Pretentious** means exaggerated importance or worth. For example, wearing big jewelry and talking about your mansion might be considered **pretentious**. This is closest in meaning to answer choice **(C) pompous**.
5. **Impartial** means fair and just. For example, judges are supposed to be **impartial** when making decisions on cases. This is closest in meaning to answer choice **(B) neutral**.
6. **Frugal** means economical in regard to money. For example, using coupons and shopping for things on sale would be considered **frugal** things to do. This is closest in meaning to answer choice **(D) thrifty**.
7. **Indignant** means feeling or showing anger at being treated unfairly. For example, if you feel that you were fired from your job without a good reason you might become **indignant**. This is closest in meaning to answer choice **(B) resentful**.
8. **Submissive** means likely to listen or obey someone else. For example, a dog that obeys commands could be considered **submissive** to his/her owner. This is closest in meaning to answer choice **(D) compliant**.
9. **Anomaly** means something that is not normal or standard. For example, if you are a straight A student and then you fail a quiz, it would probably be considered an **anomaly**. This is closest in meaning to answer choice **(A) oddity**.
10. **Abridged** means something that has been made shorter in length. For example, during slow times a restaurant might have **abridged** hours to cut costs. This is closest in meaning to answer choice **(C) shortened**.
11. **Acclimate** means to become accustomed to new conditions. For example, when you move to a new city, it might take you a while to **acclimate** to your new surroundings. This is closest in meaning to answer choice **(B) adjust**.
12. **Obsolete** means no longer produced or used. For example, cassette tapes are pretty much **obsolete** in today's world of iTunes and Spotify. This is closest in meaning to answer choice **(A) outdated**.
13. **Ancillary** means supplementary or extra. For example, Apple develops many **ancillary** services to support its main products. This is closest in meaning to answer choice **(C) additional**.

14. **Circumspect** means unwilling to take risks. For example, celebrities are often very **circumspect** when talking to the media so that what they say does not get misconstrued. This is closest in meaning to answer choice **(A) wary**.
15. **Taint** means to tarnish or pollute something. For example, dumping toxic waste into a stream would most likely **taint** the water. This is closest in meaning to answer choice **(C) contaminate**.
16. **Emancipate** means to set free. For example, a child might feel that the only way to **emancipate** themselves is to move out of their parents house. This is closest in meaning to answer choice **(B) liberate**.
17. **Taunt** means to challenge someone with insulting remarks. For example, a bully will usually **taunt** the people he or she bullies. This is closest in meaning to answer choice **(D) provoke**.
18. **Prestigious** means inspiring respect and admiration. For example, Harvard is considered a very **prestigious** school to graduate from. This is closest in meaning to answer choice **(A) distinguished**.
19. **Sardonic** means cynically humorous. For example, on the show The Fresh Prince of Bel-Air, the character Jeffery had a very **sardonic** personality. This is closest in meaning to answer choice **(C) mocking**.
20. **Renounce** means to formally give up a claim, right, or possession. For example, if a king no longer wants to have his role, he might **renounce** his title. This is closest in meaning to answer choice **(A) abandon**.
21. **Pacify** means to bring peace or soothe. For example, a mediator in a negotiation might have to **pacify** the situation if things get a little too heated. This is closest in meaning to answer choice **(C) calm**.

### Synonyms Set 3

1. **Persistent** means continuing in spite of obstacles or opposition. For example, if a child asks his/her parent for a dog every day despite being told no each time, that child is **persistent**. This is closest in meaning to answer choice **(C) determined**.
2. **Competent** means having the necessary skill or knowledge to do something. For example, when you are getting surgery, you want your doctor to be highly **competent**. This is closest in meaning to answer choice **(B) capable**.

3. **Naive** means having or showing a lack of experience. For example, a con man usually tries to take advantage of a **naive** person who doesn't realize they are being tricked. This is closest in meaning to answer choice **(B) unsophisticated**.
4. **Exasperate** means to irritate or annoy intensely. For example, waiting in line for hours to buy tickets to a concert, only to find out that they are sold out, would probably **exasperate** someone.. This is closest in meaning to answer choice **(C) frustrate**.
5. **Decadent** means rich and/or luxurious, self-indulgent. For example, some rich celebrities have a wealthy and **decadent** lifestyle. This is closest in meaning to answer choice **(D) indulgent**.
6. **Lucid** means easy to understand. For example, an eye-witness to a crime may be able to give a fairly **lucid** account of what happened. This is closest in meaning to answer choice **(A) coherent**.
7. **Concurrent** means happening at the same time as something else. For example, if you want to watch 2 **concurrent** football games, you will need 2 TVs. This is closest in meaning to answer choice **(C) simultaneous**.
8. **Deference** means humble respect. For example, a smart lawyer will always act with **deference** to the judge presiding over his/her case. This is closest in meaning to answer choice **(A) reverence**.
9. **Augment** means to make something greater by adding to it. For example, many young professionals will **augment** their income by getting a side job. This is closest in meaning to answer choice **(A) supplement**.
10. **Bellicose** means showing aggression or willingness to fight. For example, a group of **bellicose** protestors might riot if provoked. This is closest in meaning to answer choice **(C) antagonistic**.
11. **Avarice** means extreme desire for wealth. For example, some people see John D. Rockefeller as the pinnacle of **avarice**. This is closest in meaning to answer choice **(B) greed**.
12. **Livid** means extremely angry. For example, if you crash your best friend's new car, they will probably be **livid**. This is closest in meaning to answer choice **(D) furious**.
13. **Wary** means careful and watchful of potential dangers. For example, if you are walking alone at night, you might be **wary** of your surroundings. This is closest in meaning to answer choice **(A) cautious**.
14. **Dubious** means doubtful. For example, many people are **dubious** of get rich quick schemes. This is closest in meaning to answer choice **(C) uncertain**.

15. **Allege** means to assert that something is true. For example, a store owner who has been robbed might **allege** to know the identity of the thief. This is closest in meaning to answer choice (A) **claim**.
16. **Indolent** means wanting to avoid activity or exertion. For example, some people are quite **indolent** on the weekends and don't get much done. This is closest in meaning to answer choice (D) **lazy**.
17. **Callous** feeling or showing no sympathy. For example, going into work when you have the flu shows a **callous** disregard for your coworker's health. This is closest in meaning to answer choice (A) **insensitive**.
18. **Impoverished** means lacking resources or money. For example, many people in third world countries live an **impoverished** life. This is closest in meaning to answer choice (B) **poor**.
19. **Chagrin** means to feel distressed or embarrassed. For example, if you fail your math test you might be **chagrined** and not want to show your parents. This is closest in meaning to answer choice (C) **humiliated**.
20. **Tangible** means something that can be measured or touched. For example, some people prefer **tangible** books rather than reading on a screen. This is closest in meaning to answer choice (D) **tactile**.
21. **Hallowed** means holy. For example, many christians believe the Vatican is a **hallowed** place. This is closest in meaning to answer choice (B) **sacred**.

#### Synonyms Set 4

1. **Content** means in a state of peaceful happiness. For example, many people would be **content** with their life if they had a loving family and a good home. This is closest in meaning to answer choice (C) **satisfied**.
2. **Discredit** means to prove something is false. For example, you might show your parents a good grade you received on a test to **discredit** their belief that you didn't study. This is closest in meaning to answer choice (C) **disprove**.
3. **Nostalgia** means a sentimental feeling remembering the past. Many adults get a feeling of **nostalgia** when thinking about their high school years. This is closest in meaning to answer choice (D) **recollection**.
4. **Emulate** means to copy or recreate. For example, many people try to **emulate** the style of their favorite celebrity. This is closest in meaning to answer choice (A) **imitate**.

5. **Eloquent** means clearly expressing something. For example, Martin Luther King Jr. was considered to have a very **eloquent** way of speaking. This is closest in meaning to answer choice **(B) articulate**.
6. **Tedious** means tiresome and monotonous. For example, driving across the country might be described as a **tedious** journey. This is closest in meaning to answer choice **(A) unvaried**.
7. **Hamper** means to interfere with or restrict something. For example, bad weather might **hamper** someone's travel plans. This is closest in meaning to answer choice **(D) impede**.
8. **Incessant** means continuing without pause or interruption. For example, a baby might let you know they are hungry with **incessant** crying. This is closest in meaning to answer choice **(B) ceaseless**.
9. **Vow** means an oath or promise. For example, when you get married you make a **vow** to your husband or wife. This is closest in meaning to answer choice **(A) promise**.
10. **Seize** means to take something usually by force or through authority. For example, during a war, one army might **seize** their enemy's weapons. This is closest in meaning to answer choice **(C) capture**.
11. **Prolific** means highly productive. For example, Tom Brady is one of the most **prolific** quarterbacks in history, having won 6 Super Bowls. This is closest in meaning to answer choice **(D) productive**.
12. **Cynical** means distrustful of human decency. For example, if someone has had a very hard life, they may be **cynical** about any good thing that comes their way. This is closest in meaning to answer choice **(B) skeptical**.
13. **Stifle** means to cause someone to not be able to breath properly. For example, smoke from a fire will **stifle** anyone who tries to breathe it in. This is closest in meaning to answer choice **(B) suffocate**.
14. **Meticulous** means having a great attention to detail. For example, when building a model car, you have to be **meticulous** to get all the pieces together correctly. This is closest in meaning to answer choice **(B) precise**.
15. **Superfluous** means exceeding what is necessary. For example, some people think that Bill Gates's wealth is **superfluous**. This is closest in meaning to answer choice **(A) unnecessary**.
16. **Zealous** means having or showing passion for something. For example, a preacher might be very **zealous** while delivering a sermon to his/her church. This is closest in meaning to **(C) passionate**.

17. **Bereave** means to deprive someone of something. For example, the death of a loved one will most likely **bereave** their family of happiness for a time. This is closest in meaning to answer choice **(D) deprive**.
18. **Sage** means wise or prudent. For example, a successful person will probably give you **sage** advice. This is closest in meaning to answer choice **(C) wise**.
19. **Scathing** means severely critical. For example, if an author writes a bad book the reviews he/she receives might be **scathing**. This is closest in meaning to answer choice **(A) scornful**.
20. **Revere** means to feel a deep respect or admiration for someone or something. For example, many children **revere** their favorite athlete. This is closest in meaning to answer choice **(D) admire**.
21. **Stoic** means not affected by or showing feelings. For example, someone who shows little emotion during a funeral might be described as **stoic**. This is closest in meaning to answer choice **(B) apathetic**.

### Synonyms Set 5

1. **Unbiased** means showing no prejudice for or against something. For example, a good reporter will be able to write an **unbiased** story based on facts and not his/her opinions. This is closest in meaning to answer choice **(D) impartial**.
2. **Despair** means the complete loss of hope. For example, a prolonged drought might drive a farmer, who needs rain for his/her crops, to **despair**. This is closest in meaning to answer choice **(C) dejection**.
3. **Lavish** means elaborate or extravagant. For example, many celebrities live in **lavish** homes filled with expensive furnishings. This is closest in meaning to answer choice **(B) luxurious**.
4. **Analyze** means examine carefully. For example, in order to improve in a subject at school, a student needs to **analyze** what he/she did wrong on the previous test. This is closest in meaning to answer choice **(A) scrutinize**.
5. **Feasible** means possible to do or reasonable. For example, it is not usually **feasible** for someone to own 30 different cars. This is closest in meaning to answer choice **(C) practical**.
6. **Serene** means calm or tranquil. For example, the water of a lake on a windless night would be still and **serene**. This is closest in meaning to answer choice **(D) peaceful**.
7. **Abate** means to become smaller or less intense. For example, Tylenol and Advil might help to **abate** pain caused by an injury. This is closest in meaning to answer choice **(A) diminish**.

8. **Absolve** means to declare someone free of blame or responsibility. For example, a defense lawyer uses evidence to help to **absolve** his/her client from what they are accused of. This is closest in meaning to answer choice **(C) pardon**.
9. **Disparage** means to lower in rank or value. For example, some politicians use ads where they **disparage** and talk badly about their opponents. This is closest in meaning to answer choice **(B) depreciate**.
10. **Exalt** means to hold something in very high regard. For example, someone who is conceited might **exalt** their accomplishments. This is closest in meaning to answer choice **(A) glorify**.
11. **Vexed** means annoyed or frustrated. For example, you might be **vexed** if your boss asks you to stay late at work on short notice. This is closest in meaning to answer choice **(D) irritated**.
12. **Imminent** means about to happen. For example, right before a volcano erupts, anyone who is near it is in **imminent** danger. This is closest in meaning to answer choice **(D) impending**.
13. **Anguish** means severe mental or physical pain or suffering. For example, a trip to the dentist when you have a cavity might cause you a lot of **anguish**. This is closest in meaning to answer choice **(C) agony**.
14. **Adamant** means insistent or refusing to be persuaded. For example, your parents might be **adamant** that you are home by 11 pm on weekends. This is closest in meaning to answer choice **(B) firm**.
15. **Grave** means significant or serious. For example, leaving an iron on in your house could be a **grave** mistake as it might lead to a fire. This is closest in meaning to answer choice **(B) profound**.
16. **Dilapidated** means broken down or old. For example, an abandoned house might be **dilapidated** and falling apart from years of neglect. This is closest in meaning to answer choice **(A) shabby**.
17. **Raucous** means loud and possibly disorderly. For example, the crowd at a college basketball game might become **raucous** if they feel the referee makes a bad call. This is closest in meaning to answer choice **(A) noisy**.
18. **Precarious** means dependent on chance or uncertain. For example, walking across a river on a log is a **precarious** situation as you might fall in the water. This is closest in meaning to answer choice **(C) risky**.
19. **Banal** means lacking in originality. For example, many songs today are **banal** and sound just like every other song. This is closest in meaning to answer choice **(D) cliched**.

20. **Complicit** means associated with doing something, usually committing a crime. For example, a security guard would be **complicit** in a robbery if he/she unlocked the doors for the criminals. This is closest in meaning to answer choice **(A) involved**.
21. **Shrewd** means savvy or sharp-witted. For example, a **shrewd** negotiator will often come out of a negotiation gaining more than he/she lost. This is closest in meaning to answer choice **(C) astute**.

### Synonyms Set 6

1. **Credibility** means the quality of being trustworthy. For example, Michael Jordan has a lot of **credibility** when talking about basketball because he's one of the greatest players ever. This is closest in meaning to answer choice **(A) validity**.
2. **Mediocre** means not very good or of moderate quality. For example, if you go out to eat and the food is just ok, you might say the restaurant is **mediocre**. This is closest in meaning to answer choice **(D) average**.
3. **Accredit** means to attribute or give credit to. For example, most people **accredit** Benjamin Franklin with inventing the lightning rod. This is closest in meaning to answer choice **(B) attribute**.
4. **Entrust** means to put something into someone's care or protection. For example, parents often **entrust** their children's safety to a babysitter when they go out. This is closest in meaning to answer choice **(C) assign**.
5. **Abasement** means the act of degrading someone. For example, a politician involved in a scandal might have to endure years of **abasement**. This is closest in meaning to answer choice **(A) humiliation**.
6. **Devious** means not straightforward and/or deceptive. For example, a **devious** salesperson might lie in order to make a sale. This is closest in meaning to answer choice **(D) cunning**.
7. **Travesty** means a distorted or inferior imitation. For example, allowing students to cheat on tests would be a **travesty** of education. This is closest in meaning to answer choice **(C) perversion**.
8. **Tranquil** means calm or free from disturbance. For example, snow falling gently onto an open field is a very **tranquil** scene. This is closest in meaning to answer choice **(B) still**.
9. **Eccentric** means unusual or slightly strange. For example, painting your house like a rainbow would be an **eccentric** thing to do. This is closest in meaning to answer choice **(B) unconventional**.

10. **Facsimile** means an exact copy. For example, if a child looks identical to their parent, people might say he/she is almost a **facsimile**. This is closest in meaning to answer choice **(A) replica**.
11. **Indigenous** means originating or occurring naturally in a place. For example, Native Americans are the **indigenous** people of The United States. This is closest in meaning to answer choice **(B) native**.
12. **Abdicate** means to renounce or give up your position. For example, because of a scandal, a king may be forced to **abdicate** his throne. This is closest in meaning to answer choice **(B) resign**.
13. **Profuse** means abundant or plentiful. For example, if a region gets a lot of rain, farmers will usually have a **profuse** harvest. This is closest in meaning to answer choice **(C) ample**.
14. **Ameliorate** means to make something better. For example, school reform will help to **ameliorate** the education system. This is closest in meaning to answer choice **(B) enhance**.
15. **Innate** means natural or existing from birth. For example, while Tiger Woods has worked very hard to get where he is today, he also has a lot of **innate** abilities. This is closest in meaning to answer choice **(C) instinctive**.
16. **Facade** means the front of a building or an outward appearance. For example the White House has a very famous **facade**. This is closest in meaning to answer choice **(D) front**.
17. **Smite** means to strike with a firm blow. For example, in medieval times, knights would try to **smite** their enemies with a sword on the battlefield. This is closest in meaning to answer choice **(A) strike**.
18. **Truncate** means to cut short. For example, due to the global pandemic and less sales, many stores had to **truncate** their hours to save on costs. This is closest in meaning to answer choice **(B) shorten**.
19. **Jeer** means to make rude or mocking remarks. For example, at a sporting event, the fans of the opposing team might **jeer** the players of that team. This is closest in meaning to answer choice **(C) taunt**.
20. **Reproach** means to find fault with. For example, a teacher might **reproach** a student for acting irresponsibly in the classroom. This is closest in meaning to answer choice **(D) accuse**.
21. **Procure** means to get possession of something. For example, if you are trying to start a business, you might go to a bank to try to **procure** a loan. This is closest in meaning to answer choice **(A) obtain**.

## Synonyms Set 7

1. **Forthcoming** means candid or cooperative. For example, many times actors aren't very **forthcoming** about upcoming movies because they don't want to give any spoilers. This is closest in meaning to answer choice **(D) informative**.
2. **Gullible** means easily persuaded to believe something. For example, a con man will often look for the most **gullible** person to take advantage of. This is closest in meaning to answer choice **(C) naive**.
3. **Contempt** means a disregard or lack of respect for something. For example, if you are speeding down the road in dangerous conditions, you are acting with **contempt** for the safety of the drivers around you. This is closest in meaning to answer choice **(C) disdain**.
4. **Entropy** means lack of order or predictability. For example, you can prevent your kitchen from falling into **entropy** by storing everything in its rightful place. This is closest in meaning to answer choice **(A) disorder**.
5. **Scarcity** means a shortage. For example, during a drought there is a **scarcity** of water. This is closest in meaning to answer choice **(B) lack**.
6. **Squander** means to waste something in a reckless way. For example, many lottery winners **squander** all their money by spending it on expensive cars and other luxury items. This is closest in meaning to answer choice **(D) waste**.
7. **Innumerable** means too many to be counted. For example, the amount of stars in the sky could be described as **innumerable**. This is closest in meaning to answer choice **(D) numerous**.
8. **Placate** means to make someone less angry or hostile. For example, politicians will often attempt to **placate** the public with promises of change. This is closest in meaning to answer choice **(B) pacify**.
9. **Irate** means feeling extreme anger. For example, your parents might be **irate** if you accidentally crash the family car. This is closest in meaning to answer choice **(A) fuming**.
10. **Biased** means unreasonably liking or disliking something based on personal opinions. For example, liking a certain political party just because your family does is a **biased** opinion. This is closest in meaning to answer choice **(C) prejudice**.
11. **Admonish** means to warn or scold someone. For example, a librarian might **admonish** children about excessive noise. This is closest in meaning to answer choice **(D) reprimand**.

12. **Ambivalent** means having mixed feelings about something or someone. For example, if you love some parts of your job but hate other parts, your feelings on your job are **ambivalent**. This is closest in meaning to answer choice (C) **unsure**.
13. **Auspicious** means favorable or conducive to success. For example, a party is an **auspicious** time to ask for donations to a charity because everyone is happy and feeling good. This is closest in meaning to answer choice (A) **opportune**.
14. **Devout** means totally committed to a cause or belief. For example, a **devout** christian will rarely miss going to church on Sundays. This is closest in meaning to answer choice (B) **pious**.
15. **Ingenuity** means the quality of being clever or inventive. For example, Elon Musk has shown a lot of **ingenuity** in creating multiple successful companies over his career. This is closest in meaning to answer choice (D) **inventiveness**.
16. **Inflammable** means easily set on fire. For example, gasoline is a very **inflammable** substance because it will catch on fire with little effort. This is closest in meaning to answer choice (A) **combustible**.
17. **Appalling** means very bad or awful. For example, some people around the world live in **appalling** conditions without much food or water. This is closest in meaning to answer choice (B) **horrific**.
18. **Reconciliation** means the restoration of friendly relations. For example, after a fight with a friend, you might want to try to come to some sort of **reconciliation** and make amends. This is closest in meaning to answer choice (B) **settlement**.
19. **Hackneyed** means lacking in originality. For example, many songs today are **hackneyed** and sound just like every other song. This is closest in meaning to answer choice (A) **trite**.
20. **Vilify** means to speak ill of someone or defame them. For example, if a celebrity makes an offensive comment in public, the press might try to **vilify** them. This is closest in meaning to answer choice (D) **disparage**.
21. **Rebuke** means to express disapproval or criticism of someone. For example, a parent will probably **rebuke** a misbehaving child. This is closest in meaning to answer choice (C) **chastise**.

### Synonyms Set 8

1. **Ambiguous** means unclear or inexact. For example, if a movie has an **ambiguous** plot, no one will be able to follow what is going on. This is closest in meaning to answer choice (B) **obscure**.

2. **Optimal** means most desirable or best. For example, a hot sunny day is the **optimal** time to go to the beach. This is closest in meaning to answer choice **(A) favorable**.
3. **Synchronize** means occur at the same rate or time. For example, during a movie, the sound and picture have to **synchronize** perfectly. This is closest in meaning to answer choice **(B) harmonize**.
4. **Trivial** means of little value or importance. For example, a book can feel boring if it contains too many **trivial** or unimportant details. This is closest in meaning to answer choice **(D) insignificant**.
5. **Transient** means lasting for only a short time. For example, a shooting star is **transient** and easy to miss if you're not looking. This is closest in meaning to answer choice **(A) fleeting**.
6. **Fallible** means capable of making mistakes. For example, all humans are **fallible** and make mistakes, so we should try not to judge other people too quickly. This is closest in meaning to answer choice **(C) flawed**.
7. **Belligerent** means aggressive. For example, a dog might become **belligerent** if you attempt to take his food while he is eating. This is closest in meaning to answer choice **(D) hostile**.
8. **Volatile** means tending to fluctuate sharply and rapidly. For example, the price of gasoline can be **volatile** and change drastically in a short amount of time. This is closest in meaning to answer choice **(A) unpredictable**.
9. **Futile** means serving no useful purpose. For example, many times arguing with a stubborn person is a **futile** exercise. This is closest in meaning to answer choice **(B) pointless**.
10. **Apathetic** means showing or feeling no interest or enthusiasm. For example, if you are **apathetic** about studying for a test, you probably won't get a good grade. This is closest in meaning to answer choice **(A) indifferent**.
11. **Impeccable** means flawless or faultless. For example, a diamond without any flaws or imperfections could be described as **impeccable**. This is closest in meaning to answer choice **(C) untarnished**.
12. **Salute** means a gesture of respect. For example, lower ranking officers in the military will often **salute** their superiors as a sign of respect. This is closest in meaning to answer choice **(D) honor**.
13. **Appease** means to pacify or satisfy something or someone. For example, many children eat their vegetables only to **appease** their parents. This is closest in meaning to answer choice **(D) soothe**.

14. **Tenacity** means persistence. For example, a boxer who keeps getting up despite being knocked down multiple times is showing a lot of **tenacity**. This is closest in meaning to answer choice **(A) determination**.
15. **Acquit** means to free from a criminal charge. For example, a lawyer’s job is to get the jury to **acquit** his/her client. This is closest in meaning to answer choice **(D) free**.
16. **Grapple** means a hand to hand struggle. For example, if someone attacks you on the street, you might **grapple** with them in self defense. This is closest in meaning to answer choice **(B) wrestle**.
17. **Fervent** means having or displaying intensity. For example, on a hot day the sun’s rays are **fervent**. This is closest in meaning to answer choice **(A) ardent**.
18. **Recluse** means a person who lives a solitary life. For example, if you don't have many friends and never leave your house, you might be described as a **recluse**. This is closest in meaning to answer choice **(D) hermit**.
19. **Garrulous** means excessively talkative. For example, if the passenger next to you on a plane talks to you the whole flight, they would be described as **garrulous**. This is closest in meaning to answer choice **(B) talkative**.
20. **Coveted** means greatly desired. For example, wealth and success are **coveted** by many people. This is closest in meaning to answer choice **(C) envied**.
21. **Eschew** means to deliberately avoid using or doing something. For example, vegetarians **eschew** any food product that comes from animals. This is closest in meaning to answer choice **(D) abstain**.
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### Single Sentence Completions Set 1

1. **The correct answer is choice (A) diminishing, which means decreasing.** The blank in this sentence is describing the earth’s resources. The sentence is talking about concerned environmentalists who urged corporations to stop wasting the earth's resources before they are completely depleted. If you want someone to stop wasting something before it is completely depleted, that means that right now it is not completely depleted but it is decreasing or **diminishing**.
2. **The correct answer is choice (B) oblivious, which means not aware or or not concerned with something.** The subject of this sentence is a man who has made a series of romantic gestures to a woman named Sarah. Normally if someone was making a series of romantic gestures to another person the person making the gestures would get noticed and possibly get a response. The word

“despite” at the start of the sentence tells us that what we think would normally happen didn’t, so we know that Sarah was not concerned or aware of this man and instead was completely **oblivious**.

3. **The correct answer is choice (A) illogical, which means lacking sense or clear reasoning.** This sentence is talking about experts who questioned the validity of a study after reading it. The blank in this sentence is describing the conclusions of the study. The sentence also mentions that the methodology of the study was faulty, which is a negative descriptor, so we can infer that we are looking for a negative descriptor as our answer choice also. If experts are questioning the validity of a study and the reason is because the methodology is faulty, then it would make sense that the conclusions of that study would lack clear sound reasoning or be **illogical**.
4. **The correct answer is choice (C) biased, which means unfairly prejudiced for or against something or someone.** The sentence is talking about a mother who removed herself from the judging panel of a beauty contest that her daughter was competing in. The blank in this sentence is describing what she feared her opinions would be and is the reason she removed herself. The sentence gives us no reason to believe that her opinions would be squandered or wasted, inadequate, or innovative, so we can eliminate those choices. If we think about it, it makes sense that if a mother was judging her own daughter in a contest, her opinions might be unfairly in favor of her daughter or **biased**.
5. **The correct answer is choice (B) inferior, which means lower in quality.** This sentence is describing how a person feels about his classmates laptops when compared to his own. The blank is referring to the features and specifications of the subject's laptop. The second part of the sentence says that the subject of the sentence did not feel his classmates' laptops justified their high price tag. Normally if someone didn’t feel that a classmate's laptop was worth the price compared to their own, we would assume that their laptop was at least equal if not better than their classmates. However, the word “though” at the start of the sentence tells us that something is up and we should be looking for an answer that goes against what we would normally think. Instead of the subject's laptop being equal or superior, it is actually lower quality or **inferior** compared to his classmates.
6. **The correct answer is choice (C) aptitude, which means a natural ability to do something.** This sentence is talking about a girl’s parents encouraging her to join a tennis league. The blank in the sentence is describing what her parents realized about her and athletics and is the reason they encouraged her in the first place. Right off the bat we can eliminate answer choice (B) because it wouldn’t make any sense to encourage someone to do something they hate or loathe. To be able to have empathy for something, that thing has to be able to have feelings and since athletics can’t have feelings, we can eliminate answer choice (A). It also doesn’t make sense to say that someone possessed a fortitude for athletics, so we can eliminate answer choice (D). If her parents are encouraging her to join the tennis team it is most likely because she is good at or has an **aptitude** for athletics.

7. **The correct answer is choice (D) flawless, which means without imperfections or blemishes.** The sentence is talking about a person who is a desirable candidate for a role. The blank is describing what this person is NOT. The sentence tells us that this person has high ethical standards and unwavering compassion and that this is what made him a desirable candidate. Typically if someone was described this way, people might think that person was perfect, but because this sentence starts with the word “though” we are looking for an answer that goes against what we would normally think. The sentence is saying that despite this person possessing some very positive attributes, he is not a **flawless** character.
8. **The correct answer is choice (A) mediocre, which means of only moderate quality or not very good.** The subject of this sentence is a dancer who is disappointed. The reason she is disappointed has to do with her performance at a dance recital. The blank in this sentence is describing how her performance went. From that alone we can infer that the answer choice is going to be a negative descriptor because she wouldn’t be disappointed if her performance went well. The only answer choice that has a negative connotation is **mediocre**.
9. **The correct answer is choice (B) subtle, which means difficult to perceive or understand.** This sentence is talking about a person who didn’t notice that he upset a woman. The blank in this sentence is describing the woman’s angry notes in her rebuttal. If the man didn’t recognize that the woman was upset then her angry notes must not have been very noticeable or easy to perceive. Not easily perceived or noticed is the same thing as **subtle**.
10. **The correct answer is choice (C) plausible, which means seeming possible.** The sentence is talking about a man’s proposed solution to a company’s problem. The blank in this sentence is describing that solution. The sentence starts off with the word “though” which lets us know that the sentence will most likely contain contrasting ideas. The second part of the sentence says that the solution was too expensive to execute in a timely manner, which would usually point to a bad solution or one that at least wouldn’t appear to be good. In this case however, the contrasting idea is that the solution was actually possible or **plausible**, just not in the time that was available.
11. **The correct answer is choice (A) adversities, which means difficulties or misfortunes.** This sentence is describing the subject, Rachel, as an optimist. An optimist is someone who is hopeful and positive about their future, even when times are hard. The answer we are looking for needs to show that Rachel is an optimist. Answer choices (C) and (D) have nothing to do with being an optimist, so we can cross them out. Answer choice (B) could work, but it is not the best choice we have, so we can cross it out too. To really show Rachel is an optimist, the sentence is saying that even when her life is hard and she’s experiencing challenges, she chooses to view those **adversities** as opportunities for growth, which is the definition of optimism.
12. **The correct answer is choice (C) abusive, which means extremely offensive or insulting.** The sentence is describing a company that has battled an increasingly high turnover rate and internal complaints. A turnover rate is the rate at which a company hires new employees, either because

they are fired or quit. We can infer that in this case most of them quit because the company was also dealing with internal harassment complaints. Overall this does not seem like a very good work environment to be in. The blank in this sentence is describing the type of practices the company used against its employees, so we know we are looking for an answer that would cause the work environment to be so bad. The only type of practices that would cause a workplace to be this bad would be offensive or **abusive** practices.

- 13. The correct answer is choice (B) optimal, which means best or most favorable.** This sentence is describing a man who consumes three nutritious meals a day and exercises regularly. The blank is describing the type of health he is trying to achieve by doing this. If we think about it, eating healthy food and getting exercise are both things that doctors and fitness experts recommend to do, so it would make sense that he was doing this to achieve the best or **optimal** health.
- 14. The correct answer is choice (C) coincidental, which means happening by chance.** The sentence is talking about a police officer dealing with a suspect and the suspect was the last person to see the victim before his disappearance. If someone disappears and you were the last one to see them, that might seem a little fishy, or make it look like you were involved somehow. The blank in this sentence is describing what the police officer does NOT suspect about this situation. If the police officer has the same feeling that most people would have and thought that the situation seemed a bit fishy, he would NOT think the suspect was the last person to see the victim by chance or that it was **coincidental**.
- 15. The correct answer is choice (A) appalling, which means horrific or very bad.** The sentence is talking about a babysitter and a badly behaved toddler. The blank is describing how the babysitter felt about the toddler's behavior. The sentence tells us that the toddler exhibited violent behavior and had a complete inability to follow instructions. If you were babysitting a child and they acted this way you wouldn't think their behavior was cute or charming, so answer choice (B) is incorrect. Answer choices (C) and (D) do not have anything to do with how someone would feel in this situation, so they are also incorrect. It would make sense in this situation for the babysitter to think the toddler's behavior was horrific or **appalling**.
- 16. The correct answer is choice (D) innovations, which means new methods, ideas, or products.** The sentence is talking about the software industry retiring old technologies. The blank in this sentence is the reason these companies decided to do this. If a company decided to get rid of their old technologies for something new, it is probably because there is some sort of better new product or idea. So the answer we are looking for is new products or ideas, which is another way of saying **innovations**.
- 17. The correct answer is choice (D) affluent, which means wealthy.** The sentence is about a man who realized something about his hosts. The man saw a bunch of luxury cars in the host's driveway and the blank is referring to what he now realized. If you see a bunch of luxury cars in someone's

driveway, you would probably assume the people who lived there were pretty wealthy or **affluent**, or else they wouldn't be able to afford the luxury cars in the first place.

- 18. The correct answer is choice (C) originality, which is the quality of being unique, new, or unusual.** This sentence is describing a professor who critiqued his/her students' thesis for lacking something. The blank in the sentence is what the thesis was lackin. To figure out which answer is correct, we have to read the second part of the sentence. The professor's critique was that the students paper covered basic subject matter that has been explored in-depth dozens of times, or put another way it lacked new ideas or **originality**.
- 19. The correct answer is choice (B) diversity, which means variety or being composed of many different elements.** The second part of this sentence says that the employer wanted to invite a broader spectrum of opinions into the collective corporate thought. Basically he/she wanted to have more unique opinions in the company than they did now. The blank is describing what the employer expanded in order to try to accomplish this. If you wanted to have more unique and varied opinions at a company, it would make sense that you would try to hire or bring in more unique and varied people to the labor force. This is another way of saying bring **diversity** to the labor force.
- 20. The correct answer is choice (B) competencies, which means abilities to successfully do something.** In the sentence, Marcus is shocked that he wasn't selected for the promotion because something of his far exceeded his competition's in all technical aspects. If Marcus was shocked that he didn't get the promotion, then that means he expected it. If he expected the promotion then he must have felt that his abilities to succeed or **competencies**, exceeded that of his competition.

### Single Sentence Completions Set 2

- 1. The correct answer is choice (B) accredit, which means to officially recognize or authorize a person or organization.** If we look at the first part of the sentence, it says that the administrator felt it was unjust that the government refused to "blank" her institution, so we know that whatever the government failed to do was something the administrator wanted. If we look at the second part of the sentence it says that the administrator's school far exceeded the necessary requirements to qualify, so we know the blank has to do with his/her school qualifying for something. The only answer choice that a school would want to or be able to qualify for is **accreditation**.
- 2. The correct answer is choice (C) serene, which means peaceful or calm.** The first part of the sentence says she drove to the beach when she felt mentally overwhelmed. When you feel mentally overwhelmed it would make sense that you would try to unwind or calm yourself down. The blank is describing the waters of the ocean and the second part of the sentence says that the waters provoked a sense of peace in her mind. Since the ocean's waters brought her peace, we wouldn't think that they would be rough and chaotic, instead it makes sense that they would be calm or **serene**.

3. **The correct answer is choice (A) hinder, which means to create difficulties for someone or something.** The subject of this sentence did something to her boyfriend's career opportunities abroad so that she could keep him close by. The beginning of the sentence tells us that she feels guilty about her deception, so we know we are looking for an answer that could be considered deceitful or sneaky. If her boyfriend's career opportunities abroad worked out, he would most likely have to move away in order to take the job, so it makes sense that if she wanted him to stay close by she would try to obstruct or **hinder** those opportunities.
4. **The correct answer is choice (C) evoked, which means to make someone remember something or feel an emotion.** The sentence is set at a funeral and the subject is a mother who gave a heartfelt speech at her child's funeral. The blank is describing how the speech affected the audience. A funeral is already a sad occasion and a heartfelt speech would only add to that sadness, so it makes sense that the mother's speech made the audience feel, or **evoked**, a strong sense of sorrow and sympathy.
5. **The correct answer is choice (D) innate, which means present from birth or natural.** The sentence is describing someone who struggled to understand Dutch despite having studied it for three years. That would lead us to believe that maybe the subject of the sentence isn't very good at learning languages but the word "though" at the beginning of the sentence tells us that something is off. Since the sentence starts off with though, that tells us that the subject probably is good at learning languages and is struggling despite this fact. If the subject is good at learning languages then it would make sense that she would have a natural or **innate** aptitude for it.
6. **The correct answer is choice (B) cynicism, which means distrust or skepticism.** This sentence is about Judy and how she approached relationships. The sentence tells us that Judy has had a lifetime of betrayal from lifelong friends and family members. If we think about how someone would feel about relationships if the people who were closest to them (their friends and family) consistently betrayed them, it makes sense that they might be wary or approach new relationships with **cynicism**.
7. **The correct answer is choice (A) vital, which means necessary or essential.** The sentence is about an arrogant girl who gets removed from a group project by the other group members and the blank is describing the arrogant girl's skill set. Removing someone from a group project would only happen if the rest of the group felt that they could complete the project without the person that was removed. This would mean the removed person's skill set was not necessary or **vital** to the completion of the project.
8. **The correct answer is choice (D) hyperbole, which means exaggerated claims or statements.** This sentence is talking about Amy and her friends not being sure if she is telling the whole truth when she is telling stories. If we think about why someone would not fully believe you when you

tell a story, it makes sense that the reason could be because you tend to exaggerate certain details or inject **hyperbole** into the stories you tell, making it hard to know what actually happened.

9. **The correct answer is choice (A) tangible, which means physical or able to be touched.** This sentence is contrasting Julianne and her sister. The first word in the sentence, “while”, tells us that the sentence is most likely going to discuss two opposing ideas. The first part of the sentence says that Julianne was completely satisfied with receiving love and respect from her partner. Love and respect are examples of more abstract ideas and not something you can hold or see with your eyes. In contrast to this Julianne’s sister preferred more **tangible** gifts that could be held or touched, such as jewelry or clothing.
10. **The correct answer is choice (A) entrusted, which means to put something in someone’s care or protection.** The sentence is talking about Jeremy providing care for his girlfriend’s dog while she traveled abroad. This sentence gives clues to the answer we are looking for in the words it uses, ie. providing care. Giving someone the task of providing care for something is another way of saying you are **entrusting** them with that task. While answer choice (C) does make sense grammatically, it is not the best answer because it does not specifically imply that the task will require providing care.
11. **The correct answer is choice (B) travesty, which means a false, absurd, or distorted representation of something.** The sentence is talking about a newly appointed principal and how she feels about the events happening in one of her new classrooms. The sentence says the principal witnessed shocking, violent behavior from the students and that witnessing this made her wonder something. The blank in this sentence is describing the education in the classroom, which we know is not what normal education in a classroom would look like. A normal classroom would not have violence, so this classroom could be described as a false representation of what a classroom should look like or a **travesty** of education.
12. **The correct answer is choice (C) amicable, which means having the spirit of friendliness.** This sentence is talking about a man and how he feels about his former wife’s new husband. The sentence starts off by saying that the man will never develop a deep bond with his former wife’s new husband, but that he aimed to be “blank.” The word “but” is a clue that tells us that whatever comes after it is going to contrast or somewhat backtrack on what came before it. We are looking for an answer that is not a deep bond, because the sentence told us that will never happen, but is possibly a lesser version of a deep bond. A lesser version of a deep bond could be that the man would aim to be friendly or **amicable** with his wife’s new husband. The sentence also mentions he will do this for the sake of his children, which when we think about it is a common real life situation and further solidifies our answer choice.
13. **The correct answer is choice (D) pretentious, which means having an inflated self worth especially when it appears undeserved.** The sentence is talking about a teenager named Madison and the blank is describing how society sees her. We know one of the ways society sees her is

entitled, which is usually a negative description of someone. The first word in the sentence, “while”, is a clue that tells us that there are probably two ideas in this sentence that are opposing. The second part of the sentence says that Madison’s “true friends” know she is an authentic character full of compassion and humility. To figure out which answer choice best fits, we have to find the one that is most in contrast with Madison being authentic, full of compassion, and humble. The opposite of humble would be cocky or conceited, which are both associated with having a very high opinion of yourself or being **pretentious**.

- 14. The correct answer is choice (A) indigenous, which means originating or occurring naturally in a particular place.** This sentence is describing how reggae music became the most widespread musical preference in a country. The blank is describing the relationship between reggae music and the region mentioned in the sentence. The word “but” in the middle of the sentence is a clue to us that the first part of the sentence might not exactly line up with the second part. If a certain type of music becomes the most widespread type of music in a country, it would make sense to think that it was probably native to that country, but the word “but” means that is not true and the music was not **indigenous** to the country.
- 15. The correct answer is choice (D) devious, which means cunning or not straightforward.** The sentence is describing Devyn and his character. The blank in the sentence is describing what most in the community recognized about Devyn. The word “but” in this sentence is a clue that the ideas in this sentence won’t perfectly line up with each other. The second part of the sentence tells us that no one in the community could have predicted that Devyn would tell such hateful lies. If no one could predict that he would do something so bad, we would think they probably felt he was a good person, but the word “but” tells us that that’s not the case. If the word “but” was “and” then we would be looking for an answer choice like lawful or credible that would go along with the community being shocked when he did something horrible, but because it says “but” we are looking for an answer choice that points to him being a **devious** character.
- 16. The correct answer is choice (B) chaos, which means complete disorder and confusion.** The sentence is set in a daily briefing between a President and his leading officials. The blank is referring to what is spreading throughout the population as a result of the government’s shortcomings or failings. If a government is failing it would make sense that the population that is being governed would be disorderly and unpredictable and there would be rising **chaos**.
- 17. The correct answer is choice (B) profuse, which means plentiful or abundant.** This sentence is talking about a farmer who is experiencing a drought. The blank is describing the fruits and vegetables the farmer was able to sell. If a region is experiencing a drought that would usually mean that farmers would not have a bountiful harvest because plants tend to not grow well without water. However, the word “but” in the middle of the sentence tells us something is up and we should be looking for an answer choice that goes against our initial instinct, like the farmer harvesting plentiful or **profuse** crops.

- 18. The correct answer is choice (D) indolent which means wanting to avoid exertion or lazy.** The sentence is contrasting a child with her older brother who played numerous sports. The blank is describing the child who the sentence says is “unlike” her brother and prefers to sit on the couch and watch TV. If the child in the sentence is unlike her brother, who plays numerous sports, and prefers to sit around, then she could be described as lazy or **indolent**.
- 19. The correct answer is choice (A) incoherent, which means expressed in an incomprehensible or confusing way.** The subject of this sentence could not identify what his friend was saying as she spoke to him half asleep and the blank is describing the way she is speaking to him. If he could not understand what she was saying then her speech was probably incomprehensible or **incoherent**.
- 20. The correct answer is choice (A) outlandish, which means looking or sounding bizarre or unfamiliar.** The blank in this sentence is describing a person’s mode of dress, or how they dressed while at work. The sentence says that the person’s co-workers compared his/her clothes to that of a clown or a child wearing a strange halloween costume. If someone wore a halloween costume or dressed like a clown at work that wouldn’t be normal, in fact, it would probably be fair to that as bizarre or **outlandish**.

### Single Sentence Completions Set 3

- 1. The correct answer is choice (B) abnormal, which means unusual or strange.** This sentence is comparing how a behavior is perceived depending on what type of person is behaving that way. The sentence says that temper tantrums are considered typical in developing young children. The blank refers to how throwing a temper tantrum would be perceived if an adult did it. The word “but” tells us that the answer we are looking for is going to be in contrast with the idea of typical behavior. The opposite of typical or normal is unusual or **abnormal**. This is further supported by the fact that in real life if we saw an adult throw a temper tantrum that would be strange and not a regular occurrence.
- 2. The correct answer is choice (D) adjoining, which means next to or joined with.** The sentence is describing four factories that burned down as a result of a candle and what the government did as a response to this. In response, the government forbade the development of factories within 50 feet of one another. To find the answer to this question, we have to ask ourselves why would the government forbid factories being built next to each other. If one candle burned down 4 factories, and as a result the government wouldn’t allow factories to be built next to each other, then we can infer that the reason for both of those things was that the factories that burnt down were right next to each other or **adjoining**.
- 3. The correct answer is choice (B) vowed, which means promised.** This sentence is talking about Jason getting in a traumatic car accident and how that affected him. The sentence goes on to say that Jason “blanked” that he would never ride in the car with a drunk driver again. Answer choices (A) and (C) don’t make grammatical sense in the blank so we can cross them out. While Jason

might have proposed or suggested that he would never ride in a car again, that’s not really a strong enough declaration after being in a bad car accident. It makes more sense that he promised or **vowed** to never ride in a car with a drunk driver again.

4. **The correct answer is choice (C) emissions, which means the production and discharge or something.** The sentence starts off by saying a woman was disappointed with something about her new sunglasses. If the woman was disappointed, then her sunglasses must not have been working properly like she expected. The primary function of sunglasses is to block the sun's light from going into your eyes. The sentence says that the sunglasses she purchased failed to effectively block the sun’s “blank” of light. If the primary purpose of sunglasses is to block the sun's light and she was disappointed that hers failed to block something, we can infer that the sunglasses failed to block the sun's discharge or **emissions** of light.
5. **The correct answer is choice (A) augment, which means increase or improve something.** The second part of this sentence tells us that the employees at this company were introverted, or they mostly kept to themselves. We also know that the manager of this company sought to improve collaboration, or working together, through new creative methods. The blank in this sentence is describing what she hoped would happen to the employees social bonds because of this. If the employees were introverted and the manager wanted to promote more working together, we can infer that the manager wanted to improve or **augment** the social bonds of her employees so they would be more likely to collaborate.
6. **The correct answer is choice (B) equipped, which means to prepare someone mentally for a particular task or situation.** This sentence is talking about a mother helping her daughter move into her new college dormitory. The sentence says that the mother hoped that she “blanked” her child with the strength and drive needed for collegiate success. If a mother was sending her daughter off to college she would probably want her to be prepared and have the strength and drive that was needed, so it would make sense that the mother would hope that she prepared or **equipped** her daughter properly.
7. **The correct answer is choice (C) ordinance, which means a piece of legislation or a law.** The blank in this sentence is referring to something the city implemented that prohibited residents from purchasing new vehicles that didn’t meet certain standards. If a city wants to prohibit something usually they would implement a new law or **ordinance** in order to accomplish that. An example of this would be a new law prohibiting residents from parking in a certain area of the city.
8. **The correct answer is choice (D) preserve, which means maintain something in its original state.** This sentence is talking about a couple that is attending marriage counseling. The blank in this sentence is describing why they wanted to do this. If a couple was attending marriage counseling, that would usually indicate that they were having problems in their relationship, which is supported in the sentence when it says their marriage was tumultuous, and they would go to counseling to hopefully help maintain or **preserve** their relationship.

9. **The correct answer is choice (C) analyze, which means assess or examine.** This sentence is talking about a young man realizing what to do in a situation. The blank is describing what the young man did to figure out what to do. If a person is in a situation and they need to figure out what the most ethical course of action is in that situation, then what do they do to figure that out? Typically you would examine or **analyze** all the surrounding information and use that to make your decision.
10. **The correct answer is choice (B) perceptions, which means points of view.** This sentence is talking about a group of people that all agreed some degree of independence was beneficial for development. A clue to the answer choice we are looking for is the word “though” at the start of the sentence, which tells us that there will probably be something unexpected in this sentence. Typically if a group of people all agree on something, we would assume they probably view the word in a similar way, but because the sentence starts off with “though” we are looking for something that is not typical. It would not be typical for a group of people that all agree on something to hold varying points of view or **perceptions**.
11. **The correct answer is choice (A) originate, which means begin or come from something.** This sentence is talking about a professor who refrained from punishing his students. He refrained despite the fact that they had similar ideas for their thesis. The blank in this sentence describes why he did this. The reason students would get punished for having similar thesis ideas would be because the professor thought they somehow cheated or worked together, so if he refrained from punishing the students, he must not have thought this. Since the professor didn’t think the students cheated, it makes sense that he would understand that similar ideas could come from or **originate** from multiple minds.
12. **The correct answer is choice (B) synchronize, which means occur or move at the same time or rate.** This sentence is talking about a dance instructor and her students. The blank is referring to what the instructor wanted her students to do to their choreography. We know whatever it is must be hard to do because the sentence tells us that the instructor understood this was an ambitious goal. If we think about dancers, usually if they are very good they are all dancing or moving at the same time as each other. It makes sense then that the instructor wanted her students to dance at the same time or **synchronize** their choreography. It also makes sense that this might be hard for young students to do perfectly.
13. **The correct answer is choice (C) hazardous, which means dangerous or risky.** The sentence is talking about a police officer who encountered many situations that required her to think quickly to avoid injury. The blank in this sentence is describing those situations. If a situation requires someone to think quickly to avoid injury then it must be a pretty dangerous or **hazardous** situation.
14. **The correct answer is choice (B) impeccable, which means flawless.** This sentence says that Molly failed her latest math test and wanted to tell her friends, but that she didn’t want to tarnish or

ruin her academic reputation. The blank in this sentence is describing Molly’s reputation. If someone doesn’t want to tarnish or ruin something, it is usually because that thing is of high quality or high standard. Since Molly didn’t want to tarnish her reputation, we can infer that her academic reputation must have been without many flaws up until this point, or **impeccable**.

- 15. The correct answer is choice (A) innumerable, which means too many to be counted.** This sentence is talking about historians that remained uncertain of who a region’s original settlers were. The blank is right after the word “despite” which tells us that there are going to be contrasting ideas in this sentence. Typically if historians didn’t know something about a particular region it would be because they hadn’t done enough research or academic explorations into the region. Because the blank is after the word despite, the sentence is saying that even though the historians did do multiple or **innumerable** academic explorations, they still did not know who settled the region.
- 16. The correct answer is choice (C) livid, which means extremely angry.** This sentence is about Nancy and how she felt after discovering that her friend stole jewelry from her and sold it. If we put ourselves in the situation Nancy was in, it would make sense that if someone we trusted deceived us and stole our property, we would be very angry or **livid**.
- 17. The correct answer is choice (D) admonishing, which means reprimanding firmly.** This sentence is talking about a young father who didn’t like to do something to his children and preferred that his spouse do it. Answer choices (B) and (C) do not make sense grammatically, so we can cross them out. Answer choice (A) means feeling a deep respect for someone, so it wouldn’t make sense that a father wouldn’t want to revere his children. It does make sense that a young father might not enjoy reprimanding or **admonishing** his children, but would prefer to let his spouse be the “bad guy”.
- 18. The correct answer is choice (B) devout, which means having deep religious commitment.** The sentence is talking about Katie and how she was dressed more modestly than she preferred because she was visiting a traditionally conservative nation. This nation’s citizens were servants of their religion and the blank in this sentence is describing what kind of servants they were. The clue in this sentence is the reference to the servants’ religion, this tells us that we might be looking for an answer that realtesto religion in some way. Since **devout** means having a deep religious commitment, it makes the most sense in this sentence.
- 19. The correct answer is choice (A) submissive, which means to obey or yield to someone else.** This sentence is describing how when ridiculed by his manager, James yelled back at him and announced he was quitting. The sentence starts off by saying rather than be “blank”, so we know the answer we are looking for is the opposite of however James actually acted. By yelling at his manager and quitting his job, James acted very defiant, and the opposite of defiant is **submissive**.
- 20. The correct answer is choice (C) reconciliation, which means the restoration of friendly relations.** This sentence involves former friends who long for something but don’t believe they

would be able to forgive the transgressions of the other. The word “but” in the middle of the sentence tells us that the ideas in this sentence are probably contrasting. Normally if two people can’t forgive the transgressions of one another, they would not want to be friends again. The contrasting idea to this is that these former friends did want a **reconciliation** or restoration of their friendship.

### Single Sentence Completion Set 4

- 1. The correct answer is choice (B) lucid, which means clear or easily understood.** The sentence is talking about a person who is trying to provide an account of a crime he’s just witnessed, but is unable to because of his drug induced rambling. The blank in this sentence is describing the account that he was unable to give. Describing someone’s speech as drug-induced rambling paints the picture of someone who is not able to speak clearly, so it would make sense that they would be unable to give an easily understood or **lucid** account of something they saw.
- 2. The correct answer is choice (A) distinct, which means distinguishable or easily recognizable.** This sentence is about a woman, Nancy, who encountered a scent of her former lover's cologne. The blank is describing the scent she encountered. The sentence says that whenever Nancy encountered this scent in a crowd of people, she was overwhelmed with longing. If we think about being in a crowd of people, it would usually be pretty hard to pinpoint one smell, so we know the scent had to be more easily distinguishable or **distinct** than usual.
- 3. The correct answer is choice (C) vital, which means absolutely necessary or important.** The subject of this sentence is a man who works in a company. The sentence says that this man took advantage of his manager's leniency and skipped meetings he found boring. The blank in this sentence is describing what type of component this man was for the company's success and why he was able to get away with his behavior. Usually if an employee skips a meeting at work, they would get in some sort of trouble and eventually probably be fired. In this case the sentence does not mention the man getting in trouble, so we can infer that the company values him highly, even if he skips meetings. This means that he must be a very important or **vital** component to the company's success.
- 4. The correct answer is choice (B) pompous, which means arrogant or exhibiting self importance.** The sentence is talking about how everyone started to roll their eyes when Samantha began another account of how she came into wealth. The blank in this sentence is describing the account, along with the word boastful. Usually if someone is boasting they are being arrogant or **pompous**, so it makes sense that everyone rolled their eyes as most people don’t enjoy listening to someone else brag about things.
- 5. The correct answer is choice (C) eclectic, which means taking ideas, style, or taste from a diverse range of sources.** This sentence is talking about a woman who was confused why a restaurant branded itself as Asian. The blank in this sentence is describing the type of menu the

restaurant had. The sentence tells us the reason the woman was confused was because the menu offered various foods from around the world and served very little Asian cuisine. Since the menu served many different foods from around the world, it clearly had tastes from a diverse range of places, so it would be described as **eclectic**.

6. **The correct answer is choice (B) headstrong, which means willful, stubborn, or not easily restrained.** The sentence is talking about Marcus and how he could have avoided an incident. The blank is describing Marcus's nature and how, if he didn't let that override his personal ethics and the well-intentioned advice or people around him, he could have avoided the incident. The sentence seems to imply that this incident was not a good thing and that Marcus would have preferred to be able to avoid it. Even with advice from people around him and having personal ethics, Marcus still could not avoid the incident, so we can infer that he was probably pretty stubborn or **headstrong** in his decision because it seems like nothing could change his mind once he made it up.
7. **The correct answer is choice (A) hyperbole, which are exaggerated statements or claims not meant to be taken literally.** This sentence is talking about a judge who dismisses the accusations of a defendant. The blank in this sentence is describing what the judge thought of the defendants' accusations. The sentence says that the defendant's accusations were exaggerated and that her antics were frenzied. The sentence referring to the defendant's accusations as exaggerated is another way of calling them **hyperbole** and it would make sense for a judge to dismiss them.
8. **The correct answer is choice (C) audacity, which means boldness.** The sentence describes a sister who is shocked by her brother's decision to stand up for himself. Since his sister was surprised by his behavior, we can assume that the behavior that shocked her was not normal. The sentence describes the brother as having a timid and submissive nature, so it makes sense that the sister was shocked when he stood up for himself in an aggressive way. She did not think he had the boldness or **audacity** to behave in this manner based on his normal personality.
9. **The correct answer is choice (D) placated, which means soothed especially by giving someone what they want.** This sentence is describing a babysitter and how she made her evening babysitting simpler. The sentence says that the babysitter satisfied the child's request for more dessert, but did not want to reinforce bad behavior. Since the sentence says the babysitter did this in order to make her night simpler, we can infer that by doing this she calmed or **placated** the child by giving him/her what he/she wanted.
10. **The correct answer is choice (A) curating, which means selecting, organizing, and looking after items.** The sentence is talking about a woman whose manager gives her a big responsibility. The blank in this sentence is describing what the responsibility is that her manager gave her and it has to do with multiple beloved sites around the town. The sentence tells us that the woman does not think her manager should have given her this responsibility because she is new in town, so we can infer that she felt either the responsibility was too big or that someone who knew the town better should do it or both. We know the responsibility has to do with beloved sites in the town, so

it would make sense that the responsibility of looking after them or **curating** them would be very important and probably intimidating to a newcomer to the town who doesn't know as much about the sites as a local would.

- 11. The correct answer is choice (B) invaded, which means trespassed.** This sentence is talking about how Angela's roommate rummaged through her belongings when she thought Angela was not home. The clue to the correct answer in this sentence is the fact that Angela's roommate did this when she thought Angela was not home, so we can infer that her roommate felt that Angela would not approve or allow this. Angela's roommate knew she had trespassed or **invaded** Angela's personal space by entering her room without her permission.
- 12. The correct answer is choice (C) dubious, which means not to be relied upon, or suspicious.** The sentence is talking about a physician not believing his patient's recount of events that led to the patient being stabbed in the thigh. The blank in this sentence is describing that recount. If the doctor did not believe the patient, he must have felt that the patient's story was suspicious or **dubious** and thus could not be trusted.
- 13. The correct answer is choice (D) frivolous, which means not having any serious purpose or value.** The sentence is talking about Hannah and how she refused to spend money on caring for her lawn. The reason Hannah did not spend money on her lawn is because she believed it was an unnecessary expense. Saying something is an unnecessary expense is another way of saying it is **frivolous**.
- 14. The correct answer is choice (C) triumph, which means joy or satisfaction resulting from a success.** The sentence is describing how an audience reacted when listening to a speaker. The sentence says that the audience smiled when they heard something in the speaker's voice, and the blank in this sentence is what they heard. Since the sentence tells us that the audience smiles, we can infer that whatever they heard was something positive or uplifting, so we can eliminate answer choices (A), (B), and (D) because they are neither of those things. It makes the most sense that the audience heard joy or **triumph** in the speaker's voice.
- 15. The correct answer is choice (C) industrious, which means diligent and hard-working.** The subject in this sentence is an employee who was fearful he was going to be fired. The sentence says he feared this despite his "blank" nature, so we know we are looking for an answer that would usually be a desirable trait in an employee. The sentence also says that he did not possess the creative thought process the job required. Between these two clues we can assume that the employee possessed a hard-working or **industrious** nature but lacked the creativity required by this specific job.
- 16. The correct answer is choice (D) pragmatic, which means practical or realistic.** This sentence is talking about a man who wanted to buy a mansion that was recently listed for sale but he can't. The sentence says that the reason he can't is because his desires are financially "blank". If someone

wants to buy something but can't because of a financial reason, usually it's because they can't afford it or because it's financially unrealistic. This is the same as saying that their desires are not **pragmatic**.

17. **The correct answer is choice (A) optimal, which means best or most favorable.** The sentence says that a woman inquired about how her coworker was emotionally fairing when she realized something about him. She did this when she realized that he was operating far below his “blank” performance. Usually if someone asks how you are emotionally fairing, it is because they are worried about you or you are acting differently. In a work setting this could mean that your performance has gone down or that you are not performing at your best or **optimal** level.
18. **The correct answer is choice (C) sanction, which means to give approval or permission for an action.** This sentence is describing an employee who wanted to travel abroad during his weekend vacation. The employee could not do this however because he knew that his employer would not “blank” the trip. If the employee wanted to go but couldn't because of his employer, we can infer that the employer would not allow or **sanction** the employee's trip.
19. **The correct answer is choice (D) obsolete, which means no longer needed.** The chemical engineer in the sentence feared sharing his invention with others and the reason he feared this is the answer we are looking for. The sentence tells us that the engineer sharing his invention would lead to layoffs throughout the nation and that it would make several widespread technologies “blank” If an invention of new technology leads to layoffs, that means that it probably made some older technology no longer needed or **obsolete** and in turn made companies more efficient and require less employees.
20. **The correct answer is choice (A) bellicose, which means demonstrating aggression and willingness to fight.** This sentence is describing a man who encountered a pack of wolves in the woods and because of this he decided to refrain from exploring areas he was unfamiliar with. If encountering the wolves made the man decide to no longer explore areas of the woods he didn't know, we can assume that the wolves probably scared him and were aggressive or **bellicose**.
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### Double Sentence Completions Set 1

1. **The correct answer is choice (C) vain, which means having an excessively high opinion of your appearance, and content, which means satisfied.** The first blank in this sentence is describing what a woman realized about her boyfriend after watching him stare at his reflection for the tenth time in the last hour. Someone who stares at their reflection ten times in one house must really like looking at themselves and probably has a pretty high opinion of their appearance or is very **vain**. Conceited also works for this first blank, so we have to use the second blank to figure out the correct answer. The second blank refers to what the woman realized about how she would feel about their relationship going forward. Someone being vain or conceited wouldn't really make

it hard for you to be enraged with your relationship, but it might make it hard for you to be **content** with it.

2. **The correct answer is choice (A) analyzing, which means examining, and perceptions, which means observations.** The first blank in the sentence is describing something the man in the sentence did to his specimens under the microscope. It wouldn't make sense to rupture or ignore specimens under a microscope, so we can cross out answer choices (B) and (D). Both **analyzing** and observing both work for the first blank, so we have to use the second blank to find the correct answer. The second part of the sentence says that the man realized his initial "blanks" of the organism's biological functions were wrong. It doesn't make sense to say his initial grievances were wrong, so we can cross out answer choice (C), but it does make sense to say his initial observations or **perceptions** were wrong.
3. **The correct answer is choice (B) exceptional, which means unusually good, and hesitant, which means unwilling or reluctant.** The first blank in this sentence is referring to a novel's cliché storyline. A cliché storyline means that the story was not original or **exceptional**, so answer choices (B), (C), and (D) all work for the first blank and we have to use the second blank to find the correct answer. The second part of the sentence says that because of the cliché and unexceptional storyline, the book critic was "blank" to recommend it to her audience. If a novel was not exceptional and the storyline was cliché, it wouldn't make sense for a book critic to be forced or pleased to recommend it to her audience, as they would probably not enjoy the book. It would make sense for her to be unwilling or **hesitant** to recommend it because she didn't feel the book was anything special.
4. **The correct answer is choice (A) empathetic, which means the ability to understand and share feelings with another, and despair, which means the complete loss of hope.** The first blank is describing the type of individual the subject of the sentence is. Right after the blank the sentence says that the subject wept when the stranger spoke of something. If a stranger tells you something and you weep, they probably told you something sad and you are understanding and **empathetic**. Answer choices (A) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing what the stranger said to make the subject of the sentence weep. As stated before, if you weep and something someone tells you, it is most likely something sad, in this case the stranger spoke of the continuous loss of hope or **despair** he'd experienced.
5. **The correct answer is choice (B) unbiased, which means impartial, and involved, which means having a romantic relationship.** This sentence is tricky because any of the choices can work for the first blank. To find the right answer we have to look at both blanks and see if the choices make sense when we put the answers in. For choice (A) the sentence would say, Emily struggled to write a positive review of the employee because she'd been enamored with him since December. Being enamored or in love with someone would make it easy to write a positive review, so answer choice (A) is incorrect. For answer choice (B) the sentence would say, Emily struggled

to write an **unbiased** review of the employee because she'd been **involved** with him since December. This choice makes sense because if you had been dating someone since December it would be hard to give an impartial opinion on them. For answer choice (C) the sentence would say, Emily struggles to write a biased review of the employee because she'd been upset with him since December. Being upset with someone would make it easy to write a biased review, so answer choice (C) is incorrect. For answer choice (D) the sentence would say, Emily struggled to write a thorough review of the employee because she'd been impressed with him since December. Being impressed with someone would have no effect on if you could write a thorough review, so answer choice (D) is incorrect.

6. **The correct answer is choice (D) secondary, which means less important than, and irresponsible, which means careless or reckless.** The first blank in this sentence is describing how the subject of the sentence is treating his academic performance compared to his social life, so we are looking for a word that would mean more, less, or equal. Answer choices (B) and (D) both work for the first blank, so we have to use the second blank to find the answer. The second blank is what the subject parents accused him of being after treating his academic performance as inferior or **secondary** to his social life. It wouldn't really be disrespectful to do that, so answer choice (B) is incorrect. However the subject's parents could accuse him of being careless or **irresponsible** for doing that.
7. **The correct answer is choice (B) extend, which means to make longer, and insistent, which means unwilling to change your mind.** The first blank in this sentence is describing what the subject wanted to do to his vacation abroad. It wouldn't make sense to say someone wanted to corrode or strengthen their vacation, so we can eliminate answer choices (A) and (D). Answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is how the subject's employer responded to him wanting to **extend** or elongate his vacation. Since the second blank comes after the word "but" in the sentence, we can assume that it will oppose the idea of the subject extending his vacation. The subject employer being unwilling to change his mind or **insistent** on him returning on the original date opposes the subject's want to make his vacation longer.
8. **The correct answer is choice (C) aggravated, which means annoyed or frustrated, and hypocritical, which means behaving in a way that contradicts what you claim or believe.** The first blank in this sentence is describing the subject's friend's complaining. Usually when someone complains it is unpleasant and **aggravating**. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the answer. The second blank is what the subject realized about herself after noticing that she also complained about the poor taste of her sandwich multiple times. Doing something yourself that you got aggravated at someone else for doing is not observant but it is **hypocritical**.
9. **The correct answer is choice (A) confiscate, which means take or seize, and mandatory, which means required by law or rules.** The first blank in the sentence is referring to what the professor

tried to do to a student's phone. The sentence says the student refused to give the phone to him, so we know he must have tried to take or **confiscate** it. Answer choices (A) and (D) both work for the first blank, so we have to use the second blank to find the answer. The second blank is what the student claimed after refusing to give the professor his/her cell phone. It wouldn't make sense for the student to claim that it was not legal for students to refrain from using their phones between classes because this would mean that he/she was breaking the law and in turn the professor was right for trying to take the cell phone. It would make sense for the student to claim that it was not required by rules or **mandatory** that students refrain from using their phones between classes and that is why he/she refused to give the phone to the professor.

- 10. The correct answer is choice (D) inexperienced, which means having little knowledge of a particular thing, and intelligence, which means the ability to apply knowledge and skills.** This sentence starts off with the word “though”, which should be a clue to us that there will probably be opposing ideas in this sentence. The first blank is describing how the subject was with the subject matter even though she was still able to successfully complete the task. Because of the word “though” we know we are looking for an answer that means not knowledgeable or **inexperienced**. Answer choices (C) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank refers to how the subject was able to complete the task. Having an impressive mortality or death wouldn't help you succeed at a task but having an impressive **intelligence** would.
- 11. The correct answer is choice (B) enthusiastic, which means showing intense enjoyment or interest in something, and irritated, which means slightly angry or annoyed.** The first blank in this sentence is describing how the chemist felt about his new work opportunity at a leading pharmaceutical company. We can assume that a chemist getting a new job at a good company is a good thing and he would react positively and probably be very excited or **enthusiastic** about it. Answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank describes how the chemist felt when he found out that at this new job, his new boss was his wife's ex-husband. The sentence also has the word “but” right before the second blank, so we know that the second blank is probably in contrast with the chemist feeling enthusiastic about the new job. Feeling nothing or being apathetic is not in contrast with feeling excited or enthusiastic, and we can assume that most people would feel a little angry or **irritated** if they found out their new boss was their partner's ex.
- 12. The correct answer is choice (C) preserve, which means maintain something in its original form, and refused, which means not willing to do something.** The first blank in the sentence is referring to the young man's dignity. It doesn't make sense to say he could originate or release his dignity, so answer choices (A) and (B) are incorrect. It does make sense to say the young man could **preserve** or maintain his dignity. Answer choices (C) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank refers to what the young man did to a coworker who spread vicious lies about him in the workplace. If someone told

vicious lies about you, you would probably be angry and wouldn't attempt to apologize to them, you would not be willing to or **refuse** to apologize.

- 13. The correct answer is choice (D) conceited, which means vain or having an extremely high opinion of yourself, and hesitant, which means unsure.** This sentence is tricky because all of the answer choices can work in the first blank, so we have to look at both blanks together and make a sentence that makes sense. Answer choice (A) is incorrect because the attractive man being so glamorous would not cause him to be unable to accept that his colleague was unable to go on a date with him. Answer choice (B) is incorrect because the attractive man being so arrogant would not cause him to be unable to accept that his colleague was preferring to go on a date with him. Answer choice (C) is incorrect because the attractive man being so charming would not cause him to be unable to accept that his colleague was favored to go on a date with him. Answer choice (D) is correct because the attractive man being **conceited** or vain would cause him to not be able to accept that his colleague was **hesitant** to go on a date with him.
- 14. The correct answer is choice (C) replace, which means to put something new in the place of, and unique, which means unlike anything else.** The first blank describes what the director wanted to do to the ending scene. As a director it wouldn't make sense that you would want to undermine or weaken the ending scene of your movie, so answer choice (B) is incorrect. Grammatically it doesn't make sense to say the director wanted to delete the ending scene *with* something else, so answer choice (D) is incorrect. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second part of the sentence tells us that the director's partner didn't want him to change the ending scene because audiences would appreciate the original scene's sense of familiarity. This tells us that the director wanted to change or **replace** the ending scene with something less familiar or more **unique**.
- 15. The correct answer is choice (A) scold, which means reprimand, and disrespectful, which means rude or impolite.** The first blank in this sentence is referring to what the teacher wanted the unruly child's parents to do to him. If we think about a teacher who is dealing with an unruly child, we can assume that the teacher probably wants the child to behave better and that he would want the child's parents to punish or **scold** him. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank refers to how the child's parents felt about the child's behavior and it also comes after the word "but", which tells us that how they felt is probably going to be in contrast to how the teacher felt. If the child's parents didn't feel his behavior was amicable, they would be agreeing with the teacher, so we know they must have felt that his actions were not impolite or **disrespectful**.
- 16. The correct answer is choice (B) accustomed, which means used to something, and open-minded, which means accepting of new ideas.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the type of individuals the subject of the sentence is interacting with. The second part of the sentence says that the subject was surprised he could share his controversial opinions without receiving backlash. If

you can share controversial opinions with people and not receive any backlash, those people are probably pretty accepting of new ideas or **open-minded**. This answer choice also makes sense in the first blank because the subject of the sentence would only be surprised by this if he was not used to or **accustomed** to iterating with such individuals.

17. **The correct answer is choice (C) remarkable, which means exceptional or extraordinary, and superior, which means higher in quality.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is comparing the remake of the classical film to the original film. The only answer that makes sense when comparing two things is **superior**. This answer choice also makes sense in the first blank because an extraordinary or **remarkable** cinematic direction could be a reason that viewers felt the remake of the film was better than the original.
18. **The correct answer is choice (A) receding, which means moving back or further away, and strategize, which means to plan.** The first blank is describing what the army general realized the enemy’s troops were doing. It wouldn’t make sense to say the enemy’s troops were trembling into the jungle, so answer choice (D) is incorrect. Answer choices (A), (B), and (C) all work for the first blank, so we have to use the second blank to find the answer. The second part of the sentence says that the general commanded his men to hold their fire until he could “blank” their next move. This implies that the general did not know what his troops next move was and he had to plan or **strategize** before his troops could start firing again.
19. **The correct answer is choice (D) regret, which means to feel disappointed about something that has happened, and pursue, which means to try to achieve.** The first blank in this sentence is describing how the subject of the sentence did NOT feel about leaving his hometown. The second part of the sentence tells us that he did miss the close-knit community, so right away we can eliminate answer choice (C). It wouldn’t make sense for the subject of the sentence to not approve leaving his town, because it was his decision, so answer choice (A) is incorrect. Answer choices (B) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing why the subject left his hometown. It wouldn't make sense for the subject of the sentence to leave his hometown to improve his dreams, but it would make sense for him to leave to chase or **pursue** them.
20. **The correct answer is choice (B) recount, which means to tell someone about something, and atrocities, which means cruel acts.** In this sentence, the blanks are very close to each other, so we have to look at both blanks in each choice and see if they make sense together. We know that the prisoner of war’s eyes clouded with tears when he did something, so we can assume that whatever he is doing in the sentence is sad or emotional. Testify the theatrics and narrate the fantasies don’t have anything to do with being sad or emotional, so we can eliminate answer choices (C) and (D). Answer choice (A) makes sense grammatically but it isn’t specific enough to be the correct answer. It makes more sense that as the prisoner of war began to tell someone about or **recount** the horrible acts or **atrocities** he witnessed, his eyes would be clouded by tears.

**Double Sentence Completions Set 2**

- 1. The correct answer is choice (C) pious, which means devoutly religious, and depraved, which means morally corrupt.** This question is tricky because separately all of the answer choices for the first blank could work and all of the answer choices for the second blank could also work. To find the correct answer we have to find the answer choices that work together. The first part of the sentence starts with the word “though” and the first blank is describing what Emily never believed about her neighbors demeanor. We know that whatever Emily felt about her neighbor’s demeanor is going to be in contrast with how she actually behaved in the second part of the sentence. If Emily never believed her neighbors religious or **pious** demeanor was genuine, she might not
- 2. The correct answer is choice (B) volatile, which means unpredictable, and belligerent, which means hostile and aggressive.** The first blank is describing how the verbal argument in the sentence is changing. Since the sentence tells us the argument grew louder, we can infer that it was probably getting more ludicrous or **volatile**. Answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is what the witnesses feared the participants would become as a result of the argument growing louder. The word “physically” is a clue to the correct answer as **belligerent** is most closely associated with physical violence.
- 3. The correct answer is choice (C) vilify, which means to speak about someone in a negative manner, and reconciliation, which means the repair of a relationship.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing what the girl in the sentence had hoped for after she forgave her parents for stealing funds from her. If someone you care about stole from you, it would make sense that you might be upset, but if you forgave them for stealing from you, that would imply that you had hopes of rebuilding the relationship you had with them or **reconciliation**. None of the other answer choices make sense in the second blank. **Vilify** also makes sense in the first blank because if someone had hoped to rebuild a relationship with someone else, publicly speaking about them in a negative manner would not be a good idea.
- 4. The correct answer is choice (D) integral, which means necessary or essential, and grapple, which means struggle to overcome something.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank refers to something the subject of the sentence’s friends helped him do with the deep sorrow he experienced after losing his father. If someone is feeling sorrow and sadness over a negative experience, it makes sense that they would struggle to overcome or **grapple** with those feelings. The first blank would then be **integral**, which makes sense because your friends are usually an essential or **integral** part of helping you get through tough times.
- 5. The correct answer is choice (A) innumerable, which means countless or many, and resistant, which means somewhat unwilling.** This sentence starts with the word “though” which tells us that

there will probably be contrasting ideas somewhere in the sentence. The first blank is describing the declarations the woman in the sentence made about how much she valued her friendships. It wouldn't make sense for the woman to make cynical or autonomous declarations, so answer choices (B) and (C) are incorrect. Answer choices (A) and (D) both make sense for the first blank, so we have to use the second blank to find the correct answer. Remember, because of the word "though" the ideas in the sentence are probably going to contradict each other. If the woman made enthusiastic declarations of how much she valued her friendships, it would not be contradictory that she would be gracious in providing emotional support when her friends were in need. If the woman made countless or **innumerable** declarations about how much she valued her friendships, it would be contradictory for her to be somewhat unwilling or **resistant** to providing emotional support when her friends were in need.

6. **The correct answer is choice (B) tranquil, which means peaceful or soothing, and pester, which means to bother.** The first blank is describing the type of environment the woman in the sentence preferred to immerse or put herself in when she was relaxing. If someone is relaxing it makes sense that they would want a peaceful or **tranquil** environment. None of the other answer choices really make sense for the first blank. **Pester** works for the second blank because if you were trying to relax, you wouldn't want people bothering you with insignificant matters and you might get upset.
7. **The correct answer is choice (A) avarice, which means extreme greed, and advance, which means to accelerate the growth of something.** This sentence is tricky because all of the answer choices can work in the first blank, so we have to look at both blanks together and make a sentence that makes sense. If the man in the sentence was primarily driven by apprehension it wouldn't have anything to do with him developing friendships that could conjecture his financial ventures, so answer choice (B) is incorrect. If the man in the sentence was primarily driven by greed he would only devote time to develop relationships that would help not hinder his financial ventures, so answer choice (C) is incorrect. If the man in the sentence was primarily driven by benevolence, or kindness, it wouldn't cause him to only develop relationships that could aid his financial ventures, so answer choice (D) is incorrect. The only answer that makes sense is if the man was primarily driven by extreme greed or **avarice**, then he would only devote time to relationships that could accelerate the growth of, or **advance**, his financial ventures.
8. **The correct answer is choice (A) tedious, which means dull and monotonous, and evoked, which means bring a feeling to mind.** The first blank is describing the nature of the task in the sentence. We can eliminate answer choice (D) because jaunt is a non and doesn't fit grammatically. If we read the sentence as a whole, notice that the second half of the sentence mentions a sense of boredom in the woman's exhausted mind. The words "boredom" and "exhausted mind" are clues to the correct answer. If a task is boring it is most likely **tedious** or dull, and the word mind hints to the fact that the task **evoked** boredom.

9. **The correct answer is choice (C) travesty, which means a false or distorted representation of something, and function, which means purpose or role.** The first blank is describing what the woman in the sentence thought the spiteful arrest was. Grammatically it wouldn't make sense to say the arrest was a restive of the justice system, so answer choice (B) is incorrect. Since the sentence describes the arrest as spiteful or malicious, we can infer that the first blank will be a negative word and can eliminate answer choice (D). The clue in this sentence is the colon after the word system. That tells us that whatever comes after the colon is going to be a description or explanation of what came before it. If the woman believed the arrest was a distorted representation, or **travesty**, of the justice system, the explanation is that it is a complete mockery of its **function** in the government.
10. **The correct answer is choice (D) wary, which means feeling caution about something, and entrust, which means to assign the responsibility of doing something.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing what the father accepted about his daughter's boyfriend. The sentence says he accepted he could "blank" him with the task... Grammatically it wouldn't make sense to say defer him with the task or inter him with the task, so we can eliminate choices (A) and (C). For the remaining two answer choices, we can use them in the sentence and see if it makes sense as a whole. If the father was annoyed by his daughter's boyfriend for years, it wouldn't make sense for him to then accept that he could appease or pacify the boyfriend with the task of being a supportive partner for his child, so answer choice (B) is incorrect. It would make sense that after years of being cautious or **wary** of his daughter's boyfriend, that the father finally accepted he could assign the responsibility or **entrust** the boyfriend with the task of being a supportive partner for his child.
11. **The correct answer is choice (B) indigenous, which means native, and vulnerable, which means susceptible to physical harm.** This sentence starts with the word "though" which tells us that there will probably be contrasting ideas somewhere in the sentence. The first blank in this sentence is referring to the relationship between the tropical flowers and the rainy region. It doesn't make sense to say something is poignant to a region, so answer choice (A) is incorrect. Answer choices (B), (C), and (D) all work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing the flowers' relationship with the climate patterns of the area. It wouldn't make sense grammatically to say the flowers were still reaped to the climat, so answer choice (D) is incorrect. Remember, because the sentence starts with "though" we are looking for two ideas that are in some way contrast to each other. The flowers being unique to the region would not be in contrast to them being unaccustomed to the climate, so answer choice (C) is incorrect. The flowers being native or **indigenous** to the region would be in contrast to them being susceptible or **vulnerable** to the climate because if something is from a certain area, it is usually well adapted to the environment.
12. **The correct answer is choice (B) impartial, which means fair and just, and livid, which means extremely angry or upset.** The first blank in this sentence is describing something the girl's parents were completely unable to do. The first part of the sentence says that the girl realized that

her parents were showing favoritism towards her sibling, which is another way of saying they were not being unbiased, **impartial**, or objective. Answer choices (A), (B), and (C) all mean similar things and all work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing how the girl felt after realizing this about her parents. If you just realized that your parents were treating you unfairly, you would probably be pretty upset or **livid**.

- 13. The correct answer is choice (D) decadent, which means luxuriously self-indulgent, and nostalgic, which means thinking fondly of a past time.** This first blank in the sentence is referring to a cinnamon sugar cake the woman in the sentence consumed. It is described as luxuriously “blank”. The only answer choice that has to do with luxury is **decadent**. The second blank is describing the memories that swirled in her mind after eating the cake. Memories refer to past events and remembering your mother baking for you as a child would be a sentimental or **nostalgic** memory.
- 14. The correct answer is choice (B) vilify, which means to speak or write negatively about someone, and exasperate, which means to irritate or frustrate.** The first blank in this sentence is describing the man’s opponent's numerous attempts to do something to the man’s character. It doesn't make sense to say numerous attempts to deter or pester his character, so answer choices (C) and (D) are incorrect. It does make sense to say that the man’s opponent made many attempts to disparage or **vilify** his character. The second blank describes how the man feels about his opponent doing this. If someone made numerous attempts to bad-mouth or put you down, it would make sense that that would begin to frustrate or **exasperate** you.
- 15. The correct answer is choice (C) scarcity, which means a shortage or in short supply, and deplete, which means to diminish in number or quantity.** The first blank is referring to what the woman knew about food following a destructive natural disaster. If we think about a destructive natural disaster, it would make sense that farms and places that you buy food might be damaged or destroyed, so there would be a shortage, or **scarcity**, of food. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the answer. The second blank is referring to what the woman hoped to ensure about her food supply by buying several boxes of canned goods. If someone buys many boxes of canned goods during a time where food was scarce, it would make sense that they were trying to ensure they wouldn’t run out of, or **deplete**, their food.
- 16. The correct answer is choice (A) infamous, which means well known for some bad quality, and contentious, which means controversial.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the time of conversations that Max engaged people in. The sentence tells us that the conversation made Kiara feel uncomfortable, so it makes sense that they were controversial topics or **contentious**. The first blank refers to why Kiara avoided Max, so since we know controversial conversations made Kiara uncomfortable, it makes sense that she avoided Max because he was known, or **infamous**, for engaging in these types of conversations.

17. **The correct answer is choice (D) banal, which means lacking originality or cliched, and credibility, which means the quality of being trusted and believed in.** This sentence is tricky because all of the answer choices can work in the first blank, so we have to look at both blanks together and make a sentence that makes sense. If the musician's new album focused on uninspired thematic narratives, it wouldn't make sense for the listeners to question his/her affinity, or love, as a creative revolutionary, so answer choice (A) is incorrect. If the musician's new album focused on peculiar, or wierd, thematic narratives, it wouldn't make sense for the listeners to question his/her invective, or insulting language, as a creative revolutionary, so answer choice (B) is incorrect. If the musician's new album focused on pious, or religious, thematic narratives, it wouldn't make sense for the listeners to question his/her cadence, or rhythm, as a creative revolutionary, so answer choice (C) is incorrect. It would make sense for the listeners to question the musician's credibility as a creative revolutionary if his/her new album focused on unoriginal, or **banal**, thematic narratives.
18. **The correct answer is choice (C) dissuade, which means discourage, and tenacity, which means determination.** This sentence starts with the word “though” which tells us that there will probably be contrasting ideas somewhere in the sentence. The first blank in this sentence refers to what Connor did not want to do to his son regarding him pursuing his dreams of becoming a doctor. It doesn't make sense to say that Connor did not want to augment or jeopardize his son from pursuing his dreams, so answer choices (B) and (D) are incorrect. The second blank is referring to something he didn't feel his child had that he needed to complete medical school. Remember, because the sentence starts with “though” we are looking for two ideas that are in some way contrast to each other. If Connor didn't believe that his child had the self confidence, or aplomb, to complete medical school, that would not encourage him to pursue his dreams of becoming a doctor, so answer choice (A) is incorrect. If Connor didn't believe that his child had the determination, or **tenacity**, to complete medical school, that would probably **discourage** him from pursuing his dreams, and Connor does not want that.
19. **The correct answer is choice (B) frugal, which means economical in regards to money, and frivolous, which means silly or foolish.** This question is tricky because separately all of the answer choices for the first blank could work and all of the answer choices for the second blank could also work. To find the correct answer we have to find the answer choices that work together. This sentence starts with the word “though” which tells us that there will probably be contrasting ideas somewhere in the sentence. The man being a lavish, or excessive, individual is not in contrast with him thinking it was ludicrous, or unreasonable, for his friend to refuse to turn the lights on to save money. The man being a pensive, or a deep thinking, individual has nothing to do with him thinking it was mundane, or dull, for his friend to refuse to turn the lights on to save money. The man being an inefficient individual has nothing to do with him thinking it was bizarre, or strange, for his friend to refuse to turn the lights on to save money. The man being an economical, or **frugal**, individual is in contrast with him thinking it was foolish, or **frivolous**, for his friend to refuse to turn the lights on to save money.

20. **The correct answer is choice (C) apathetic, which means uninterested, and futile, which means pointless.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing any attempt to engage Kelsey in conversation about the political landscape. It wouldn't make sense to describe an attempt at something as extinct or unresponsive, so we can eliminate answer choices (B) and (D). Of the remaining two answer choices, only one makes sense in the first blank, **apathetic**. If Kelsey was uninterested, or **apathetic**, towards current events and global affairs, it would make sense that attempting to engage her in conversations about the political landscape would be pointless, or **futile**.

### Double Sentence Completions Set 3

1. **The correct answer is choice (C) analyzing, which means examine in detail, and tentative, which means preliminary or unconfirmed.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the conclusion that the detective felt would prove correct. It doesn't make sense to describe a conclusion as undulating, so answer choice (A) is incorrect. For the three remaining answer choices, we can go through and see which one makes the most sense. It wouldn't make sense for the detective to feel confident that his frivolous, or foolish, conclusion would be correct after he destroyed the evidence, so answer choice (B) is incorrect. It wouldn't make sense for the detective to feel confident that his discordant, or opposing, conclusion would be correct after he truncated, or shortened, the evidence, so answer choice (D) is incorrect. If the detective had an idea of what he thought happened and formed an initial, or **tentative**, conclusion, it would make sense that he would feel confident in that conclusion after he went back and examined, or **analyzed**, the evidence and found it supported what he first believed.
2. **The correct answer is choice (D) adversity, which means difficulties or misfortune, and outlook, which means point of view.** The sentence starts out with the word "despite" so that tells us that the ideas in this sentence are going to be in contrast to each other. If we read the sentence as a whole, we can see that the main idea is that despite "blank", Susan still had a very optimistic "blank" on life. So we are looking for an answer choice where despite the first word, the second word still happened. If someone had misfortune, or **adversity**, during the primary developmental years of their life, it would not be uncommon for them to have a negative view on life. In this case, Susan still had a positive **outlook**, despite her hardships.
3. **The correct answer is choice (A) ominous, which means threatening or menacing, and evoking, which means bringing something to mind.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank in this sentence is referring to a surge of fear and dread. Fear and dread are feelings, and the only answer choice that has to do with certain types of feelings is **evoking**. This also makes sense in the sentence as a whole, because if you perceive something threatening or ominous, it would make sense that whatever you perceived would bring to mind feelings of fear and dread.

4. **The correct answer is choice (B) congruent, which means consistent, and hypocrites, which are people who act in contradiction to what they say they believe.** The first blank is describing Karen’s friend’s actions and how they were not “blank” with her convictions. It wouldn’t make sense to say her actions were not bellicose with her convictions, so answer choice (C) is incorrect. Aligning, **congruent**, and harmonious all mean consistent, so we have to use the second blank to find the correct answer. The second blank is describing what Karen’s friend spoke about with disdain and irritation. If Karen's friend's actions were not consistent with her convictions, this would make her a hypocrite, so it would make sense that this would shock Karen if she spoke about **hypocrites** with disdain and irritation.
5. **The correct answer is choice (C) ingenuity, which means the quality of being clever or inventive, and dissuaded, which means discouraged.** The first blank in this sentence is describing something the screenplay forced with odd philosophical tangents and incomprehensible attempts at wit. Philosophical tangents and attempt at wit, if done correctly in a screenplay, would be described as **ingenuity** or possibly dexterity. Since both answer choices (C) and (D) work for the first blank, we will have to use the second blank to find the correct answer. The second blank is describing what the forced cleverness of the script did to most producers when considering it for production. If we think about it, a screenplay that seems forced and not natural is probably not that good of a screenplay, and producers would be discouraged, or **dissuaded**, from considering it for production.
6. **The correct answer is choice (A), integral, which means necessary or essential, and laborious, which means difficult and time consuming.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the task the data analyst finished. The task is described with two words, the first being the blank and the second being extensive. If a task was extensive, or sizable, we can assume that it was probably difficult and time consuming, or **laborious**. If the task was laborious and extensive and the data analyst was hesitant to assume responsibility, we would normally assume that he probably didn’t contribute much to the completion of the task. But, since the sentence has the word “but” in it, we know that we have to think opposite of what we normally would and the data analyst must have been essential, or **integral**, to its completion.
7. **The correct answer is choice (C) facsimile, which means an exact copy, and historic, which means known from the past.** The first blank in this sentence is describing what the plagiarizing speech writer submitted to the politician. Someone plagiarizing copies other people's work, so it would make sense that the speechwriter submitted an exact copy, or **facsimile**, of someone else’s speech. The second blank in this sentence is describing the speech that the speechwriter submitted. The speech was delivered by a governor in the eighteenth century, so it was a known speech from the past, or a **historic** speech.

8. **The correct answer is choice (B) ambiguous, which means unclear or misleading, and exasperate, which means to irritate or frustrate.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is referring to what the suspect's responses began to do to the interrogator. It wouldn't make sense grammatically for the suspect's responses to begin to inoculate or perpetuate the interrogator, so answer choices (C) and (D) are incorrect. Of the remaining answer choices, Choice (A) is incorrect because it wouldn't make sense for the suspect's arbitrary, or random, responses to reprimand the interrogator. It would make sense for the suspect's intentionally misleading, or **ambiguous**, responses to irritate, or **exasperate**, the interrogator because he wouldn't be able to get the information he was trying to.
9. **The correct answer is choice (D) inferior, which means lower quality, and indignant, which means angry or unhappy.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank refers to the letter Natalie sent the salon manager. Since the letter that Natalie sent was outlining her frustrations, it would probably be described as unhappy, or **indignant**. The first blank in the sentence is describing the type of treatment Natalie's friend received at the beauty salon. Since we know that Natalie was unhappy in her letter, we can infer that her friend must have received lower quality, or **inferior**, treatment when she went to the beauty salon.
10. **The correct answer is choice (B) condescending, which means patronizing, and engender, which means produce or give rise to.** For this sentence we can start with the second blank to find the correct answer more easily. The second part of this sentence says the remarks the man's friend made would not "blank" the respect he craved from others. It doesn't make grammatical sense to say the remarks would not notarize the respect he craved, or to say the remarks would not embellish the respect he craved, so answer choices (A) and (D) are incorrect. Of the remaining answer choices, answer choice (C) is incorrect, because it doesn't make sense that his friend making needy, or indigent, remarks would not garner, or earn, respect. It does make sense that if his friend was making patronizing, or **condescending**, remarks, that it would not give rise to, or **engender**, the respect he craved because it would probably insult the people he made the remarks to.
11. **The correct answer is choice (C) caution, which means warning, and congest, which means clog up.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is referring to what flushing masses of paper towel down the drain would do to the pipes. If we think about it, flushing masses of paper towel down a small drain would most likely clog up, or **congest**, the pipes. This answer choice also makes sense for the first blank, because if the boy ignored his mother's word of warning, or **caution**, and flushed the paper towel anyway, he would most likely cause a plumbing disaster. Answer choice (B) is incorrect because disown does not work in the second blank.
12. **The correct answer is choice (B) wafted, which means drifted or passed through the air, and permeated, which means filled or spread through.** The first blank in this sentence is describing

what the decadent scent from the chocolate chip cookies did through the kitchen. We are looking for a verb for this blank, so we can cross off answer choices (A) and (C). The word *trekked* means to go on a long and hard journey and is typically associated with someone walking, so we can assume it is incorrect and illuminate answer choice (D). That leaves answer choice (B), **wafted**, which makes sense because a strong smell can drift, or pass, through the air. The second blank is referring to what that smell did to the entire area. **Permeated** makes sense because a strong smell that is drifting through the kitchen would probably fill, or spread through, the entire area.

- 13. The correct answer is choice (C) accommodate, which means oblige or indulge, and amicable, which means friendly or good-natured.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing a character trait of James. The sentence has already told us that he is kind so we can assume that the word we are looking for would also be a positive trait similar to kind. *Nefarious* means wicked or criminal, so we can eliminate choice (A) and *flaccid* means soft or limp, so we can eliminate choice (D). Choices (B) and (C) both work for the second blank, so we will have to use the first blank to find the correct answer. The first blank is describing what Madison was usually unwilling to do with respect to the requests of strangers. *Relocate* means to move to a new place and it doesn't make sense to say someone is unwilling to move the requests of strangers to a new place, so we can eliminate answer choice (B). That leaves **accommodate** for the first blank, which makes sense because Madison was usually unwilling to oblige the requests of strangers but she did this time because James was a friendly, or **amicable**, person.
- 14. The correct answer is choice (A) apathetic, which means indifferent or unemotional, and hysterical, which means overcome by emotion.** The first blank in this sentence is referring to Lauren's attitude towards emotional films. The sentence tells us that she retains an expressionless face throughout them, so we are looking for a word that would imply she is unaffected by them. Answer choices (A) and (B) both work for the first blank, so we have to use the second blank to find the answer. The second blank is describing how Lauren's sister reacts to emotional movies. The sentence tells us that her reaction is unlike Lauren's, so we know we are looking for a word that would be the opposite of unemotional. *Fallacious* means based on a mistaken belief, so we can eliminate answer choice (B). Since Lauren is **apathetic** to emotional films, it would make sense that if her sister was unlike her, she would be overcome by emotion, or **hysterical**, during sad moments in movies.
- 15. The correct answer is choice (D) astound, which means to astonish or amaze, and countless, which means many or a lot.** The first blank is describing what the woman continued to do to her manager with her devotion to the organization's cause. If an employee was devoted to an organization's cause, it would make sense that that would impress or **astound** their manager. Answer choices (B), (C), and (D) all work for the first blank, so we have to use the second blank to find the correct answer. The sentence tells us that the woman was able to be devoted to the organization's cause despite having other personal obligations, and the second blank is describing those obligations. *Precarious* means insecure or uncertain, so it wouldn't really make sense in the

second blank. Peripheral means outer or outlying, so it also would not make much sense in the second blank. However, it would make sense that the woman's manager would be impressed with her devotion to the organization's cause despite her having many, or **countless**, other personal obligations.

- 16. The correct answer is choice (B) exasperated, which means irritated or frustrated, and indifferent, which means apathetic or unemotional.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing how the woman felt towards the people her parents were setting her up on dates with. It doesn't make sense to say someone felt exorbitant or patronizing towards someone else, so answer choices (A) and (D) are incorrect. Answer choices (B) and (C) both work for the second blank, so we have to use the first blank to find the correct answer. It wouldn't make sense for the woman to be flabbergasted, or surprised, that her parents kept trying to set her up on dates with people she felt appreciative towards, so answer choice (C) is incorrect. It would however make sense for the woman to be frustrated, or **exasperated**, that her parents kept trying to set her up on dates with people she felt unemotional, or **indifferent**, towards.
- 17. The correct answer is choice (C) steadfast, which means dedicated or relentless, and innate, which means natural or god-given.** The first blank is describing the woman's devotion to her vision. The second part of the sentence tells us that the woman was about to build a corporate empire in only four years. Building a corporate empire in four years is a pretty impressive feat and one that would probably take a lot of determination and hard work. We can infer that if the woman was a determined hard worker, that her devotion to her vision would be relentless, or **steadfast**, in order to accomplish her goal. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing the woman's ability to work countless hours without facing exhaustion. If the woman is a hard worker that is dedicated to her vision, it wouldn't make sense that she would be averse, or against, working countless hours, so answer choice (A) is incorrect. It would however, make sense for a hardworking person to have a natural, or **innate**, ability to work countless hours without getting tired.
- 18. The correct answer is choice (B) novelty, which means newness or freshness, and recede, which means gradually diminish.** The second part of this sentence tells us that after something happened, the woman was able to observe her partner's less attractive qualities. The blanks in this sentence refer to what happened that caused her to be able to do this. The first blank is referring to a quality of the woman's new relationship. The word "new" is a clue that the answer we are looking for would be a quality typically associated with a new relationship. It would make sense that a new relationship would have freshness, or **novelty**, and it would also make sense that a new relationship would have extreme happiness, or bliss. Answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing something that happened to the newness of the relationship after a period of time. After a period of time, a new relationship would no longer be new, so it would make sense that the

freshness of a new relationship would gradually diminish, or **recede**, which would allow a person to more clearly see their partner’s less attractive qualities.

- 19. The correct answer is choice (C) commonplace, which means a usual occurrence, and mandatory, which means required.** For this question, let’s plug in each answer choice and see which one makes sense. Answer choice (A) is incorrect because if smallpox is less widespread or common, it wouldn’t make sense that the vaccination is malignant or infectious. Answer choice (B) is incorrect because it doesn’t make sense to describe smallpox as dubious which means untrusting or skeptical. Answer choice (D) is incorrect because it doesn’t make sense to describe a vaccine as inexperienced. Answer choice (C) is correct because if smallpox is less commonplace or common, it would make sense that this is because vaccines are mandatory or required.
- 20. The correct answer is choice (B) abasement, which means humiliation or degradation, and disparaging, which means belittling.** The first blank is describing what Jeanie suffered at the hands of a verbally abusive friend. If someone’s friend is verbally abusive, it would make sense for that person to suffer humiliation, or **abasement**. Answer choices (A) and (B) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank describes the type of remarks Jeannie’s abusive friend attacked her with. Since we know her friend is verbally abusive, we can infer that the remarks she attacked Jeanie with would be aggressive and negative. Docile means mild or passive, so we can eliminate answer choice (A). It would make sense that Jeannie’s verbally abusive friend would attack her with belittling, or **disparaging**, remarks, and that this would cause Jeannie to leave the friendship.

#### Double Sentence Completions Set 4

- 1. The correct answer is choice (C) confiscation, which means seizure, and repression, which means oppression or control.** This first blank is describing what the government did to a villager’s agricultural land. It wouldn’t make sense for the government to congeal, or coagulate, the villager’s land, so answer choice (A) is incorrect. Answer choices (B), (C), and (D) all work for the first blank, so we have to use the second blank to find the correct answer. The second blank describes how the villagers felt about what the government did to their land. It wouldn’t make sense for the villagers to consider the government’s seizure, or **confiscation**, of their agricultural land an attempt at financial liberty or entropy, so answer choices (B) and (D) are incorrect. If the government was taking the villager’s agricultural land, it would stop the villagers from being able to grow and sell food, which could be seen as an attempt at financial oppression, or **repression**.
- 2. The correct answer is choice (B), tangible, which means real or physical, and implausible, which means improbable or unlikely.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the woman’s friend’s account of the day’s events, which the woman refused to believe. If the woman refused to believe the account, then it would make sense that the account was probably unlikely, or **implausible**. We can use the first blank to check our answer. Obviously if the woman’s friend had real, or **tangible**, evidence,

then the woman would probably believe her recount of the day’s events no matter how improbable. However, without such evidence it makes sense that she refused to believe it.

3. **The correct answer is choice (D) naive, which means lacking experience or wisdom, and wary, which means cautious or careful.** The first blank in the sentence is describing the girl. We know that the girl ignored the police officer’s warning because she believed that it was impossible for any misfortune to fall upon her. If someone ignores the warning of a trusted government official like a police officer, we can assume that they are probably lacking wisdom, or **naive**. The second blank in this sentence is referring to the warning the police officer gave her. A police officer would only give someone a warning if they felt that they might be in danger, so it would make sense for the police officer to want the girl to be cautious, or **wary**, of her environment to avoid any potential danger.
4. **The correct answer is choice (C) profuse, which means abundant or a large amount, and discredit, which means to prove something false.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing what the new evidence would do to the man’s claims. Since the sentence tells us the evidence would reveal the man’s guilt, it must prove his claims false, or **discredit** them. If someone was about to be proven guilty for something and they knew it, then it would make sense for that person to be nervous. People who are very nervous oftentimes are overcome with large amounts of, or **profuse**, sweat, meaning they are sweating a lot.
5. **The correct answer is choice (A) practical, which means feasible or sensible, and import, which means to bring in from another country.** The beginning of this sentence tells us that the store manager realized it was more financially “blank” to do something. It wouldn’t make sense to say that something is more financially serene, or peaceful, so answer choice (D) is incorrect. A clue in this sentence is the word “though” at the start of the sentence. This tells us that there will probably be contrasting ideas in this sentence. The second half of the sentence says that the store manager chose to purchase the materials from retailers instead of doing something else. Because of the word “though” at the start of the sentence, we can infer that whatever the store manager realized was in contrast to him buying the materials from retailers. The store manager realizing that it was more sensible, or **practical**, to bring in the materials from another country, or **import** them, is in contrast to him buying them from retailers.
6. **The correct answer is choice (B) eclectic, which means composed of elements drawn from various sources, and resonated, which means something people related to.** The first blank in this sentence is describing the track listing of an album. The sentence tells us that the track listing had diverse lyrical subject matter and various instrumental compositions. In other words the track listing was composed of various elements, or **eclectic**. Both answer choices (B) and (D) work for the first blank, so we have to use the second blank to find the correct answer. The second blank refers to how the album affected everyone who heard it. It doesn’t make sense to say that the album inquired, or asked for information from, everyone who heard it, so answer choice (D) is incorrect.

It does however make sense that an album with diverse lyrical and subject matter would be relatable, or **resonate**, with everyone who heard it.

7. **The correct answer is choice (C) vilify, which means to speak or write about in a disparaging way, and insolent, which means rude, impolite, or arrogant.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank in the sentence is describing Kelly’s behavior. The second half of the sentence says that Samantha confronted Kelly and explained that her impolite behavior was making everyone uncomfortable. Since we know that Kelly was being impolite, the only two answer choices that make sense when describing her behavior are dismissive and **insolent**. The word “rather” at the start of the sentence tells us that Samantha confronted Kelly about this behavior instead of doing whatever the first blank was describing, so we know the first blank is referring to something someone might do if their friend was being impolite. It wouldn’t make sense for Samantha to sustain, or support Kelly for being impolite, so we can eliminate answer choice (D). It would, however, make sense for Samantha to publicly talk bad about, or **vilify**, Kelly for being impolite.
8. **The correct answer is choice (D) futile, which means pointless or useless, and inevitable, which means a situation that is unavoidable.** The first blank in this sentence is describing the physician’s attempts to resuscitate the patient. We know from later in the sentence that the patient died, so the first blank has to at least mean the physician's attempts were unsuccessful. None of the choices mean unsuccessful but **futile** means useless, which also fits given the outcome. The second blank is describing what the medical staff realized about the patient's death. It only makes sense that the physician's attempts to save the patient were pointless if the patient's death was unavoidable, or **inevitable**.
9. **The correct answer is choice (D), anticipated, which means expected, and transient, which means lasting for only a short time.** The first blank in this sentence is describing the storm that was expected to occur during the man’s vacation. It wouldn’t make sense to describe a storm as cliched or religious, so answer choices (B) and (C) are incorrect. You could potentially describe a storm as antagonistic, so we won’t eliminate answer choice (A) yet. The best choice for how to describe an expected storm is **anticipated**. To find the correct answer we have to use the second blank. If the man did not cancel his trip despite the expected storm, he must have believed the storm would not be as serious or last as long as predicted. Maligned means defamed, so that does not work for the second blank. Since the man did not cancel his trip we know that he must have thought the storm would be **transient**.
10. **The correct answer is choice (A) apprehensive, which means nervous or anxious, and obsolete, which means outdated or no longer useful.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing the medical equipment that the sentence also describes as having outdated features. Since the medical equipment has outdated features, we know that it must be old or **obsolete**. Answer choices (A) and (D) both work for the second blank, so we have to use the first blank to find the correct answer.

The first blank is describing how the hospital felt about purchasing this outdated medical equipment. The sentence tells us that the medical equipment had a reduced cost but the hospital feared it would increase patient mortality rates and confuse physicians. If the hospital had fears about buying this medical equipment it wouldn't make sense to say they were excited about buying it. However, it would make sense to say that the hospital was anxious, or **apprehensive**, about buying the medical equipment.

- 11. The correct answer is choice (B) tenacity, which means determination or persistence, and inclinations, which means natural tendencies.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank in this sentence is referring to something the people around the woman abandoned that relates to procrastination, and this allowed the people to pursue their goals. Basically whatever they people are abandoning in this sentence was preventing them, in part, from pursuing their goals. The only answer choice that makes sense in the second blank is **inclinations** because people who had natural tendencies towards procrastination would probably have a tough time pursuing their ambitions. The first blank would then be **tenacity**, which makes sense because when you see or are around someone who is determined they probably don't procrastinate too much, and this can often inspire you to be more like them.
- 12. The correct answer is choice (A) melancholy, which means pensive sadness or sorrow, and grapple, which means to begin to understand or deal with something.** The first blank in this sentence is describing the music the man composed. The sentence tells us that the music reflected the man's internal sorrow, so we can assume that the music was probably pretty sad or **melancholy**. Answer choices (A) and (C) can both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is referring to what the music the man composed helped him to do with the burdens in his life. Homogenize means to merge or blend, so that wouldn't make sense in this sentence. Many people use music and creating art as a way to deal, or **grapple**, with difficult situations in their life, so it would make sense for the man's music to help him with this.
- 13. The correct answer is choice (D) cynical, which means distrustful of, or pessimistic about human sincerity or integrity , and repress, which means suppress or subdue.** The first blank in this sentence is describing how Evelyn tried not to feel about forming friendships. The clue in this sentence is the second part of the sentence when it mentions feelings of distrust and uncertainty towards others. This is basically the definition of **cynical**, so we should try that answer choice first and see if it works. The word "but" in the middle of the sentence tells us that the two ideas in this sentence are probably going to be in contrast to each other. If someone was not pessimistic about forming friendships, normally they would not find it difficult to suppress feelings of distrust towards others. In this case however, Evelyn tried to not be distrustful of forming friendships, but she found it difficult to **repress** those feelings of uncertainty towards others.

- 14. The correct answer is choice (B) counterfeit, which means fake, and homogeneous, which means matching or all alike.** The first blank in this sentence is describing a diamond that the woman did not find it difficult to identify. It wouldn't make sense to call a diamond jovial because it is an inanimate object, so answer choice (A) is incorrect. It also does not make sense to call a diamond diminishing, or decreasing, in this sentence, so answer choice (C) is incorrect. Answer choices (B) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing the other stones on the shelf and why it was easy for the woman to distinguish the diamond. It wouldn't make sense for the woman to not find it difficult to identify the pulverized, or ground up, diamond because it was easy to distinguish it from the original stones on the shelf, so answer choice (D) is incorrect. It makes more sense for the woman to not find it difficult to identify the fake, or **counterfeit**, diamond because it was easy to distinguish it from all the other matching, or **homogeneous**, stones on the shelf.
- 15. The correct answer is choice (C) charismatic, which means charming, and irresolute, which means uncertain or indecisive.** The first blank in the sentence is describing what Wendy liked about the interviewee, so the word must be positive. This eliminates answer choices (B) and (D) because abrasive means harsh and mediocre means average; these are not positive words. The second blank is a negative word, and we know that it describes responses that are difficult to believe. Irresolute means wavering or indecisive. Wavering responses are hard to believe, so **irresolute** fits in the second blank the best.
- 16. The correct answer is choice (C) sinister, which means threatening or alarming, and intuition, which means instinct or the ability to sense something immediately.** The first blank in this sentence is describing the man's motivations and says there was no evidence that they were "blank". A clue to the answer we are looking for is the second part of the sentence that tells us that something cautioned the woman against trusting him regardless of those intentions, so we know that his intentions must not have seemed bad. If the man's intentions were not bad then there would be no evidence that they were threatening, or **sinister**. Answer choices (B), (C), and (D) can all work for the first blank, so we have to use the second blank to find the correct answer. The second blank is referring to what cautioned the woman against trusting the man. Since the man's intentions did not seem alarming, it must have been some natural instinct, or **intuition**, that cautioned the woman against trusting him.
- 17. The correct answer is choice (B) deluge, which means an overwhelming number of something, and condescending, which means patronizing or snobby.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing how the author never acted when discussing literature with others. The clue in this sentence is the sentence telling us that the author always remained humble. Humble means modest and not thinking you are better than others, so it would make sense then that the author was never patronizing, **condescending**, when discussing literature with others. This answer choice would make the first blank **deluge**, which makes sense because if someone had impressive accomplishments you would expect them to have a large number of awards.

- 18. The correct answer is choice (A) faltered, which means hesitated or stalled, and belligerent, which means hostile and aggressive.** The first blank in this sentence is referring to what the man did when he was struck by fear and before he approached the other men. If we think about someone who is scared, it makes sense that they would hesitate, or **falter**, before doing whatever made them scared. Answer choices (A) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing the men who were arguing. Since the men were having an argument and the man was scared to approach them, we can infer that these men were probably aggressive, or **belligerent**, in their arguing.
- 19. The correct answer is choice (D) congruent, which means consistent or harmonious, and inundated, which means overwhelmed or swamped.** The first blank in this sentence is referring to the relationship between the woman going to a party instead of studying and her desire to pass her exam. If someone wanted to pass an exam, they would probably need to study, so going out to a party instead of studying would seem counterproductive to their desire. In other words, going to a party instead of studying would not be consistent, or **congruent**, with their desire. Answer choices (A) and (D) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is referring to the woman’s homework and the second part of the sentence says she longed for a break from academics. We can infer that the reason the woman longed for a break from academics was because she had been doing a lot of schoolwork recently, so it would make sense then that she was overwhelmed, or **inundated**, with homework.
- 20. The correct answer is choice (A) interlude, which means intermission or break, and scintillating, which means exciting or lively.** This sentence is talking about a woman at a play and the first blank is referring to when the woman chose to stay seated. The second part of this sentence says she had heard that the cast planned on putting on a performance during the break. Since the sentence tells us the performance was going to be during the break, we know the woman must have stayed seated for the intermission, or **interlude**. Answer choices (A), (B), and (C) all work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing the performance the cast was going to put on during the recess. Since the woman chose to stay seated instead of getting up and taking a break as someone would normally do during a break in a play, we can infer that she must have heard the performance was going to be exciting, or **scintillating**.

# Math Courses

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**MATH COURSE 1****General Percents Set 1**

- 1. Answer choice (B) is the correct answer.** Change 45% into a decimal by moving the decimal two places to the left to get 0.45. Multiply 0.45 by 600 to get 270.
- 2. Answer choice (B) is the correct answer.** Divide 15 by 75 to get 0.2. Change 0.2 into a percent by moving the decimal two places to the right to get 20%.
- 3. Answer choice (D) is the correct answer.** Change 15% into a decimal by moving the decimal two places to the left to get 0.15. Divide 300 by 0.15 to get 2000.
- 4. Answer choice (C) is the correct answer.** Change 132% into a decimal by moving the decimal two places to the left to get 1.32. Multiply 1.32 by 60 to get 79.2.
- 5. Answer choice (A) is the correct answer.** Change 6% into a decimal by moving the decimal two places to the left to get 0.06. Multiply 0.06 by 90 to get 5.4.
- 6. Answer choice (D) is the correct answer.** Change 40% into a decimal by moving the decimal two places to the left to get 0.4. Divide 12 by 0.4 to get 30.
- 7. Answer choice (B) is the correct answer.** Change 112% into a decimal by moving the decimal two places to the left to get 1.12. Multiply 1.12 by 260 to get 291.2.
- 8. Answer choice (D) is the correct answer.** Divide 36 by 12 to get 3. Change 3 into a percent by moving the decimal two places to the right to get 300%.
- 9. Answer choice (D) is the correct answer.** Find 50% of 620 by multiplying 0.5 by 620 to get 310. Then find 10% of 310 by multiplying 0.1 by 310 to get 31.
- 10. Answer choice (A) is the correct answer.** Divide 21 by 140 to get 0.15. Change 0.15 into a percent by moving the decimal two places to the right to get 15%.
- 11. Answer choice (C) is the correct answer.** Divide 30 by 90 to get 0. . Change 0.  into a percent by moving the decimal two places to the right to get 33. %.
- 12. Answer choice (A) is the correct answer.** Find 30% of 200 by multiplying 0.3 by 200 to get 60. Then find 20% of 60 by multiplying 0.2 by 60 to get 12.
- 13. Answer choice (B) is the correct answer.** Change 20% into a decimal by moving the decimal two places to the left to get 0.2. Divide 5 by 0.2 to get 25.

- 14. Answer choice (B) is the correct answer.** Find 25% of 840 by multiplying 0.25 by 840 to get 210. Then find 20% of 210 by multiplying 0.2 by 210 to get 42.

### General Percents Set 2

- 1. Answer choice (B) is the correct answer.** Change 42% into a decimal by moving the decimal two places to the left to get 0.42. Multiply 0.42 by 400 to get 168.
- 2. Answer choice (B) is the correct answer.** Divide 120 by 500 to get 0.24. Change 0.24 into a percent by moving the decimal two places to the right to get 24%.
- 3. Answer choice (B) is the correct answer.** Change 75% into a decimal by moving the decimal two places to the left to get 0.75. Divide 84 by 0.75 to get 112.
- 4. Answer choice (B) is the correct answer.** Change 140% into a decimal by moving the decimal two places to the left to get 1.4. Multiply 1.4 by 70 to get 98.
- 5. Answer choice (A) is the correct answer.** Divide 33 by 132 to get 0.25. Change 0.25 into a percent by moving the decimal two places to the right to get 25%.
- 6. Answer choice (A) is the correct answer.** Change 8% into a decimal by moving the decimal two places to the left to get 0.08. Multiply 0.08 by 90 to get 7.2.
- 7. Answer choice (D) is the correct answer.** Divide 84 by 35 to get 2.4. Change 2.4 into a percent by moving the decimal two places to the right to get 240%.
- 8. Answer choice (B) is the correct answer.** Change 2% into a decimal by moving the decimal two places to the left to get 0.02. Divide 10 by 0.02 to get 500.
- 9. Answer choice (C) is the correct answer.** Divide 120 by 48 to get 2.5. Change 2.5 into a percent by moving the decimal two places to the right to get 250%.
- 10. Answer choice (C) is the correct answer.** Find 10% of 900 by multiplying 0.1 by 900 to get 90. Then find 20% of 90 by multiplying 0.2 by 90 to get 18.
- 11. Answer choice (B) is the correct answer.** Find 40% of 500 by multiplying 0.4 by 500 to get 200. Then find 90% of 200 by multiplying 0.9 by 200 to get 180.
- 12. Answer choice (D) is the correct answer.** Change 25% into a decimal by moving the decimal two places to the left to get 0.25. Divide 16 by 0.25 to get 64.

- 13. Answer choice (C) is the correct answer.** Find 40% of 800 by multiplying 0.4 by 800 to get 320. Then find 30% of 320 by multiplying 0.3 by 320 to get 96.
- 14. Answer choice (B) is the correct answer.** Find 50% of 120 by multiplying 0.5 by 120 to get 60. Then find 70% of 60 by multiplying 0.7 by 60 to get 42.
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### Percent Change Set 1

- 1. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 8 and 12 is 4 → 4 divided by 8 is 0.5 → 0.5 times 100 equals 50%.
- 2. Answer choice (D) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 60 and 80 is 20 → 20 divided by 60 is  $0.\bar{3}$  →  $0.\bar{3}$  times 100 equals  $33.\bar{3}\%$
- 3. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 48 and 36 is 12 → 12 divided by 48 is 0.25 → 0.25 times 100 equals 25%.
- 4. Answer choice (B) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 3.2 and 2.8 is 0.4 → 0.4 divided by 3.2 is 0.125 → 0.125 times 100 equals 12.5%.
- 5. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 8 and 9.6 is 1.6 → 1.6 divided by 8 is 0.2 → 0.2 times 100 equals 20%.
- 6. Answer choice (B) is the correct answer.** If you double a number, you've increased the number by itself. Therefore, you've increased the number by 100%.
- 7. Answer choice (D) is the correct answer.** To increase 450 by 200%, add 200% of 450 to 450. 200% of 450 equals 900, and 900 plus 450 equals 1350.
- 8. Answer choice (A) is the correct answer.** Any number decreased by 100% equals 0 because 100% of any number is just itself. 100% of 6.8 equals 6.8, and 6.8 decreased by 6.8 equals 0.
- 9. Answer choice (D) is the correct answer.** To increase 90 by 20%, add 20% of 90 to 90. 20% of 90 equals 18, and 18 plus 90 equals 108.

- 10. Answer choice (B) is the correct answer.** To decrease 7 by 40%, subtract 40% of 7 from 7. 40% of 7 equals 2.8, and 7 minus 2.8 equals 4.2
- 11. Answer choice (C) is the correct answer.** If you multiply a number by 4, the new number is 400% of the old number, but it has only increased by 300%. Use 100 as your number and multiply it by 4 to get 400. The percent increase from 100 to 400 is 300%.
- 12. Answer choice (B) is the correct answer.** Use 100 as your starting number and increase it by 200% to get 300. To get from 100 to 300, you need to multiply by 3.
- 13. Answer choice (A) is the correct answer.** Let  $a$  equal 100, so  $1.4a$  equals 140. The percent change from 100 to 140 is 40%.
- 14. Answer choice (A) is the correct answer.** Let  $x$  equal 100, so  $3x$  equals 300 and  $1.8x$  equals 180. The percent change from 300 to 180 is 40%.

### Percent Change Set 2

- 1. Answer choice (D) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 50 and 70 is 20  $\rightarrow$  20 divided by 50 is 0.4  $\rightarrow$  0.4 times 100 equals 40%.
- 2. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 30 and 60 is 30  $\rightarrow$  30 divided by 30 is 1  $\rightarrow$  1 times 100 equals 100%.
- 3. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 72 and 54 is 18  $\rightarrow$  18 divided by 72 is 0.25  $\rightarrow$  0.25 times 100 equals 25%.
- 4. Answer choice (C) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 5.5 and 6.6 is 1.1  $\rightarrow$  1.1 divided by 5.5 is 0.2  $\rightarrow$  0.2 times 100 equals 20%.
- 5. Answer choice (A) is the correct answer.** To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 24 and 16.8 is 7.2  $\rightarrow$  7.2 divided by 24 is 0.3  $\rightarrow$  0.3 times 100 equals 30%.
- 6. Answer choice (A) is the correct answer.** If you triple 2000, you get 6000. To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 2000 and 6000 is 4000  $\rightarrow$  4000 divided by 2000 is 2  $\rightarrow$  2 times 100 equals 200%.

7. **Answer choice (B) is the correct answer.** If you multiply 700 by 1.5, you get 1050. To find percent change, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 700 and 1050 is 350 → 350 divided by 700 is 0.5 → 0.5 times 100 equals 50%.
  8. **Answer choice (D) is the correct answer.** To increase 120 by 300%, add 300% of 120 to 120. 300% of 120 equals 360, and 360 plus 120 equals 480.
  9. **Answer choice (B) is the correct answer.** To decrease 68 by 10%, subtract 10% of 68 from 68. 10% of 68 equals 6.8, and 68 minus 6.8 equals 61.2
  10. **Answer choice (B) is the correct answer.** To increase 40 by 45%, add 45% of 40 to 40. 45% of 40 equals 18, and 18 plus 40 equals 58.
  11. **Answer choice (C) is the correct answer.** If you multiply a number by 2, the new number is 200% of the old number, but it has only increased by 100%. Use 100 as your number and multiply it by 2 to get 200. The percent increase from 100 to 200 is 100%.
  12. **Answer choice (B) is the correct answer.** Use 100 as your starting number and increase it by 400% to get 500. To get from 100 to 500, you need to multiply by 5.
  13. **Answer choice (A) is the correct answer.** Let  $b$  equal 100, so  $0.65b$  equals 65. The percent change from 100 to 65 is 35%.
  14. **Answer choice (A) is the correct answer.** Let  $x$  equal 100, so  $5x$  equals 500 and  $5.5x$  equals 550. The percent change from 550 to 500 is 10%.
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### Percent Word Problems Set 1

1. **Answer choice (A) is the correct answer.** Subtract \$246 and \$145 from \$460 to find out how much money James had left which equals \$69. Now we are answering the question, “69 is what percent of 460.” Divide 69 by 460 to get 0.15 which equals 15%.
2. **Answer choice (B) is the correct answer.** Percent discount is a specific type of percent change, but it uses the same formula. To find percent change, or discount, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 550 and 440 is 110 → 110 divided by 550 is 0.2 → 0.2 times 100 equals 20%.
3. **Answer choice (C) is the correct answer.** Percent increase is a specific type of percent change, but it uses the same formula. To find percent change, or increase, divide the difference in the

numbers by the starting number, and then multiply the result by 100. The difference between 3.00 and 3.60 is 0.6 → 0.6 divided by 3.00 is 0.2 → 0.2 times 100 equals 20%.

4. **Answer choice (C) is the correct answer.** Find 35% of \$50 by multiplying 0.35 by \$50 to get \$17.50. Since the shirt was discounted by 35%, or \$17.50, subtract \$17.50 from \$50 to get \$32.50.
5. **Answer choice (A) is the correct answer.** Find how much money Michelle spends on rent by multiplying 0.5 by \$800 to get \$400. She spends 30% of her remaining \$400 on food, so multiply 0.3 by \$400 to find that she spends \$120 on food. She spends \$400 on rent and \$120 on food, so she spends \$520 in total. \$800 minus \$520 equals \$280, so she has \$280 leftover. Divide \$280 by her starting \$800 to get 0.35 which equals 35%.
6. **Answer choice (B) is the correct answer.** Since the problem doesn't tell us how much money Purvi started with, just use \$100 as her starting amount. She spends 40% of the \$100 which is \$40, so she has \$60 left. She then spends 10% of the \$60 she has left which is \$6, so she has \$54. \$54 is 54% of her original \$100.
7. **Answer choice (B) is the correct answer.** Find their total goal by answering the question, "\$440 is 80% of what number?" Solve this by dividing \$440 by 0.8 to get \$550. If \$550 was their goal and they raised \$440, they have \$110 left to raise (\$550 minus \$440 equals \$110).
8. **Answer choice (B) is the correct answer.** Since Bennet is 35% short, this means that he has 75% of the money he needs. Therefore, \$660 represents 75% of the money Bennet needs to pay his bill. Find the total money Bennet needs by answering the questions, "\$660 is 75% of what number?" Divide \$660 by 0.75 to get \$880. Subtract \$660 from the total \$880 that Bennet needs, to get that Bennet needs \$220 more.
9. **Answer choice (B) is the correct answer.** Since the problem doesn't tell us the starting price of the shirt, just use \$100 as the starting price. Increase \$100 by 10% to get \$110. Then decrease \$110 by 10% to get \$99. The percent change from \$100 to \$99 is 1%.
10. **Answer choice (D) is the correct answer.** Since the problem doesn't tell us the starting price of the stock, just use \$100 as the starting price. Increase \$100 by 12% to get \$112. Then decrease \$112 by 10% to get 100.8. The percent change from 100 to 100.8 is 0.8%.
11. **Answer choice (C) is the correct answer.** Find the number of green marbles by increasing 40 red marbles by 20%:  $40 + 20\% \text{ of } 40 = 40 + 8 = 48$  green marbles. Find the number of yellow marbles by decreasing 40 red marbles by 10%:  $40 - 10\% \text{ of } 40 = 40 - 4 = 36$  yellow marbles. Add up the 40 red marbles, 48 green marbles, and 36 yellow marbles to get 124 total marbles.
12. **Answer choice (C) is the correct answer.** We want to answer the question, "\$0.40 is 25% of what number." To do this, divide \$0.40 by 0.25 to get \$1.60.

- 13. Answer choice (B) is the correct answer.** Since the problem doesn't tell us the original price of the item, just use \$100 as the original price. On Friday, the item is 50% off, so it costs \$50. On Saturday, the item goes back up to its original \$100. The percent change from the price of the item on Friday, \$50, to the price of the item on Saturday, \$100, is 100%.
- 14. Answer choice (C) is the correct answer.** Since the problem doesn't tell us what the two numbers are, just say they are both 10, so the original product is 10 times 10 which equals 100. Increase one number by 20% to get 12, and decrease the other number by 30% to get 7. The new product is 7 times 12 which equals 84. The percent change from 100 to 84 equals 16.
- 15. Answer choice (B) is the correct answer.** Since the problem doesn't tell us what the two numbers are, just say they are both 10, so the original product is 10 times 10 which equals 100. Increase each number by 10%, so now both numbers equal 11. The new product is 11 times 11 which equals 121. The percent change from 100 to 121 is 21%.

### Percent Word Problems Set 2

- 1. Answer choice (D) is the correct answer.** Increase \$5 by 45% by adding 45% of 5 to 5.  $45\% \text{ of } 5 = 0.45 \cdot 5 = 2.25$ . Add \$2.25 to \$5 to get \$7.25.
- 2. Answer choice (B) is the correct answer.** Find 15% of \$120 by multiplying 0.15 by \$120 to get \$18. Since the shirt was discounted by 15%, or \$18, subtract \$18 from \$120 to get \$102.
- 3. Answer choice (A) is the correct answer.** Percent increase is a specific type of percent change, but it uses the same formula. To find percent change, or increase, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 600 and 636 is 36  $\rightarrow$  36 divided by 600 is 0.06  $\rightarrow$  0.06 times 100 equals 6%.
- 4. Answer choice (B) is the correct answer.** Find the number of goats on the farm by subtracting the number of chickens and cows from the total number of animals:  $30 - 15 - 9 = 6$  goats. Find what percent of her animals are goats by dividing 6 by 30 to get 0.2, and then change 0.2 into a percent by moving the decimal two places to the right to get 20%.
- 5. Answer choice (C) is the correct answer.** Percent discount is a specific type of percent change, but it uses the same formula. To find percent change, or discount, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 16.40 and 4.10 is 12.3  $\rightarrow$  12.3 divided by 16.4 is 0.75  $\rightarrow$  0.75 times 100 equals 75%.
- 6. Answer choice (C) is the correct answer.** Since the problem doesn't tell us how much money Jonah started with, just use \$100 as his starting amount. He spends 18% of the \$100 which is \$18, so he has \$82 left. He then spends 10% of the \$82 he has left which is \$8.20, so he has \$73.80. If he has \$73.80 out of \$100 left, then he spent \$26.20. 26.20 is 26.2% of his original \$100.

7. **Answer choice (C) is the correct answer.** Joe wrote 25% of the 80 pages on Monday, so he wrote 20 pages. Therefore, he has 60 pages left. On Tuesday, he writes 40% of those 60 pages, so he writes 24 pages. In total, he has completed 20 pages on Monday and 24 on Tuesday, so 44 total pages. Now we are answering the question, “44 is what percent of 80.” Divide 44 by 80 to get 0.55 which equals 55%.
8. **Answer choice (B) is the correct answer.** Since Lucy is 20% short, this means she has paid 80% of the money she owes Percy. Therefore, we want to answer the question, “\$360 is 80% of what number?” to find the total amount Lucy owes. Find this by dividing 360 by 0.8 to get \$450. Since Lucy owes a total of \$450 and she has paid \$360, she owes Percy \$90 more.
9. **Answer choice (A) is the correct answer.** First, find the total amount of money the team needs to raise by answering the question, “\$2400 is 75% of what number?” Find this by dividing 2400 by 0.75 to get \$3200. Subtract \$2400 from \$3200 to get that they still need to raise \$800.
10. **Answer choice (A) is the correct answer.** Since the problem doesn’t tell us the original price of the stock, set the original price to \$100. Decrease \$100 by 20% to get \$80 as the price of the stock after it decreased by 20%. Then increase this new price by 25% by adding 25% of \$80 to \$80 → 25% of 80 = \$20 → \$20 + \$80 = \$100. Since the stock price started and ended at the same price of \$100, the overall percent change is 0%.
11. **Answer choice (D) is the correct answer.** We want to answer the question, “\$6.00 is 30% of what number?” We can do this by dividing \$6.00 by 0.3 to get \$20.
12. **Answer choice (B) is the correct answer.** Find the number of nickels by increasing the number of quarters by 15% → 15% of 60 =  $0.15 \cdot 60 = 9$  →  $9 + 60 = 69$  nickels. Find the number of dimes by decreasing the number of quarters by 30% → 30% of 60 =  $0.3 \cdot 60 = 18$  →  $60 - 18 = 42$  dimes. Add the number of quarters, nickels, and dimes:  $60 + 69 + 42 = 171$  total coins.
13. **Answer choice (B) is the correct answer.** Since the problem doesn’t tell us the original price of the item, just use \$100 as the original price. On Saturday, the item is 20% off, so it costs \$80 ( $100 - 20\% \text{ of } 100 = 100 - 20 = 80$ ). On Sunday, the item goes back up to its original \$100. The percent change from the price of the item on Saturday, \$80, to the price of the item on Sunday, \$100, is 25% (increase from 80 to 100 is 20 and 20 is 25% of 80).
14. **Answer choice (A) is the correct answer.** Since the problem doesn’t tell us the two starting numbers, set them both equal to 10. Therefore, the original product of the two numbers is  $10 \cdot 10 = 100$ . Increase one number by 30% to get 13, and decrease the other number by 20% to get 8. Therefore, the new product =  $13 \cdot 8 = 104$ . The percent change from 100 to 104 is 4%.
15. **Answer Choice (C) is the correct answer.** Since the problem doesn’t tell us the two starting numbers, set them both equal to 10. Therefore, the original product of the two numbers is  $10 \cdot 10 =$

100. Decrease both numbers by 10%, so now both numbers equal 9. The product of the new numbers is  $9 \cdot 9 = 81$ . The percent decrease, or change, from 100 to 81 equals 19%

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### Ratios and Proportions Set 1

- 1. Answer choice (B) is the correct answer.** The height to shadow ratio of the tree must equal the height to shadow ratio of Chelsea. Set up the proportion  $\frac{15}{10} = \frac{x}{3}$  using  $x$  as Chelsea's height. Cross multiply to get  $45 = 10x$ . Divide both sides by 10 to get that  $x$  equals 4.5 ft.
- 2. Answer choice (A) is the correct answer.** Set up the proportion  $\frac{3}{2} = \frac{x}{6}$  using  $x$  as the number of apples. Cross multiply to get  $18 = 2x$ . Divide both sides by 2 to get that  $x$  equals 9 apples. Add together 6 oranges and 9 apples to get 15 total pieces of fruit.
- 3. Answer choice (A) is the correct answer.** Set up the proportion  $\frac{2}{30} = \frac{x}{45}$  using  $x$  as the width of the model. Cross multiply to get  $90 = 30x$ . Divide both sides by 30 to get that  $x$  equals 3 inches.
- 4. Answer choice (D) is the correct answer.** Set up the equation  $7x + 2x = 108$ , where  $7x$  represents the number of blue marbles and  $2x$  represents the number of red marbles. Solve the equation to get  $x = 12$ . Since the number of blue marbles equals  $7x$ , multiply 7 by 12 to get 84 blue marbles.
- 5. Answer choice (B) is the correct answer.** Set up the equation  $5x + 3x = 72$ , where  $5x$  is the number of yellow ping-pong balls and  $3x$  is the number of green ping-pong balls. Solve the equation to get  $x = 9$ . Since the number of yellow ping-pong balls is  $3x$ , multiply 3 by 9 to get 27 yellow balls. Since the number of green ping-pong balls is  $5x$ , multiply 5 by 9 to get 45 green balls. Find the difference between 45 and 27 by subtracting 27 from 45 to get 18.
- 6. Answer choice (D) is the correct answer.** Remember for ratios that the units of each part must be the same. 1 foot is equal to 12 inches, so the width to height ratio is 8:12 which simplifies to 2:3.
- 7. Answer choice (B) is the correct answer.** The height to shadow ratio of the building must equal the height to shadow ratio of the tree. Set up the proportion  $\frac{80}{60} = \frac{20}{x}$  using  $x$  as the length of the tree's shadow. Cross multiply to get  $1200 = 80x$ . Divide both sides by 80 to get that  $x$  equals 15 ft.

- 8. Answer choice (C) is the correct answer.** Since the numbers are negative, the *smaller* number represents the 5 part of the ratio. Set up the proportion  $\frac{3}{5} = \frac{x}{-30}$  using  $x$  as the larger number. Cross multiply to get  $-90 = 5x$ . Divide both sides by 5 to get that  $x$  equals  $-18$ .
- 9. Answer choice (A) is the correct answer.** We need to make the blue shirts part of each ratio equal so we can compare the pink to white shirts. The ratio of pink to blue shirts is 2:5, which is the same as 4:10. Since the ratio of blue to white shirts is 10:7, this means that the ratio of pink to white shirts is 4:7.
- 10. Answer choice (C) is the correct answer.** First, change 1.5 hours into minutes by multiplying by 60 to get 90 minutes. Set up the proportion  $\frac{12}{10} = \frac{x}{90}$  using  $x$  as the number of pages read in 1.5 hours. Cross multiply to get  $1080 = 10x$ . Divide both sides by 10 to get that  $x$  equals 108 pages.
- 11. Answer choice (D) is the correct answer.** First, change 75 mm into cm by dividing by 10 to get 7.5 cm. Set up the proportion  $\frac{5}{21} = \frac{7.5}{x}$  using  $x$  as the distance between the two towns in real life. Cross multiply to get  $157.5 = 5x$ . Divide both sides by 5 to get that  $x$  equals 31.5 km.
- 12. Answer choice (B) is the correct answer.** The original ratio of girls to boys is 15:20 which equals 3:4. If we add 3 girls, there are now 18 girls. Set up the proportion  $\frac{3}{4} = \frac{18}{x}$  using  $x$  as the new number of boys. Cross multiply to get  $72 = 3x$ . Divide both sides by 3 to get that  $x$  equals 24 boys. Since we started with 20 boys, we need to add 4 boys to get to 24 and keep the ratio equal.
- 13. Answer choice (C) is the correct answer.** Set up the equation  $4x + 9x = -65$  where  $4x$  represents the larger number (because the numbers are negative) and  $9x$  represents the smaller number. Solve the equation to get that  $x = -5$ . Since the larger number equals  $4x$ , multiply 4 by  $-5$  to get  $-20$  as the larger number.
- 14. Answer choice (B) is the correct answer.** Set up the equation  $3x + 2x + 6x = 44$ , where  $2x$  represents the smallest number,  $3x$  represents the middle number, and  $6x$  represents the largest number. Solve the equation to get  $x = 4$ . Since the smallest number equals  $2x$ , multiply 2 by 4 to get 8 as the smallest number.
- 15. Answer choice (D) is the correct answer.** Since the ratio of chocolate chip to sugar cookies is 5:8, the ratio of chocolate chip to total cookies is 5:13. Check each answer choice to see which one has the ratio of chocolate chip to total cookies as 5:13. Answer choice (A) is incorrect because the ratio of chocolate chip to total cookies is 10:16 which equals 5:8. Answer choice (B) is incorrect because the ratio of chocolate chip to total cookies is 8:13. Answer choice (C) is incorrect because

the ratio of chocolate chip to total cookies is 16:26 which equals 8:13. Answer choice (D) is correct because the ratio of chocolate chip to total cookies is 10:26 which equals 5:13.

### Ratios and Proportions Set 2

- Answer choice (C) is the correct answer.** Set up the proportion  $\frac{5}{28} = \frac{x}{112}$  using  $x$  as the number of prizes. Cross multiply to get  $560 = 28x$ . Divide both sides by 28 to get that  $x$  equals 20 prizes.
- Answer choice (B) is the correct answer.** Using the three part ratio, we can say that the ratio of oil to vinegar is 4:3. Set up the proportion  $\frac{4}{3} = \frac{2}{x}$  using  $x$  as the number of cups of vinegar. Cross multiply to get  $4x = 6$ . Divide both sides by 4 to get that  $x$  equals 1.5 cups of vinegar.
- Answer choice (D) is the correct answer.** Set up the proportion  $\frac{1}{4} = \frac{15}{x}$  using  $x$  as the height of the real house in *yards*. Cross multiply to get  $x = 60$  *yards*. The answer choices are in *feet*, and there are 3 feet in 1 yard, so multiply 60 yards by 3 to get 180 feet.
- Answer choice (A) is the correct answer.** Set up the equation  $7x + 5x = 96$ , where  $7x$  represents the number of black marbles and  $5x$  represents the number of white marbles. Solve the equation to get  $x = 8$ . Since the number of black marbles equals  $7x$ , multiply 7 by 8 to get 56 black marbles.
- Answer choice (A) is the correct answer.** The height to shadow ratio of the statue must equal the height to shadow ratio of the box. Set up the proportion  $\frac{12}{18} = \frac{x}{6}$  using  $x$  as the height of the box. Cross multiply to get  $72 = 18x$ . Divide both sides by 18 to get that  $x$  equals 4 ft.
- Answer choice (C) is the correct answer.** We need to make the white cars part of each ratio equal so we can compare the black to gray cars. The ratio of black to white cars is 8:3, which is the same as 32:12. Since the ratio of white to gray cars is 12:7, this means that the ratio of black to gray cars is 32:7.
- Answer choice (B) is the correct answer.** The height to shadow ratio of the flagpole must equal the height to shadow ratio of the tree. Set up the proportion  $\frac{21}{24} = \frac{7}{x}$  using  $x$  as the length of the tree's shadow. Cross multiply to get  $168 = 21x$ . Divide both sides by 21 to get that  $x$  equals 8 ft.
- Answer choice (C) is the correct answer.** Set up the equation  $9x + 7x = 64$ , where  $9x$  represents the number of flower stickers and  $7x$  represents the number of heart stickers. Solve the equation to get  $x = 4$ . The number of flower stickers equals  $9x$ :  $9 \cdot 4 = 36$ . The number of heart stickers equals  $7x$ :  $7 \cdot 4 = 28$ . The difference between 36 and 28 equals  $36 - 28 = 8$ .

- 9. Answer choice (C) is the correct answer.** When writing ratios, the units of the two quantities must be the same. Therefore, we need to change 1 ft into inches: 1 foot = 12 inches. Now we can write the base to height ratio as 9:12 and simplify by dividing both parts by 3 to get 3:4.
- 10. Answer choice (C) is the correct answer.** Set up the proportion  $\frac{4}{3} = \frac{12}{x}$  using  $x$  as the number of limes. Cross multiply to get  $36 = 4x$ . Divide both sides by 4 to get that  $x$  equals 9 limes. Find the total number of fruits by adding the lemons and limes:  $12 + 9 = 21$  total pieces.
- 11. Answer choice (A) is the correct answer.** Since the numbers are negative, the *larger* number represents the 2 part of the ratio. Set up the proportion  $\frac{2}{7} = \frac{-14}{x}$  using  $x$  as the smaller number. Cross multiply to get  $-98 = 2x$ . Divide both sides by 2 to get that  $x$  equals  $-49$ .
- 12. Answer choice (C) is the correct answer.** First, change the distance between Town C and Town D on the map into inches: 1 foot = 12 inches. Now set up the proportion  $\frac{4}{16} = \frac{12}{x}$  using  $x$  as the distance between Town C and Town D in real life. Cross multiply to get  $4x = 192$ . Divide both sides by 4 to get that  $x$  equals 48 miles.
- 13. Answer choice (C) is the correct answer.** Set up the equation  $2x + 3x + 5x = 180$ , where  $2x$  represents the measure of the smallest angle,  $3x$  represents the measure of the middle angle, and  $5x$  represents the measure of the largest angle. Solve the equation to get  $x = 18$ . The measure of the largest angle equals  $5x$ , so multiply  $5 \cdot 18$  to get 90 degrees.
- 14. Answer choice (D) is the correct answer.** The original ratio of girls to boys is 12:16 which equals 3:4. If we add 9 girls, there are now 21 girls. Set up the proportion  $\frac{3}{4} = \frac{21}{x}$  using  $x$  as the new number of boys. Cross multiply to get  $84 = 3x$ . Divide both sides by 3 to get that  $x$  equals 28 boys. Since we started with 16 boys, we need to add 12 boys to get to 28 and keep the ratio equal.
- 15. Answer choice (D) is the correct answer.** Since the ratio of sandals to sneakers is 5:3, the ratio of sneakers to total shoes is 3:8. Check each answer choice to see which one has the ratio of sneakers to total shoes as 3:8. Answer choice (A) is incorrect because the ratio of sneakers to total shoes is 9:15 which equals 3:5. Answer choice (B) is incorrect because the ratio of sneakers to total shoes is 30:50 which equals 3:5. Answer choice (C) is incorrect because the ratio of sneakers to total shoes is 15:45 which equals 1:3. Answer choice (D) is correct because the ratio of sneakers to total shoes is 12:32 which equals 3:8.
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**Rates Set 1**

- 1. Answer choice (C) is the correct answer.** Use the equation  $d = rt$  to find the time it took Demi to arrive. Use 70 mph as the rate and 350 miles as the distance:  $350 = 70t$ . Divide both sides by 70 to get that it took Demi 5 hours to arrive in Los Angeles. Use the equation  $d = rt$  to find the time it took Talon to arrive. Use 50 mph as the rate and 350 miles as the distance:  $350 = 50t$ . Divide both sides by 50 to get that it took Talon 7 hours to arrive in Los Angeles. This means Talon arrived 2 hours after Demi, so he arrived at 5:00 p.m.
- 2. Answer choice (C) is the correct answer.** Denise is driving 7 mph faster than Elaine ( $55 - 48 = 7$ ). Use the equation  $d = rt$  to find how much further Denise will drive in 5 hours. Use 7 mph as the rate and 5 hours as the time:  $d = 7 \cdot 5 = 35$  miles.
- 3. Answer choice (A) is the correct answer.** Average speed = total distance  $\div$  by total time. The total distance is 60 miles plus 75 miles which equals 135 miles. The total time is 2 hours plus 1 hour plus 3 hours (don't forget to count the 1 hour break) which equals 6 hours.  $135 \text{ miles} \div 6 \text{ hours} = 22.5 \text{ mph}$ .
- 4. Answer choice (C) is the correct answer.** If Andy can run twice as fast as Abby, then he can run twice as far as Abby in the same amount of time. If Abby ran 6 miles in 60 minutes, Andy can run 12 miles in 60 minutes.
- 5. Answer choice (D) is the correct answer.** Chris can mow  $\frac{1}{2}$  of the lawn in 1 hour and Charlie can mow  $\frac{1}{3}$  of the lawn in 1 hour. Add these together to get that they can mow  $\frac{5}{6}$  of the lawn in 1 hour, or 60 minutes. Divide this by 5 to get that they can mow  $\frac{1}{6}$  of the lawn in 12 minutes. Multiply this by 6 to get that they can mow  $\frac{6}{6}$ , or 1 lawn, in 72 minutes. Divide 72 minutes by 60 to get 1.2 hours. Remember that when Charlie and Chris work together, it should save them time, so answer choices (A) and (B) can be crossed out initially because they are both longer than the time it takes Chris to mow the lawn on his own.
- 6. Answer choice (C) is the correct answer.** The number of people and the time it takes to build a sandcastle are inversely related. This means that the more people there are, the less time it will take to build the sand castle. This eliminates answer choice (A). 3 people can build a sand castle in 3 hours, so if we multiply the number of people we have by 4 to get 12 people, we have to divide the time it takes by 4. 3 hours divided by 4 equals 0.75 hours.
- 7. Answer choice (B) is the correct answer.** Change 15 minutes into hours by dividing 15 by 60 to get 0.25. Now we are trying to find how many bracelets Zoey can make in 3.25 hours. Since she can make  $x$  bracelets each hour, multiply 3.25 by  $x$  to get  $3.25x$  bracelets.
- 8. Answer choice (C) is the correct answer.** The number of painters and the time it takes to paint the house are inversely related. This means that the more painters there are, the less time it will take to paint the house. This eliminates answer choices (A) and (B). 4 painters can paint the house in 12

hours, so if we multiply the number of people we have by 2 to get 8 painters, we have to divide the time it takes by 2. 12 hours divided by 2 equals 6 hours.

9. **Answer choice (B) is the correct answer.** Ian is driving at a speed 10 mph faster than Karl. This means that every hour, Ian drives 10 more miles than Karl. After one hour, Ian has caught up 10 miles. After two hours, Ian has caught up 20 miles. After 3 hours, Ian has caught up 30 miles.
10. **Answer choice (D) is the correct answer.** If we know the difference between Kinga and Rea's speeds, we can find the number of minutes it took Kinga to catch up to Rea. Assume the difference in their speeds was 50 meters per minute. This means that every minute, Kinga runs 50 more meters than Rea, so every minute she catches up by 50 m. Using this, we could determine that it takes 2 minutes for Kinga to catch up to Rea.

### Rates Set 2

1. **Answer choice (D) is the correct answer.** Since Fred left at 2:30 p.m. and arrived at 4:00 p.m., it took him 1.5 hours to drive 105 miles. Find his speed using the equation  $d = rt$ :  $105 = 1.5r$ . Divide both sides by 1.5 to get that Fred's speed was 70 mph. Since Jordan left at 2:45 p.m. and arrived at 4:30 p.m., it took him 1.75 hours to drive 105 miles. Find his speed using the equation  $d = rt$ :  $105 = 1.75r$ . Divide both sides by 1.75 to get that Jordan's speed was 60 mph. Fred's speed of 70mph was 10 mph faster than Jordan's speed of 60 mph.
2. **Answer choice (D) is the correct answer.** Find the time it takes Randa to walk 7 miles using 4 mph as her speed and the equation  $d = rt$ :  $7 = 4t$ . Divide both sides by 4 to get that it takes Randa 1.75 hours to walk 7 miles. Find the time it takes Stephen to walk 7 miles using 3.5 mph as his speed and the equation  $d = rt$ :  $7 = 3.5t$ . Divide both sides by 3.5 to get that it takes Stephen 2 hours to walk 7 miles. Therefore, it takes Stephen 0.25 more hours than Randa. Convert 0.25 hours to minutes by multiplying it by 60:  $0.25 \cdot 60 = 15$  minutes.
3. **Answer choice (C) is the correct answer.** Vishak can rake 1 lawn in 1 hour and Partha can rake  $\frac{1}{2}$  of the lawn in 1 hour. Add these together to get that they can rake  $\frac{3}{2}$  of the lawn in 1 hour, or 60 minutes. Divide this by 3 to get that they can rake  $\frac{1}{2}$  of the lawn in 20 minutes. Multiply this by 2 to get that they can rake  $\frac{2}{2}$ , or 1 lawn, in 40 minutes. Divide 40 minutes by 60 to get  $0.\overline{6}$  hours. Remember that when Vishake and Partha work together, it should save them time, so answer choice (A) can be crossed out initially because it is longer than the time it takes Vishak to rake the lawn on his own.
4. **Answer choice (A) is the correct answer.** Average speed = total distance  $\div$  by total time. The total distance is 800 meters plus 1400 meters which equals 2200 meters. The total time is 10 minutes plus 20 minutes plus 20 minutes which equals 50 minutes (don't forget to count the 20 minute break).  $2200 \text{ meters} \div 50 \text{ minutes} = 44 \text{ meters per minute}$ .

5. **Answer choice (A) is the correct answer.** Find the number of hours that Train A traveled using the equation  $d = rt$ :  $210 = 70t \rightarrow t = 3$  hours. Since Train B traveled at twice the speed of Train A, Train B's speed is 140 mph. Train B traveled three times as far as Train A, so Train B traveled 630 miles. Find the number of hours that Train B traveled using the equation  $d = rt$ :  $630 = 140t \rightarrow t = 4.5$  hours. Therefore, since Train B traveled 4.5 hours and Train A traveled 3 hours, Train B traveled for 1.5 more hours than Train A.
6. **Answer choice (C) is the correct answer.** The number of kids and the time it takes to mow the lawn are inversely related. This means that the more kids there are, the less time it will take to mow the lawn. This eliminates answer choice (A). 2 kids can mow the lawn in 4 hours, so if we multiply the number of kids we have by 3 to get 6 kids, we have to divide the time it takes by 3  $\rightarrow$  4 hours divided by 3 equals  $1.\overline{3}$  hours.
7. **Answer choice (B) is the correct answer.** We know the hose can fill up the pool at a rate of  $x$  cubic feet per *minute*. Change 1.5 hours into *minutes* by multiplying by 60 to get 90 minutes. Therefore, to find the number of cubic feet in the pool after 90 minutes, multiply the rate by time to get  $90x$ .
8. **Answer choice (B) is the correct answer.** Carry is driving at a speed of 80 mph and Jack is driving at a speed of 60 mph. Since they are driving towards each other, each hour they get 140 miles closer to each other ( $80 + 60 = 140$ ). We can use 140 mph as their "combined rate" and 350 as their total distance to see how long it takes to meet. Use the equation  $d = rt$ :  $350 = 140t \rightarrow 2.5$  hours.
9. **Answer choice (C) is the correct answer.** The number of workers and the time it takes to build the shed are inversely related. This means that the more workers there are, the less time it will take to build the shed. First, find how long it will take 1 worker to build the shed. If we divide the number of original workers by 6 to get 1 worker, we need to multiply the original time by 6 to get 36 weeks. Now, use this to find the number of weeks it will take 9 workers. To get from 1 worker to 9 workers, we multiplied by 9. Therefore divide the time by 9: 36 divided by 9 equals 4 weeks.
10. **Answer choice (B) is the correct answer.** If we know the distance that Ed and Earl skated, we can find Ed's time by using the equation  $d = rt$ . If we know Ed's time, we can compare it to Earl's time to see who won. The difference between Ed and Earl's finishing times will not help us because we still won't know who had the faster time. The number of laps will not help us because it will not tell us the distance.
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### Appropriate Units Set 1

1. **Answer choice (B) is the correct answer.** Kiloliters are the only units of volume in the answer choices. Square feet measure area, kilograms measure weight, and miles measure distance.

2. **Answer choice (C) is the correct answer.** While feet and centimeters are both units of length, a pencil is not even one foot long, so it is more reasonable to measure it in centimeters. Milliliters measure volume and square inches measure area.
3. **Answer choice (A) is the correct answer.** While tons and milligrams are both units of weight, a truck is very heavy, so it is more reasonable to measure it in tons. Cubic centimeters measure volume and kilometers measure distance.
4. **Answer choice (C) is the correct answer.** While miles and feet are both units of length, or height, a tree is not even one mile tall, so it is more reasonable to measure it in feet. Grams measure weight or mass and square yards measure area.
5. **Answer choice (B) is the correct answer.** While kilometers and inches are both units of length, or height, a person is not even one kilometer tall, so it is more reasonable to measure his/her height in inches. Milligrams measure weight or mass and liters measure volume.
6. **Answer choice (C) is the correct answer.** Yards are the only units of length in the answer choices. Liters measure volume, grams measure weight or mass, and square feet measure area.
7. **Answer choice (B) is the correct answer.** Cups are the only units of volume in the answer choices. Pounds measure weight, kilograms measure weight or mass, and square feet measure area.
8. **Answer choice (D) is the correct answer.** Square feet are the only units of area in the answer choices. Cubic feet measure volume, kilograms measure mass or weight, and yards measure length.
9. **Answer choice (D) is the correct answer.** While inches and kilometers are both units of length, or distance, the distance between two cities is large, so it is more reasonable to measure it using kilometers. Liters measure volume and grams measure weight or mass.
10. **Answer choice (C) is the correct answer.** While grams and tons both measure weight, a toothbrush is very small and doesn't even weigh one ton, so it is more reasonable to measure its weight using grams. Centimeters measure length and milliliters measure volume.

### Appropriate Units Set 2

1. **Answer choice (C) is the correct answer.** Inches and miles are the only units of length, or width, in the answer choices. A piece of paper is not even 1 mile wide, so it wouldn't make sense to measure it in miles. Therefore, inches is a more reasonable unit of width to use than miles. Milliliters measure volume and square centimeters measure area.
2. **Answer choice (D) is the correct answer.** Seconds and hours both measure time, but seconds are too short to use when measuring the time it takes to drive between two cities, so measuring the time in hours is more reasonable. Square feet measure area and miles measure length or distance.

3. **Answer choice (A) is the correct answer.** Kilometers are the only units of length, or depth, in the answer choices. Kilograms measure mass or weight, cubic feet measure volume, and square yards measure area.
4. **Answer choice (A) is the correct answer.** Cubic feet are the only units of volume in the answer choices. Square feet measure area, kilograms measure weight or mass, and kilometers measure length.
5. **Answer choice (B) is the correct answer.** Kilograms are the only units of weight in the answer choices. Meters measure length, liters measure volume, and square centimeters measure area.
6. **Answer choice (B) is the correct answer.** Gallons are the only units of volume in the answer choices. Tons measure weight, feet measure length, and square centimeters measure area.
7. **Answer choice (D) is the correct answer.** Square yards are the only units of area in the answer choices. Kiloliters measure volume, miles measure length, and feet measure length.
8. **Answer choice (B) is the correct answer.** Grams and pounds both measure weight, but grams are too small to use when measuring the weight of a couch since a couch is heavy. Therefore, measuring the weight in pounds is more reasonable. Square centimeters measure area, and liters measure volume.
9. **Answer choice (B) is the correct answer.** Meters and millimeters both measure height, but a high-rise building is too tall to measure in millimeters because millimeters are very small. Therefore, it is more reasonable to measure the height of a high-rise building in meters.
10. **Answer choice (A) is the correct answer.** Circumference is the distance around a circle, and kilometers are the only units that measure distance in the answer choices. Liters measure volume, kilograms measure weight, and milliliters measure volume.
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### Unit Conversions Set 1

1. **Answer choice (C) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{150 \text{ yd}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{3 \text{ ft}}{1 \text{ yd}}$$

Cross out the units that show up on both the top and bottom of fractions (sec and yds) and you are left with  $150 \times 60 \times 3$  feet per minute.

2. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{40 \text{ ft}}{1 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ yd}}{3 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (min and ft) and you are left with  $\frac{40}{60 \times 3}$  yards per second.

3. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{80 \text{ km}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1000 \text{ m}}{1 \text{ km}}$$

Cross out the units that show up on both the top and bottom of fractions (km and hr) and you are left with  $\frac{80 \times 1000}{60}$  meters per minute.

4. **Answer choice (D) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{250 \text{ m}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ km}}{1000 \text{ m}}$$

Cross out the units that show up on both the top and bottom of fractions (m, sec and min) and you are left with  $\frac{250 \times 60 \times 60}{1000}$  km per hour.

5. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{4 \text{ m}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ ft}}{0.305 \text{ m}}$$

Cross out the units that show up on both the top and bottom of fractions (m, sec and min) and you are left with  $\frac{4 \times 60 \times 60}{0.305}$  feet per hour.

6. **Answer choice (C) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{12 \text{ ft}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{0.305 \text{ m}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (ft, sec and min)

and you are left with  $12 \times 60 \times 60 \times 0.305$  meters per hour.

7. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{75 \text{ miles}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ mile}}$$

Cross out the units that show up on both the top and bottom of fractions (miles, hr and min)

and you are left with  $\frac{75 \times 5280}{60 \times 60}$  feet per second.

8. **Answer choice (D) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{50 \text{ ft}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ miles}}{5280 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (ft and min)

and you are left with  $\frac{50 \times 60}{5280}$  miles per hour.

9. **Answer choice (C) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{80 \text{ miles}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ mile}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (hr, min, miles, and

ft) and you are left with  $\frac{80 \times 12 \times 5280}{60 \times 60}$  inches per second.

10. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{9 \text{ yd}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (sec, min, yd, and

ft) and you are left with  $9 \times 3 \times 12 \times 60 \times 60$  inches per hour.

## Unit Conversions Set 2

1. **Answer choice (D) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{80 \text{ ft}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{1 \text{ yd}}{3 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (sec and ft) and you are left with  $\frac{80 \times 60}{3}$  yards per minute.

2. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{100 \text{ yd}}{1 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (min, yd, and ft) and you are left with  $\frac{100 \times 3 \times 12}{60}$  inches per second.

3. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{50 \text{ km}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1000 \text{ m}}{1 \text{ km}}$$

Cross out the units that show up on both the top and bottom of fractions (hr and km) and you are left with  $\frac{50 \times 1000}{60}$  meters per minute.

4. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{650 \text{ m}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{1 \text{ km}}{1000 \text{ m}}$$

Cross out the units that show up on both the top and bottom of fractions (sec and m) and you are left with  $\frac{650 \times 60}{1000}$  km per minute.

5. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{3 \text{ m}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ ft}}{0.305 \text{ m}}$$

Cross out the units that show up on both the top and bottom of fractions (hr and m)

and you are left with  $\frac{3}{60 \times 0.305}$  feet per minute.

6. **Answer choice (D) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{20 \text{ ft}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{0.305 \text{ m}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (sec, min and ft) and you are left with  $20 \times 0.305 \times 60 \times 60$  meters per hour.

7. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{100 \text{ mi}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{5280 \text{ ft}}{1 \text{ mi}}$$

Cross out the units that show up on both the top and bottom of fractions (hr and mi)

and you are left with  $\frac{100 \times 5280}{60}$  feet per minute.

8. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{40 \text{ ft}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ mi}}{5280 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (sec, min, and ft)

and you are left with  $\frac{40 \times 60 \times 60}{5280}$  miles per hour.

9. **Answer choice (B) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{90 \text{ mi}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (hr, mi, and ft)

and you are left with  $\frac{90 \times 12 \times 5280}{60}$  inches per minute.

10. **Answer choice (C) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{90 \text{ yd}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (hr, yd, and ft)

and you are left with  $\frac{90 \times 3 \times 12}{60}$  inches per minute.

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### Quantitative Comparisons Set 1

- 1. Answer choice (C) is the correct answer.** To find 30% of 80, multiply 0.3 by 80 to get 24. To find 80% of 30, multiply 0.8 by 30 to get 24. Columns A and B are equal.
- 2. Answer choice (D) is the correct answer.** We do not know what  $x$  equals. If  $x$  equals 0, then each column equals 0, so the columns are equal. If  $x$  equals 10, then Column A equals 10 and Column B equals 5, so Column A is greater than Column B. Since the answer changes depending on what number we put in for  $x$ , answer choice (D) is the correct answer.
- 3. Answer choice (B) is the correct answer.** If Jasmine can type 90 words in 2 minutes, then she can type 45 words per minute. Multiply this by 30 to find that Jasmine can type 1350 words in 30 minutes. Column B is greater than Column A.
- 4. Answer choice (A) is the correct answer.** Set up the equation  $3x + 2x = -15$ , where  $3x$  represents the smaller number (because the numbers are negative) and  $2x$  represents the larger number. Solve the equation to get  $x = -3$ . Since the larger number equals  $2x$ , multiply 2 by  $-3$  to get  $-6$ . Since  $-6$  is greater than  $-9$ , Column A is greater than Column B.
- 5. Answer choice (A) is the correct answer.** If Tom and Jen could both mow the lawn on their own in 1 hour, then together they would be able to do it in half of the time, or 0.5 hours. However, since Tom takes *longer* to mow the lawn on his own (2 hours), if he works together with Jen, it will take *longer* than 0.5 hours. Therefore, Column A is greater than Column B.
- 6. Answer choice (C) is the correct answer.** There are 12 inches in 1 foot, and 3 feet in one yard. Therefore, to find the number of inches in 1 yards, multiply 12 by 3 to get 36 inches in one yard. Columns A and B are equal.
- 7. Answer choice (A) is the correct answer.** Let the original price of the shirt equal \$100. Increase \$100 by 10% to get \$110. Then decrease \$110 by 10% to get \$99. The original price of the shirt, \$100, is greater than the price of the shirt on Tuesday, \$99. Column A is greater than Column B.
- 8. Answer choice (B) is the correct answer.** Since  $x$  must be greater than 0, increasing it by 30% will always be greater than increasing it by 20%, since 30% is more than 20%. Column B is greater than Column A.

- 9. Answer choice (C) is the correct answer.** Cross multiply the proportion in Column A to get  $324 = 9x$ , and then divide both sides by 9 to get  $x = 36$ . Cross multiply the proportion in Column B to get  $252 = 7y$ , and then divide both sides by 7 to get  $y = 36$ . Columns A and B are equal.
- 10. Answer choice (C) is the correct answer.** To find 90% of  $a$ , multiply  $a$  by 0.9 to get  $0.9a$ . To find 30% of  $3a$ , multiply 0.3 by  $3a$  to get  $0.9a$ . Columns A and B are equal.
- 11. Answer choice (B) is the correct answer.** The ratio of boys to girls is 4:5, so there are more girls than boys in the class. If there are 20 girls, there must be fewer than 20 boys. Therefore, the number of boys is fewer than 25, so Column B is greater than Column A.
- 12. Answer choice (B) is the correct answer.** Find Jose's speed by using the equation  $d = rt$ . Use 10 miles as the distance and 2.5 hours as the time:  $10 = 2.5r$ . Divide both sides by 2.5 to get that Jose's rate, or speed, equals 4 miles per hour. Column B is greater than Column A.
- 13. Answer choice (B) is the correct answer.** To find Nikhil's average speed, divide his total distance by his total time. His total distance is 120 miles plus 120 miles which equals 240 miles. His total time is 3 hours plus 1 hour plus 2 hours (don't forget to count the 1 hour break) which equals 6 hours. 240 miles divided by 6 hours equals 40 miles per hour. Column B is greater than Column A.
- 14. Answer choice (A) is the correct answer.** Find the percent change from 40 to 50 by dividing the difference between the numbers, 10, by the starting number, 40, and then multiplying by 100.  $10$  divided by  $40$  equals  $0.25$ , and  $0.25$  times  $100$  equals  $25\%$ . Find the percent change from 50 to 40 by dividing the difference between the numbers, 10, by the starting number, 50, and then multiplying by 100.  $10$  divided by  $50$  equals  $0.2$ , and  $0.2$  times  $100$  equals  $20\%$ . Column A is greater than Column B.
- 15. Answer choice (A) is the correct answer.** 15% of 123 is greater than 15% of 89 because the percents are the same, and 123 is greater than 89.

### Quantitative Comparisons Set 2

- 1. Answer choice (B) is the correct answer.** Find the value of Column A by first changing 0.5% into a decimal to get 0.005. Multiply 0.005 by 10 to get 0.05. Column B is greater than Column A.
- 2. Answer choice (B) is the correct answer.** Find the value of Column A by multiplying 2 hours by 60 to get 120 minutes. Then multiply 120 by 60 to get 7200 seconds in 2 hours. Column B is greater than Column A.

3. **Answer choice (A) is the correct answer.** There are 12 apples in a dozen, so set up the proportion  $\frac{3}{1.60} = \frac{12}{x}$  using  $x$  as the cost of a dozen apples. Cross multiply to get  $19.2 = 3x$ . Divide both sides by 3 to get  $x = 6.4$ , so a dozen apples costs \$6.40. Column A is greater than Column B.
4. **Answer choice (B) is the correct answer.** Let the original price of the stock equal \$100. Decrease \$100 by 20% to get \$80, and then increase \$80 by 30% to get \$104. The overall percent change from \$100 to \$104 is 4%, so Column B is greater than Column A.
5. **Answer choice (B) is the correct answer.** 8 people can build the dollhouse faster than 4 people, so it will take 8 people fewer than 6 hours, so Column A is fewer than 6 hours. Therefore, Column B is greater than Column A.
6. **Answer choice (C) is the correct answer.** 40% of 30 =  $0.4 \cdot 30 = 12$ , and 60% of 20 =  $0.6 \cdot 20 = 12$ . Column A and Column B are equal.
7. **Answer choice (C) is the correct answer.** Since the numbers are negative, the smaller number is represented by the 8 part of the ratio. Set up the proportion  $\frac{5}{8} = \frac{x}{-40}$  using  $x$  as the larger number. Cross multiply to get  $8x = -200$ . Divide both sides by 8 to get  $x = -25$ . Therefore, the larger number is  $-25$ , so Column A and Column B are equal.
8. **Answer choice (B) is the correct answer.** Since  $x$  is greater than 0, 45% of  $x$  will *always* be greater than 25% of  $x$  because 45% is greater than 25%. Column B is greater than Column A.
9. **Answer choice (B) is the correct answer.** Cross multiply the proportion in Column A to get  $18x = 96$ . Divide both sides by 18 to get  $x$  equals about 5.3, so Column B is greater than Column A.
10. **Answer choice (C) is the correct answer.** 40% of  $a$  equals  $0.4a$ , and 80% of  $0.5a$  equals  $0.8(0.5)a$  which equals  $0.4a$ . Column A and Column B are equal.
11. **Answer choice (B) is the correct answer.** Find the number of miles that Kathy walked using the equation  $d = rt$ :  $d = 1.5 \cdot 3.5 = 5.25$ . Column B is greater than Column A.
12. **Answer choice (A) is the correct answer.** Set up the equation  $4x + 7x = 55$ , where  $4x$  represents the number of cats and  $7x$  represents the number of dogs. Solve the equation to get  $x = 5$ , so the number of cats equals  $4 \cdot 5 = 20$ . Column A is greater than Column B.
13. **Answer choice (B) is the correct answer.** If Sally and Billy could both build the sandcastle in 4 hours on their own, then together, they would be able to do it in half the time which is 2 hours. Therefore, since Billy can build a sandcastle on his own in less than 4 hours, when Billy and Sally work together, it will take less than 2 hours. Therefore, Column B is greater than Column A.

- 14. Answer choice (A) is the correct answer.** Find the percent change from 20 to 30 by dividing the difference in the numbers by the starting number and multiplying the result by 100:  $10 \div 20 = 0.5 \rightarrow 0.5 \cdot 100 = 50\%$ . Find the percent change from 30 to 40 by dividing the difference in the numbers by the starting number and multiplying the result by 100:  $10 \div 30 = 0.\overline{3} \rightarrow 0.\overline{3} \cdot 100 = 33.\overline{3}\%$ . Column A is greater than Column B.
- 15. Answer choice (B) is the correct answer.** To increase 300 by 70%, add 70% of 300 to 300:  $70\% \text{ of } 300 = 0.7 \cdot 300 = 210 \rightarrow 210 + 300 = 510$ . Therefore, Column B is greater than Column A.
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## MATH COURSE 2

### Exponent Rules Set 1

- 1. Answer choice (A) is the correct answer.** When multiplying two terms that have the same base, keep the base and add the exponents.
- 2. Answer choice (B) is the correct answer.** When raising a power to a power, multiply the exponents and keep the base the same.
- 3. Answer choice (C) is the correct answer.** When dividing two terms that have the same base, keep the base and subtract the exponents.
- 4. Answer choice (A) is the correct answer.** When multiplying two terms that have the same base, keep the base and add the exponents. Since the second term is multiplied by 3, the answer will also be multiplied by 3.
- 5. Answer choice (D) is the correct answer.** Multiply the 5 and 2 to get 10. When multiplying two terms that have the same base (the  $x$  terms), keep the base and add the exponents; therefore, we get  $x^2$ . Multiply the 10 and  $x^2$  together to get  $10x^2$ .
- 6. Answer choice (D) is the correct answer.** Raise both the 3 and  $x^4$  to the 2nd power. 3 to the 2nd power equals 9. When raising a power to a power, multiply the exponents and keep the base the same; therefore, we get  $x^8$ . Multiply the 9 and  $x^8$  together to get  $9x^8$ .
- 7. Answer choice (D) is the correct answer.** When dividing two terms that have the same base, keep the base and subtract the exponents. The 4 stays on the bottom of the fraction.
- 8. Answer choice (D) is the correct answer.** Raise both the 2 and  $w^2$  to the 6th power. 2 to the 6th power equals 64. When raising a power to a power, multiply the exponents and keep the base the same; therefore, we get  $w^{12}$ . Multiply the 64 and  $w^{12}$  together to get  $64w^{12}$ .

9. **Answer choice (B) is the correct answer.** Divide 6 and 2 to get 3. When dividing two terms that have the same base, keep the base and subtract the exponents; therefore, we get  $d^3$ . Multiply the 3 and the  $d^3$  to get  $3d^3$ .
10. **Answer choice (C) is the correct answer.** Multiply 4 and 2 to get 8. Combine the  $a$  terms by adding the exponents (when multiplying two terms that have the same base, keep the base and add the exponents) to get  $a^6$ . Multiply the 8,  $a^6$ , and  $b^6$  to get  $8a^6b^6$ .
11. **Answer choice (C) is the correct answer.** Raise the 4,  $d^3$ , and  $e^5$  to the 2nd power. 4 to the 2nd power equals 16. When raising a power to a power, multiply the exponents; therefore, we get  $d^6$  and  $e^{10}$ . Multiply the 16,  $d^6$  and  $e^{10}$  together to get  $16d^6e^{10}$ .
12. **Answer choice (C) is the correct answer.** The  $r$  terms are the same on the top and bottom, so they automatically cancel out. Divide 8 by 2 to get 4. When dividing two terms that have the same base, keep the base and subtract the exponents; therefore, we get  $q^2$  and we still have  $s^2$ . Multiply the 4,  $q^2$  and  $s^2$  together to get  $4q^2s^2$ .
13. **Answer choice (B) is the correct answer.** Raise each letter inside of the parenthesis by multiplying the exponents (when raising a power to a power, multiply the exponents and keep the base); therefore, we get  $q^{21}r^6s^9$ . Multiply this by the 3 on the outside to get  $3q^{21}r^6s^9$ .
14. **Answer choice (A) is the correct answer.** Simplify the first expression by raising everything in the parenthesis to the 2nd power to get  $25k^2j^8$  (when raising a power to a power, multiply the exponents). Multiply  $25k^2j^8$  by  $2k^6j^3$  to get  $50k^8j^{11}$  (when multiplying two terms that have the same base, add the exponents).
15. **Answer choice (A) is the correct answer.** Simplify the top by raising everything in the parenthesis to the 2nd power to get  $16a^2b^6c^4$  (when raising a power to a power, multiply the exponents). Simplify the bottom by adding the exponents from each  $c$  to get  $2ab^5c^3$ . Divide the 16 on the top by the 2 on the bottom to get 8. Then subtract the exponents for each variable to get  $8abc^2$ .

### Exponent Rules Set 2

1. **Answer choice (B) is the correct answer.** When raising a power to a power, multiply the exponents and keep the base the same.
2. **Answer choice (C) is the correct answer.** When multiplying two terms that have the same base, keep the base and add the exponents. In this case,  $b = b^1$ , so add  $1 + 1$  to get 2 as the exponent.
3. **Answer choice (B) is the correct answer.** When dividing two terms that have the same base, keep the base and subtract the exponents.

4. **Answer choice (D) is the correct answer.** Multiply 4 and 2 to get 8 in front. When multiplying two terms that have the same base, keep the base and add the exponents. Therefore,  $t^6 \cdot t = t^7$ . Multiply 8 and  $t^7$  to get  $8t^7$ .
5. **Answer choice (B) is the correct answer.** Anything raised to the zero power equals 1.
6. **Answer choice (D) is the correct answer.** When dividing two terms that have the same base, keep the base and subtract the exponents. The 2 stays on the top of the fraction.
7. **Answer choice (D) is the correct answer.** Raise both the 4 and  $z^5$  to the 3rd power. 4 to the 3rd power equals 64. When raising a power to a power, multiply the exponents; therefore, we get  $z^{15}$ . Multiply the 64 and  $z^{15}$  together to get  $64z^{15}$ .
8. **Answer choice (A) is the correct answer.** Multiply the 3 and 2 to get 6. When multiplying two terms that have the same base, keep the base and add the exponents; therefore, for the  $a$  terms, we get  $a^6$ . For the  $b$  terms, we get  $b^5$ . Multiply the 6,  $a^6$  and  $b^5$  to get  $6a^6b^5$ .
9. **Answer choice (A) is the correct answer.** Divide 12 by 4 to get 3. When dividing two terms that have the same base, keep the base and subtract the exponents; therefore, for the  $x$  terms we get  $x^2$ . For the  $y$  terms, we get  $y$ . For the  $z$  terms we get  $z^6$ . Multiply the simplified terms together to get  $3x^2yz^6$ .
10. **Answer choice (D) is the correct answer.** Raise the 2,  $r^2$ , and  $s^4$  to the 3rd power. 2 to the 3rd power equals 8. When raising a power to a power, multiply the exponents; therefore, we get  $r^6$  and  $s^{12}$ . Multiply the simplified terms together to get  $8r^6s^{12}$ .
11. **Answer choice (D) is the correct answer.** Raise the 3,  $k^4$ , and  $j$  to the 2nd power. 3 to the 2nd power equals 9. When raising a power to a power, multiply the exponents; therefore, we get  $k^8$  and  $j^2$ . Multiply the simplified terms and the 6 on the outside:  $6 \cdot 9k^8j^2 = 54k^8j^2$ .
12. **Answer choice (C) is the correct answer.** Multiply 4 and 3 on the top to get 12. On the top of the fraction, combine the  $x$  terms by adding the exponents to get  $x^8$ . Combine the  $y$  terms by adding the exponents to get  $y^3$ . Now we have  $12x^8y^3$  on the top. Simplify 12 over 2 to get 6. Subtract the exponents for the  $x$  terms to get  $x^5$ . Since we have a  $y^3$  on the top and bottom of the fraction, they cancel out. Therefore, we are left with  $6x^5$ .
13. **Answer choice (A) is the correct answer.** Multiply 8 by 8 to get 64. When multiplying two terms with the same base, keep the base and add the exponents. Therefore, the  $d$  terms become  $d^{10}$ , and the  $e$  terms become  $e^6$ . Multiply the simplified terms together to get  $64d^{10}e^6$ .
14. **Answer choice (D) is the correct answer.** Raise the 4,  $a$ , and  $b^6$  to the 2nd power. 4 to the 2nd power equals 16. When raising a power to a power, multiply the exponents; therefore, we get  $a^2$

and  $b^{12}$ . Now we have  $16a^2b^{12} \cdot ab^4$ . When multiplying terms with the same base, keep the base and add the exponents. Therefore, the  $a$  terms becomes  $a^3$ , and the  $b$  terms become  $b^{16}$ . Therefore, we get  $16a^3b^{16}$ .

- 15. Answer choice (B) is the correct answer.** Simplify the top by first raising the  $q$  and  $p$  inside of the parenthesis to the 3rd power to get  $q^3p^3$ . Next, combine the  $q$  and  $p$  terms on the top by adding the exponents to get  $9p^8q^4$  on the top. Now simplify the bottom by raising the 3,  $p$ , and  $q$  to the 2nd power to get  $9p^2q^2$ . Since we have a 9 on the top and bottom, they cancel out. Now simplify the  $p$  terms and the  $q$  terms by subtracting the exponents to get  $p^6q^2$ .

### Simplifying Fraction Expressions Set 1

- 1. Answer choice (D) is the correct answer.** Simplify 18 over 9 to get 2. Now we have  $\frac{2 \cdot 28}{1}$ . Multiply 2 times 28 to get 56.
- 2. Answer choice (A) is the correct answer.** Simplify 36 over 12 to get 3 and 11 over 33 to get 1 over 3. Now we have  $\frac{3}{3}$ . Simplify 3 over 3 to get 1.
- 3. Answer choice (D) is the correct answer.** Simplify  $6^2$  over 6 by dividing  $6^2$  by 6 to get 6. Simplify 4 over 4 by dividing 4 by 4 to get 1. Now we have  $6 \cdot 2$ , so multiply 6 by 2 to get 12.
- 4. Answer choice (B) is the correct answer.** Change  $7^2$  to 49 because  $7 \cdot 7 = 49$ . Now we have  $\frac{28 \cdot 63}{49 \cdot 4 \cdot 3}$ . Simplify 28 over 4 to get 7 and simplify 63 over 3 to get 21. Now we have  $\frac{7 \cdot 21}{49}$ . Simplify 7 over 49 to get 1 over 7. Now we have  $\frac{1 \cdot 21}{7}$ . Divide 21 by 7 to get 3.
- 5. Answer choice (B) is the correct answer.** Simplify what is inside of the parenthesis on the top of the fraction:  $3^3 - 9 = 27 - 9 = 18$ . Simplify what is inside of the parenthesis on the bottom of the fraction:  $6^2 - 6 = 36 - 6 = 30$ . Now we have  $\frac{25 \cdot 18}{3 \cdot 30}$ . Simplify 18 over 3 to get 6, and simplify 25 over 30 to get 5 over 6. Now we have  $\frac{5 \cdot 6}{6}$ . Simplify 6 over 6 to 1 and we are left with 5.
- 6. Answer choice (D) is the correct answer.** Since all of the numbers are squared, we can simplify them before squaring them. Simplify  $6^2$  over  $3^2$  to  $2^2$ . Simplify  $8^2$  over  $4^2$  to  $2^2$ . Now we have  $2^2 \cdot 2^2$  which equals  $4 \cdot 4$  which equals 16.

7. **Answer choice (C) is the correct answer.** Simplify 32 over 10 to get 16 over 5. Simplify 56 over 28 to get 2 over 1. Simplify 25 over 20 to get 5 over 4. Now we have  $\frac{16 \cdot 2 \cdot 5}{5 \cdot 4}$ . Simplify 5 over 5 to 1 over 1. Simplify 16 over 4 to 4 over 1. Now we have  $4 \cdot 2$  which equals 8.
8. **Answer choice (C) is the correct answer.** Simplify  $4^2$  over 4 by dividing  $4^2$  by 4 to get 4. Simplify what is inside the parenthesis on the top of the fraction:  $2^5 - 2^4 = 32 - 16 = 16$ . Simplify what is inside the parenthesis on the bottom of the fraction:  $8 - 4 = 4$ . Now we have  $\frac{4 \cdot 16}{4}$ . Simplify 4 over 4 to get 1, and we are left with 16.
9. **Answer choice (B) is the correct answer.** Simplify what is inside of the parenthesis on the top of the fraction:  $6^2 - 3^2 = 36 - 9 = 27$ . Simplify what is inside the parenthesis on the bottom of the fraction:  $5^2 - 2^2 = 25 - 4 = 21$ . Now we have  $\frac{7 \cdot 27}{9 \cdot 21}$ . Simplify 27 over 9 to get 3 over 1 and simplify 7 over 21 to get 1 over 3. Now we have  $\frac{3}{3}$  which simplifies to 1.
10. **Answer choice (D) is the correct answer.** Simplify  $5^3$  over  $5^2$  by dividing  $5^3$  by  $5^2$  to get 5. Simplify what is inside the parenthesis on the top of the fraction:  $3^2 + 3 = 9 + 3 = 12$ . Simplify what is inside the parenthesis on the bottom of the fraction:  $4^2 - 2^2 = 16 - 4 = 12$ . Now we have  $\frac{5 \cdot 12}{12}$ . Simplify 12 over 12 to get 1, and we are left with 5.

### Simplifying Fraction Expressions Set 2

1. **Answer choice (C) is the correct answer.** Simplify 48 over 16 to get 3. Now we have  $\frac{3 \cdot 21}{1}$ . Multiply 3 times 21 to get 63.
2. **Answer choice (A) is the correct answer.** Simplify 52 over 13 to get 4 and 72 over 18 to get 4. Now we have  $\frac{4 \cdot 4}{1}$ . Multiply 4 times 4 to get 16.
3. **Answer choice (C) is the correct answer.** Simplify  $5^2$  over 5 by dividing  $5^2$  by 5 to get 5. Simplify 6 over 3 to get 2. Now we have  $\frac{5 \cdot 2 \cdot 2}{1}$ , so multiply  $5 \cdot 2 \cdot 2$  to get 20.

4. **Answer choice (B) is the correct answer.** Change  $4^3$  to 64 because  $4 \cdot 4 \cdot 4 = 64$ . Change  $2^3$  to 8 because  $2 \cdot 2 \cdot 2 = 8$ . Now we have  $\frac{64 \cdot 42}{8 \cdot 7 \cdot 2}$ . Simplify 64 over 8 to get 8, and simplify 42 over 7 to get 6. Now we have  $\frac{8 \cdot 6}{2}$ . Multiply 8 by 6 to get 48 and divide by 2 to get 24.
5. **Answer choice (B) is the correct answer.** Simplify  $3^2$  on the bottom to get 9 because  $3 \cdot 3 = 9$ . Now we have  $\frac{54 \cdot 25}{9 \cdot 6 \cdot 5}$ . Simplify 54 over 9 to get 6, and 25 over 5 to get 5. Now we have  $\frac{6 \cdot 5}{6}$ . Cross out the 6 on the top and bottom to get 5.
6. **Answer choice (A) is the correct answer.** Simplify  $4^2$  to get 16 because  $4 \cdot 4 = 16$ . Simplify  $2^3$  to get 8 because  $2 \cdot 2 \cdot 2 = 8$ . Simplify  $6^2$  to get 36 because  $6 \cdot 6 = 36$ . Now we have  $\frac{18(16 + 8)}{36 \cdot 12}$ . Add the 16 and 8 in the parenthesis to get  $\frac{18 \cdot 24}{36 \cdot 12}$ . Simplify 18 over 36 to get 1 over 2 and 24 over 12 to get 2 over 1. Now we have  $\frac{2}{2}$  which equals 1.
7. **Answer choice (B) is the correct answer.** Simplify 16 over 8 to get 2 over 1. Simplify 56 over 48 to get 7 over 6. Simplify 27 over 21 to get 9 over 7. Now we have  $\frac{2 \cdot 7 \cdot 9}{1 \cdot 6 \cdot 7}$ . The 7s on the top and bottom cancel out. Simplify 9 over 6 to get 3 over 2. Now we have  $\frac{2 \cdot 3}{2}$ . The 2s on the top and bottom cancel out and we are left with 3.
8. **Answer choice (B) is the correct answer.** Simplify  $6^2$  to get 36 because  $6 \cdot 6 = 36$ . Simplify  $2^4$  to get 16 because  $2 \cdot 2 \cdot 2 \cdot 2 = 16$ . Simplify  $3^2$  to get 9 because  $3 \cdot 3 = 9$ . Simplify  $2^2$  to get 4 because  $2 \cdot 2 = 4$ . Simplify  $2^3$  to get 8 because  $2 \cdot 2 \cdot 2 = 8$ . Now we have  $\frac{36(16 - 4)}{9(4 + 8)}$ . Simplify what is inside the parenthesis on the top and bottom to get  $\frac{36(12)}{9(12)}$ . The 12s on the top and bottom cancel out, so we are left with  $\frac{36}{9}$  which equals 4.
9. **Answer choice (D) is the correct answer.** Simplify  $5^3$  which equals 125 because  $5 \cdot 5 \cdot 5 = 125$ . Simplify  $5^2$  which equals 25 because  $5 \cdot 5 = 25$ . Simplify  $4^2$  which equals 16 because  $4 \cdot 4 = 16$ . Simplify  $2^2$  which equals 4 because  $2 \cdot 2 = 4$ . Now we have  $\frac{18(125 - 25)}{30(16 + 4)}$ . Simplify what is

inside of the parenthesis on the top and bottom to get  $\frac{18(100)}{30(20)}$ . Simplify 18 over 30 to get 6 over 5, and simplify 100 over 20 to get 5 over 1. Now we have  $\frac{3(5)}{5(1)}$ . The 5s on the top and bottom cancel out and we are left with 3 over 1 which equals 3.

- 10. Answer choice (B) is the correct answer.** Simplify all of the exponents:  $8^2 = 64$ ,  $2^4 = 16$ ,  $2^3 = 8$ ,  $4^3 = 64$ , and  $4^2 = 16$ . Now we have  $\frac{64(64 - 16)}{8(64 - 16)}$ . Since we have 64 - 16 on the top and bottom, these factors cancel out, so we are left with  $\frac{64}{8}$  which equals 8.
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### Negative Exponents Set 1

- 1. Answer choice (C) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $5^{-1}$  becomes  $\frac{1}{5^1}$  which equals  $\frac{1}{5}$ .
- 2. Answer choice (B) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{1}{d^{-3}}$  becomes  $d^3$ .
- 3. Answer choice (C) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{2k^{-1}}{3}$  becomes  $\frac{2}{3k^1}$  which equals  $\frac{2}{3k}$ .
- 4. Answer choice (A) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $a^2c^{-6}$  becomes  $\frac{1}{a^2c^6}$ .
- 5. Answer choice (C) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a

positive exponent. Therefore,  $\frac{8x^{-3}}{2}$  becomes  $\frac{8}{2x^3}$ . Simplify 8 over 2 which equals 4, so we get  $\frac{4}{x^3}$ .

**6. Answer choice (D) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a

positive exponent. Therefore,  $\frac{6}{3m^{-3}}$  becomes  $\frac{6m^3}{3}$ . Simplify 6 over 3 which equals 2, so we get  $2m^3$ .

**7. Answer choice (D) is the correct answer.** Raise everything in the parenthesis to the -2nd power to get  $3^{-2}a^{-4}$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $3^{-2}a^{-4}$

becomes  $\frac{1}{3^2 a^4}$ , and  $3^2$  equals 9, so we get  $\frac{1}{9 a^4}$ .

**8. Answer choice (B) is the correct answer.** Subtract the exponents for each variable to get  $x^{-5}yz^4$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $x^{-5}yz^4$  becomes

$$\frac{yz^4}{x^5}$$

**9. Answer choice (A) is the correct answer.** Raise everything in the parenthesis to the -2nd power to get  $\left(\frac{1}{4}\right)^{-2} d^6 c^4$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,

$\left(\frac{1}{4}\right)^{-2} d^6 c^4$  becomes  $4^2 d^6 c^4$ , and  $4^2$  equals 16, so we get  $16d^6 c^4$ .

**10. Answer choice (C) is the correct answer.** Raise everything in the parenthesis to the -3rd power to get  $\frac{10a^{-6}b^{12}}{5a^{-4}b^{-1}}$ . Simplify 10 over 5 to 2, and subtract the exponents for each variable to get  $2a^{-2}b^{13}$ .

To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $2a^{-2}b^{13}$  becomes

$$\frac{2b^{13}}{a^2}$$

## Negative Exponents Set 2

- 1. Answer choice (A) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $c^{-6}$  becomes  $\frac{1}{c^6}$ .
- 2. Answer choice (B) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{5}{h^{-4}}$  becomes  $5h^4$ .
- 3. Answer choice (D) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{9}{3b^{-6}}$  becomes  $\frac{9b^6}{3}$ . Simplify 9 over 3 which equals 3, so we get  $3b^6$ .
- 4. Answer choice (C) is the correct answer.** To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{5x^6}{y^{-2}}$  becomes  $5x^6y^2$ .
- 5. Answer choice (C) is the correct answer.** Raise the 5 and the  $x^2$  to the  $-3$  power to get  $\frac{5^{-3}}{x^{-6}}$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{5^{-3}}{x^{-6}}$  becomes  $\frac{x^6}{5^3}$ . Simplify  $5^3$  to get  $\frac{x^6}{125}$ .
- 6. Answer choice (D) is the correct answer.** Raise everything in the parenthesis to the  $-4$  power to get  $r^{-8}t^{12}$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $r^{-8}t^{12}$  becomes  $\frac{t^{12}}{r^8}$ .

7. **Answer choice (A) is the correct answer.** Raise everything in the parenthesis to the -2nd power to get  $2^4w^{10}$ . Simplify  $2^4$  to get  $16w^{10}$
8. **Answer choice (A) is the correct answer.** Subtract the exponents for each variable to get  $m^5n^2p^4$ .
9. **Answer choice (B) is the correct answer.** Raise everything in the parenthesis to the -2nd power to get  $9(3^{-2}q^{10}p^{-6})$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $9(3^{-2}q^{10}p^{-6})$  becomes  $\frac{9q^{10}}{3^2 \cdot p^6}$ . Simplify  $3^2$  which equals 9, so we have  $\frac{9q^{10}}{9p^6}$ . The 9s on the top and bottom cancel out, so we are left with  $\frac{q^{10}}{p^6}$ .
10. **Answer choice (C) is the correct answer.** Raise everything in the parenthesis to the -3rd power to get  $\frac{12z^{-4}v^5}{2^3z^{-9}v^{12}}$ . Simplify  $2^3$  which equals 8, and subtract the exponents for each variable to get  $\frac{12z^5v^{-7}}{8}$ . To change a negative exponent into a positive exponent, flip the base value to the other side of the fraction line and change the negative exponent to a positive exponent. Therefore,  $\frac{12z^5v^{-7}}{8}$  becomes  $\frac{12z^5}{8v^7}$ . Finally, simplify 12 over 8 to get  $\frac{3z^5}{2v^7}$ .
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### Roots of Numbers Set 1

1. **Answer choice (B) is the correct answer.** The square root of 16 equals 4 because  $4 \cdot 4 = 16$ . Therefore, the answer is -16.
2. **Answer choice (B) is the correct answer.** The square root of 225 equals 15 because  $15 \cdot 15 = 225$ .
3. **Answer choice (A) is the correct answer.** The square root of 900 equals 30 because  $30 \cdot 30 = 900$ .
4. **Answer choice (C) is the correct answer.** The square root of 121 is 11 because  $11 \cdot 11 = 121$ , and the square root of 49 is 7 because  $7 \cdot 7 = 49$ . Therefore the square root of  $\frac{121}{49}$  is  $\frac{11}{7}$ .
5. **Answer choice (B) is the correct answer.** First, subtract 25 minus 16 which equals 9. The square root of 9 is 3 because  $3 \cdot 3 = 9$ .

6. **Answer choice (D) is the correct answer.**  $\frac{\sqrt{8}}{\sqrt{50}} = \sqrt{\frac{8}{50}}$ . Simplify  $\sqrt{\frac{8}{50}}$  to  $\sqrt{\frac{4}{25}}$ . The square root of 4 is 2 because  $2 \cdot 2 = 4$ , and the square root of 25 is 5 because  $5 \cdot 5 = 25$ . Therefore, the square root of  $\frac{4}{25}$  is  $\frac{2}{5}$ .
7. **Answer choice (C) is the correct answer.** The square root of 36 is 6 because  $6 \cdot 6$  equals 36, and the square root of 64 is 8 because  $8 \cdot 8$  equals 64. Add 6 and 8 to get 14.
8. **Answer choice (A) is the correct answer.** When you multiply a square root by itself, you are left with the number under the square root.
9. **Answer choice (D) is the correct answer.** When multiplying square roots, multiply the numbers under the square roots. Therefore,  $\sqrt{8} \times \sqrt{2} = \sqrt{16}$ . The square root of 16 equals 4 because  $4 \cdot 4$  equals 16.
10. **Answer choice (A) is the correct answer.** When adding square roots, add the numbers in front of the root and keep the root the same. Therefore,  $8\sqrt{10} + 5\sqrt{10} = 13\sqrt{10}$ .
11. **Answer choice (B) is the correct answer.** When multiplying square roots, multiply the numbers outside the roots and multiply the numbers under the square roots. Therefore,  $6\sqrt{2} \times 3\sqrt{7} = 18\sqrt{14}$ .
12. **Answer choice (B) is the correct answer.** When adding and subtracting roots, you can only combine terms with the same root by adding or subtracting the numbers in front of the root. If a root does not have a number in front of it, it is the same as having a 1. Therefore,  $8\sqrt{5} + 5\sqrt{7} + \sqrt{5} - 3\sqrt{7} = 9\sqrt{5} + 2\sqrt{7}$ .
13. **Answer choice (C) is the correct answer.**  $\sqrt{25} < \sqrt{30} < \sqrt{36}$ . The square root of 25 is 5 because  $5 \cdot 5 = 25$ , and the square root of 36 is 6 because  $6 \cdot 6$  equals 36. Therefore,  $5 < \sqrt{30} < 6$ .
14. **Answer choice (C) is the correct answer.** The square root of 24 is close to the square root of 25 which equals 5. The square root of 3 is close to the square root of 4 which equals 2. Subtract 5 minus 3 to get 2.
15. **Answer choice (A) is the correct answer.** The square root of 35 is close to the square root of 36 which equals 6. Multiply 2 by 6 to get 12.

**Roots of Numbers Set 2**

- 1. Answer choice (D) is the correct answer.** The square root of any negative number is not a real number.
- 2. Answer choice (B) is the correct answer.** The square root of 196 equals 14 because  $14 \cdot 14 = 196$ .
- 3. Answer choice (D) is the correct answer.** The square root of 1600 equals 40 because  $40 \cdot 40 = 1600$ .
- 4. Answer choice (C) is the correct answer.** The square root of 25 is 5 because  $5 \cdot 5 = 25$ , and the square root of 64 is 8 because  $8 \cdot 8 = 64$ . Therefore the square root of  $\frac{25}{64}$  is  $\frac{5}{8}$ .
- 5. Answer choice (B) is the correct answer.** The square root of 9 is 3 because  $3 \cdot 3 = 9$ . The square root of 16 is 4 because  $4 \cdot 4 = 16$ . Add  $3 + 4$  to get 7.
- 6. Answer choice (A) is the correct answer.**  $\frac{\sqrt{12}}{\sqrt{27}} = \sqrt{\frac{12}{27}}$ . Simplify  $\sqrt{\frac{12}{27}}$  to  $\sqrt{\frac{4}{9}}$ . The square root of 4 is 2 because  $2 \cdot 2 = 4$ , and the square root of 9 is 3 because  $3 \cdot 3 = 9$ . Therefore, the square root of  $\frac{4}{9}$  is  $\frac{2}{3}$ .
- 7. Answer choice (A) is the correct answer.** First add 36 and 64 to 100. Then take the square root of 100 which is 10 because  $10 \cdot 10 = 100$ .
- 8. Answer choice (D) is the correct answer.** When you multiply a square root by itself, you are left with the number under the square root.
- 9. Answer choice (A) is the correct answer.** When multiplying square roots, multiply the numbers under the square roots. Therefore,  $\sqrt{5} \times \sqrt{20} = \sqrt{100}$ . The square root of 100 equals 10 because  $10 \cdot 10$  equals 100.
- 10. Answer choice (B) is the correct answer.** When multiplying square roots, multiply the numbers outside the roots and multiply the numbers under the square roots. Therefore,  
 $4\sqrt{3} \times 2\sqrt{5} = 8\sqrt{15}$ .
- 11. Answer choice (C) is the correct answer.** When subtracting square roots, subtract the numbers in front of the root and keep the root the same. Therefore,  $12\sqrt{3} - 4\sqrt{3} = 8\sqrt{3}$ .

- 12. Answer choice (D) is the correct answer.** When adding and subtracting roots, you can only combine terms with the same root by adding or subtracting the numbers in front of the root. Therefore  $4\sqrt{11} + 3\sqrt{13} + 2\sqrt{11} = 6\sqrt{11} + 3\sqrt{13}$ .
- 13. Answer choice (B) is the correct answer.** The square root of 142 is close to the square root of 144 which equals 12. The square root of 82 is close to the square root of 81 which equals 9. Add  $12 + 9$  to get 21.
- 14. Answer choice (B) is the correct answer.**  $\sqrt{49} < \sqrt{56} < \sqrt{64}$ . The square root of 49 is 7 because  $7 \cdot 7 = 49$ , and the square root of 64 is 8 because  $8 \cdot 8$  equals 64. Therefore,  $7 < \sqrt{56} < 8$ .
- 15. Answer choice (C) is the correct answer.** The square root of 15 is close to the square root of 16 which equals 4. Multiply 3 by 4 to get 12.
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### Fraction Exponents Set 1

- 1. Answer choice (C) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 9 equals 3.
- 2. Answer choice (B) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 144 equals 12.
- 3. Answer choice (B) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 64 is 8. Then multiply by the negative to get  $-8$ .
- 4. Answer choice (D) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of a negative number is not a real number, so the square root of  $-81$  is not a real number.
- 5. Answer choice (A) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of  $-1000$  is  $-10$  because  $(-10)^3 = -1000$ .
- 6. Answer choice (D) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 9 is 3, and the square root of 4 is 2. Therefore the square root of  $\frac{9}{4}$  is  $\frac{3}{2}$ .
- 7. Answer choice (B) is the correct answer.** Raising something to the one-fourth is the same as taking the fourth root. The fourth root of 16 is 2 because  $2^4$  equals 16. Then multiply by the negative to get  $-16$ .

**8. Answer choice (B) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of 8 equals 2 because  $2^3 = 8$ . The cube root of 27 equals 3 because  $3^3$

$$= 27. \text{ Therefore, } \left(\frac{8}{27}\right)^{\frac{1}{3}} = \frac{2}{3}.$$

**9. Answer choice (A) is the correct answer.** Raising something to the one-half is the same as taking the square root. Therefore,  $x^{\frac{1}{2}} = \sqrt{x}$ .

**10. Answer choice (B) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of 1 equals 1 because  $1^3 = 1$ . The cube root of 64 equals 4 because  $4^3 = 64$ . Take the cube root of the top and bottom and remember that the answer must be negative,

$$\text{therefore, } \left(-\frac{1}{64}\right)^{\frac{1}{3}} = -\frac{1}{8}.$$

**11. Answer choice (C) is the correct answer.** Flip the term over the fraction line to change the

negative exponent to a positive exponent. Therefore,  $100^{-\frac{1}{2}}$  becomes  $\frac{1}{100^{\frac{1}{2}}}$ . Raising something

to the one-half is the same as taking the square root. The square root of 100 equals 10, so  $\frac{1}{100^{\frac{1}{2}}} =$

$$\frac{1}{10}.$$

**12. Answer choice (D) is the correct answer.**  $9^{\frac{3}{2}} = \sqrt[2]{9^3}$ . Take the square root of 9 first which equals 3. Then raise 3 to the third power to get 27.

**13. Answer choice (A) is the correct answer.**  $\left(\frac{1}{4}\right)^{\frac{3}{2}} = \sqrt[2]{\frac{1}{4}^3}$ . Take the square root of  $\frac{1}{4}$  which equals  $\frac{1}{2}$ . Raise  $\frac{1}{2}$  to the third power to get  $\frac{1}{8}$ .

**14. Answer choice (D) is the correct answer.** When raising something to a fractional exponent, the denominator becomes the root and the numerator becomes the exponent. Therefore,  $a^{\frac{2}{5}} = \sqrt[5]{a^2}$ .

**15. Answer choice (C) is the correct answer.** Flip the term over the fraction line to change the

negative exponent to a positive exponent. Therefore,  $27^{-\frac{2}{3}}$  becomes  $\frac{1}{27^{\frac{2}{3}}}$ .  $\frac{1}{27^{\frac{2}{3}}} = \sqrt[3]{\frac{1}{27}^2}$ .

Take the cube root of  $\frac{1}{27}$  which equals  $\frac{1}{3}$ . Raise  $\frac{1}{3}$  to the second power to get  $\frac{1}{9}$ .

**16. Answer choice (C) is the correct answer.** Flip the term over the fraction line to change the

negative exponent to a positive exponent. Therefore,  $\left(\frac{1}{y}\right)^{-\frac{4}{3}}$  becomes  $y^{\frac{4}{3}}$ . When raising something to a fractional exponent, the denominator becomes the root and the numerator becomes the exponent. Therefore,  $y^{\frac{4}{3}} = \sqrt[3]{y^4}$ .

### Fraction Exponents Set 2

**1. Answer choice (D) is the correct answer.** Raising 1 to any power is equal to 1.

**2. Answer choice (C) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 121 equals 11.

**3. Answer choice (B) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of  $-27$  is  $-3$  because  $(-3)^3 = -27$ .

**4. Answer choice (B) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of 125 is 5 because  $5^3 = 125$ .

**5. Answer choice (C) is the correct answer.** Raising something to the one-fourth is the same as taking the fourth root. The fourth root of 81 is 3 because  $3^4 = 81$ .

**6. Answer choice (C) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 25 is 5, and the square root of 81 is 9. Therefore the square root of  $\frac{25}{81}$  is  $\frac{5}{9}$ .

**7. Answer choice (D) is the correct answer.** Raising something to the one-sixth is the same as taking the sixth root. The sixth root (or any even root) of a negative number is not a real number.

**8. Answer choice (A) is the correct answer.** Raising something to the one-half is the same as taking the square root. Therefore,  $y^{\frac{1}{2}} = \sqrt{y}$ . Multiply by the negative on the outside to get  $-\sqrt{y}$ .

- 9. Answer choice (B) is the correct answer.** Raising something to the one-third is the same as taking the cube root. The cube root of 125 equals 5 because  $5^3 = 125$ . The cube root of 8 equals 2 because

$$2^3 = 8. \text{ Therefore, } \left(\frac{125}{8}\right)^{\frac{1}{3}} = \frac{5}{2}.$$

- 10. Answer choice (C) is the correct answer.** Flip the term over the fraction line to change the negative exponent to a positive exponent. Therefore,  $400^{-\frac{1}{2}}$  becomes  $\frac{1}{400^{\frac{1}{2}}}$ . Raising something

to the one-half is the same as taking the square root. The square root of 400 equals 20, so  $\frac{1}{400^{\frac{1}{2}}} =$

$$\frac{1}{20}.$$

- 11. Answer choice (B) is the correct answer.** Raising something to the one-fourth is the same as

taking the fourth root. The fourth root  $\frac{1}{16}$  of is  $\frac{1}{2}$  because  $\left(\frac{1}{2}\right)^4 = \frac{1}{16}$ .

- 12. Answer choice (D) is the correct answer.**  $\left(\frac{1}{4}\right)^{\frac{5}{2}} = \sqrt[2]{\frac{1}{4}^5}$ . Take the square root of  $\frac{1}{4}$  which equals  $\frac{1}{2}$ . Raise  $\frac{1}{2}$  to the fifth power to get  $\frac{1}{32}$ .

- 13. Answer choice (C) is the correct answer.**  $(64)^{\frac{2}{3}} = \sqrt[3]{64^2}$ . Take the cube root of 64 which equals 4. Raise 4 to the second power to get 16.

- 14. Answer choice (A) is the correct answer.** When raising something to a fractional exponent, the denominator becomes the root and the numerator becomes the exponent. Therefore,  $c^{\frac{2}{3}} = \sqrt[3]{c^2}$ .

- 15. Answer choice (A) is the correct answer.**  $\left(\frac{1}{9}\right)^{\frac{3}{2}} = \sqrt[2]{\frac{1}{9}^3}$ . Take the square root of  $\frac{1}{9}$  which equals  $\frac{1}{3}$ . Raise  $\frac{1}{3}$  to the third power to get  $\frac{1}{27}$ .

- 16. Answer choice (D) is the correct answer.** Flip the term over the fraction line to change the negative exponent to a positive exponent. Therefore,  $\left(\frac{1}{b}\right)^{-\frac{6}{7}}$  becomes  $b^{\frac{6}{7}}$ . When raising

something to a fractional exponent, the denominator becomes the root and the numerator becomes the exponent. Therefore,  $b^{\frac{6}{7}} = \sqrt[7]{b^6}$ .

### Breaking Up Roots Set 1

- Answer choice (B) is the correct answer.**  $\sqrt{8} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$ .
- Answer choice (A) is the correct answer.**  $\sqrt{20} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$ .
- Answer choice (B) is the correct answer.**  $\sqrt{300} = \sqrt{100} \cdot \sqrt{3} = 10\sqrt{3}$ .
- Answer choice (C) is the correct answer.**  $\sqrt{125} = \sqrt{25} \cdot \sqrt{5} = 5\sqrt{5}$ .
- Answer choice (D) is the correct answer.**  $3\sqrt{32} = 3 \cdot \sqrt{16} \cdot \sqrt{2} = 3 \cdot 4 \cdot \sqrt{2} = 12\sqrt{2}$ .
- Answer choice (C) is the correct answer.**  $5\sqrt{18} = 5 \cdot \sqrt{9} \cdot \sqrt{2} = 5 \cdot 3 \cdot \sqrt{2} = 15\sqrt{2}$ .
- Answer choice (B) is the correct answer.**  $4\sqrt{12} = 4 \cdot \sqrt{4} \cdot \sqrt{3} = 4 \cdot 2 \cdot \sqrt{3} = 8\sqrt{3}$ .
- Answer choice (B) is the correct answer.** Simplify  $\sqrt{72} \cdot \sqrt{72} = \sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$ . Simplify  $\sqrt{50}$ :  $\sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$ . Add the terms together:  $6\sqrt{2} + 5\sqrt{2} = 11\sqrt{2}$ .
- Answer choice (B) is the correct answer.** Simplify  $\sqrt{48} \cdot \sqrt{48} = \sqrt{16} \cdot \sqrt{3} = 4\sqrt{3}$ . Simplify  $\sqrt{27}$ :  $\sqrt{27} = \sqrt{9} \cdot \sqrt{3} = 3\sqrt{3}$ . Subtract the terms:  $4\sqrt{3} - 3\sqrt{3} = \sqrt{3}$ .
- Answer choice (A) is the correct answer.** Simplify  $2\sqrt{20} \cdot 2\sqrt{20} = 2 \cdot \sqrt{4} \cdot \sqrt{5} = 2 \cdot 2 \cdot \sqrt{5} = 4\sqrt{5}$ . Simplify  $3\sqrt{45} \cdot 3\sqrt{45} = 3 \cdot \sqrt{9} \cdot \sqrt{5} = 3 \cdot 3 \cdot \sqrt{5} = 9\sqrt{5}$ . Add the terms together:  $4\sqrt{5} + 9\sqrt{5} = 13\sqrt{5}$ .
- Answer choice (A) is the correct answer.** Multiply the roots:  $\sqrt{5} \cdot \sqrt{8} = \sqrt{40}$ . Simplify  $\sqrt{40}$ :  $\sqrt{40} = \sqrt{4} \cdot \sqrt{10} = 2\sqrt{10}$ .
- Answer choice (C) is the correct answer.** Multiply the roots:  $2\sqrt{5} \cdot 3\sqrt{10} = 6\sqrt{50}$ . Simplify  $6\sqrt{50}$ :  $6\sqrt{50} = 6 \cdot \sqrt{25} \cdot \sqrt{2} = 6 \cdot 5 \cdot \sqrt{2} = 30\sqrt{2}$ .

**13. Answer choice (D) is the correct answer.** Multiply the roots:  $3\sqrt{72}\cdot\sqrt{2} = 3\sqrt{144}$ . Simplify  $3\sqrt{144} : 3\sqrt{144} = 3 \cdot 12 = 36$ .

**14. Answer choice (D) is the correct answer.** Simplify the roots on the top and bottom:

$$\frac{\sqrt{200}}{\sqrt{16}} = \frac{\sqrt{100} \cdot \sqrt{2}}{4} = \frac{10 \cdot \sqrt{2}}{4} = \frac{5\sqrt{2}}{2}.$$

**15. Answer choice (C) is the correct answer.** Divide the top root by the bottom root:

$$\frac{\sqrt{120}}{\sqrt{2}} = \sqrt{60}. \text{ Simplify } \sqrt{60} : \sqrt{60} = \sqrt{4} \cdot \sqrt{15} = 2\sqrt{15}.$$

### Breaking Up Roots Set 2

**1. Answer choice (A) is the correct answer.**  $\sqrt{18} = \sqrt{9} \cdot \sqrt{2} = 3\sqrt{2}$ .

**2. Answer choice (B) is the correct answer.**  $\sqrt{75} = \sqrt{25} \cdot \sqrt{3} = 5\sqrt{3}$ .

**3. Answer choice (A) is the correct answer.**  $\sqrt{40} = \sqrt{4} \cdot \sqrt{10} = 2\sqrt{10}$ .

**4. Answer choice (B) is the correct answer.**  $\sqrt{500} = \sqrt{100} \cdot \sqrt{5} = 10\sqrt{5}$ .

**5. Answer choice (C) is the correct answer.**  $4\sqrt{8} = 4 \cdot \sqrt{4} \cdot \sqrt{2} = 4 \cdot 2 \cdot \sqrt{2} = 8\sqrt{2}$ .

**6. Answer choice (B) is the correct answer.**  $10\sqrt{48} = 10 \cdot \sqrt{16} \cdot \sqrt{3} = 10 \cdot 4 \cdot \sqrt{3} = 40\sqrt{3}$ .

**7. Answer choice (D) is the correct answer.**  $2\sqrt{24} = 2 \cdot \sqrt{4} \cdot \sqrt{6} = 2 \cdot 2 \cdot \sqrt{6} = 4\sqrt{6}$ .

**8. Answer choice (B) is the correct answer.** Simplify  $\sqrt{32} : \sqrt{32} = \sqrt{16} \cdot \sqrt{2} = 4\sqrt{2}$ . Simplify  $\sqrt{8} : \sqrt{8} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$ . Subtract the terms:  $4\sqrt{2} - 2\sqrt{2} = 2\sqrt{2}$ .

**9. Answer choice (C) is the correct answer.** Simplify  $\sqrt{20} : \sqrt{20} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$ . Simplify  $\sqrt{80} : \sqrt{80} = \sqrt{16} \cdot \sqrt{5} = 4\sqrt{5}$ . Add the terms:  $2\sqrt{5} + 4\sqrt{5} = 6\sqrt{5}$ .

**10. Answer choice (B) is the correct answer.** Simplify  $\sqrt{12} : \sqrt{12} = \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$ . Simplify  $4\sqrt{27} : 4\sqrt{27} = 4 \cdot \sqrt{9} \cdot \sqrt{3} = 4 \cdot 3 \cdot \sqrt{3} = 12\sqrt{3}$ . Add the terms together:  $2\sqrt{3} + 12\sqrt{3} = 14\sqrt{3}$ .

**11. Answer choice (D) is the correct answer.** Multiply the roots:  $\sqrt{10} \cdot \sqrt{2} = \sqrt{20}$ . Simplify  $\sqrt{20} : \sqrt{20} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$ .

**12. Answer choice (A) is the correct answer.** Multiply the roots:  $\sqrt{200} \cdot 4\sqrt{2} = 4\sqrt{400}$ . The square root of 400 is 20, so  $4\sqrt{400} = 4 \cdot 20 = 80$

**13. Answer choice (B) is the correct answer.** Multiply the roots:  $2\sqrt{50} \cdot 5\sqrt{3} = 10\sqrt{150}$ . Simplify  $10\sqrt{150} : 10\sqrt{150} = 10 \cdot \sqrt{25} \cdot \sqrt{6} = 10 \cdot 5 \cdot \sqrt{6} = 50\sqrt{6}$

**14. Answer choice (A) is the correct answer.** Simplify the roots on the top and bottom:

$$\frac{\sqrt{18}}{\sqrt{4}} = \frac{\sqrt{9} \cdot \sqrt{2}}{2} = \frac{3\sqrt{2}}{2}$$

**15. Answer choice (D) is the correct answer.** Divide the top root by the bottom root:

$$\frac{\sqrt{75}}{\sqrt{3}} = \sqrt{25} = 5$$

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### Roots of Variables Set 1

**1. Answer choice (A) is the correct answer.** The square and the square root cancel each other out, and we are just left with  $x$ .

**2. Answer choice (D) is the correct answer.**  $\sqrt{y^3} = \sqrt{y^2 \cdot y} = y\sqrt{y}$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**3. Answer choice (B) is the correct answer.**  $\sqrt{z^4} = z^2$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**4. Answer choice (D) is the correct answer.**  $\sqrt{h^{13}} = \sqrt{h^{12} \cdot h} = h^6\sqrt{h}$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**5. Answer choice (B) is the correct answer.**  $\sqrt{a^8 b^{10}} = a^4 b^5$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**6. Answer choice (A) is the correct answer.**  $\sqrt{w^2 v^6} = wv^3$ . When taking the square root of variables with an even exponent, cut the exponent in half.

7. **Answer choice (B) is the correct answer.**  $\sqrt{64k^{64}} = 8k^{32}$ . The square root of 64 equals 8 because  $8^2 = 64$ . When taking the square root of variables with an even exponent, cut the exponent in half.
8. **Answer choice (C) is the correct answer.**  $\sqrt{144x^{36}} = 12k^{18}$ . The square root of 144 equals 12 because  $12^2 = 144$ . When taking the square root of variables with an even exponent, cut the exponent in half.
9. **Answer choice (C) is the correct answer.** Simplify each part of the square root separately.  
 $\sqrt{12} = \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$ .  $\sqrt{c^9} = \sqrt{c^8 \cdot c} = c^4\sqrt{c}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $2\sqrt{3} \cdot c^4\sqrt{c} = 2c^4\sqrt{3c}$ .
10. **Answer choice (A) is the correct answer.**  $\sqrt{24b} = \sqrt{4} \cdot \sqrt{6b} = 2\sqrt{6b}$ .
11. **Answer choice (D) is the correct answer.**  $\sqrt{x^{25}y^{49}} = \sqrt{x^{24} \cdot x \cdot y^{48} \cdot y} = x^{12}y^{24}\sqrt{xy}$ .
12. **Answer choice (D) is the correct answer.** Simplify each part of the square root separately.  
 $\sqrt{8} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$ .  $\sqrt{c^{16}d^{100}} = c^8d^{50}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $2\sqrt{2} \cdot c^8d^{50} = 2c^8d^{50}\sqrt{2}$ .
13. **Answer choice (A) is the correct answer.** Simplify each part of the square root separately.  $\sqrt{9} = 3$   
 $\sqrt{a^{11}b^3} = \sqrt{a^{10} \cdot a \cdot b^2 \cdot b} = a^5b\sqrt{ab}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  
 $3 \cdot a^5b\sqrt{ab} = 3a^5b\sqrt{ab}$ .
14. **Answer choice (B) is the correct answer.**  $\sqrt{10x^{15}y^{18}} = \sqrt{10x^{14} \cdot x \cdot y^{18}} = x^7y^9\sqrt{10x}$ . When taking the square root of variables with an even exponent, cut the exponent in half.
15. **Answer choice (C) is the correct answer.** Simplify each part of the square root separately.  
 $\sqrt{48} = \sqrt{16} \cdot \sqrt{3} = 4\sqrt{3}$ .  $\sqrt{p^5q^7} = \sqrt{p^4 \cdot p \cdot q^6 \cdot q} = p^2q^3\sqrt{pq}$ . (When taking the square root of

variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $4\sqrt{3} \cdot p^2q^3\sqrt{pq} = 4p^2q^3\sqrt{3pq}$ .

### Roots of Variables Set 2

- Answer choice (C) is the correct answer.** The square and the square root cancel each other out, and we are just left with  $a$ .
- Answer choice (A) is the correct answer.**  $\sqrt{x^5} = \sqrt{x^4} \cdot x = x^2\sqrt{x}$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (B) is the correct answer.**  $\sqrt{z^{16}} = z^8$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (C) is the correct answer.**  $\sqrt{k^9} = \sqrt{k^8} \cdot k = k^4\sqrt{k}$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (B) is the correct answer.**  $\sqrt{x^{12}y^4} = x^6y^2$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (D) is the correct answer.**  $\sqrt{ab^{100}} = b^{50}\sqrt{a}$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (C) is the correct answer.**  $\sqrt{36p^{36}} = 6p^{18}$ . The square root of 36 equals 6 because  $6^2 = 36$ . When taking the square root of variables with an even exponent, cut the exponent in half.
- Answer choice (C) is the correct answer.** Simplify each part of the square root separately.  
 $\sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$ .  $\sqrt{x^{50}} = x^{25}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $5x^{25}\sqrt{2}$
- Answer choice (D) is the correct answer.** Simplify each part of the square root separately.  
 $\sqrt{27} = 9 \cdot \sqrt{3} = 3\sqrt{3}$ .  $\sqrt{m^{49}} = \sqrt{m^{48}} \cdot m = m^{24}\sqrt{m}$ . (When taking the square root of variables with an

even exponent, cut the exponent in half.) Multiply the simplified roots together:  $3\sqrt{3} \cdot m^{24}\sqrt{m} = 3m^{24}\sqrt{3m}$ .

**10. Answer choice (B) is the correct answer.** We cannot simplify root 14, so just simplify the  $w^6$  under the root to get  $\sqrt{14w^6} = w^3\sqrt{14}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.)

**11. Answer choice (A) is the correct answer.**  $\sqrt{r^{81}s^{121}} = \sqrt{r^{80} \cdot r \cdot s^{120} \cdot s} = r^{40}s^{60}\sqrt{rs}$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**12. Answer choice (B) is the correct answer.** Simplify each part of the square root separately.  $\sqrt{16} = 4$ .  $\sqrt{a^{64}b^{400}} = a^{32}b^{200}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $4a^{32}b^{200}$

**13. Answer choice (A) is the correct answer.** Simplify each part of the square root separately.

$\sqrt{18} = 9 \cdot \sqrt{2} = 3\sqrt{2}$ .  $\sqrt{a^{19}b^{13}} = \sqrt{a^{18} \cdot a \cdot b^{12} \cdot b} = a^9b^6\sqrt{ab}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $3\sqrt{2} \cdot a^9b^6\sqrt{ab} = 3a^9b^6\sqrt{2ab}$ .

**14. Answer choice (A) is the correct answer.**  $\sqrt{22x^{20}y^{21}} = \sqrt{22x^{20} \cdot y^{20} \cdot y} = x^{10}y^{10}\sqrt{22y}$ . When taking the square root of variables with an even exponent, cut the exponent in half.

**15. Answer choice (D) is the correct answer.** Simplify each part of the square root separately.

$\sqrt{72} = \sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$ .  $\sqrt{pq^{25}} = \sqrt{p \cdot q^{24} \cdot q} = q^{12}\sqrt{pq}$ . (When taking the square root of variables with an even exponent, cut the exponent in half.) Multiply the simplified roots together:  $6\sqrt{2} \cdot q^{12}\sqrt{pq} = 6q^{12}\sqrt{2pq}$ .

## Scientific Notation Set 1

- 1. Answer choice (D) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 45 in scientific notation, change it into a decimal that is in between 1 and 10: 45 becomes

4.5. To get from 4.5 to 45, we need to move the decimal point 1 time to the right. Therefore, we can write 45 as  $4.5 \times 10^1$  which is the same as  $4.5 \times 10$ .

2. **Answer choice (D) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The positive two exponent tells us to move the decimal point in 3.246 two places to the right. Therefore,  $3.246 \times 10^2 = 324.6$ .
3. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The negative four exponent tells us to move the decimal point in 8.8 four places to the left. Therefore,  $8.8 \times 10^{-4} = 0.00088$ .
4. **Answer choice (D) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.005 in scientific notation, change it into a decimal that is in between 1 and 10: 0.005 becomes 5. To get from 5 to 0.005, we need to move the decimal point 3 times to the left. Therefore, we can write 0.005 as  $5 \times 10^{-3}$ .
5. **Answer choice (C) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The negative three exponent tells us to move the decimal point in 6, or 6.0, three places to the left. Therefore,  $6 \times 10^{-3} = 0.006$ .
6. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 123,444 in scientific notation, change it into a decimal that is in between 1 and 10: 123,444 becomes 1.23444. To get from 1.23444 to 123,444, we need to move the decimal point 5 times to the right. Therefore, we write 123,444 as  $1.23444 \times 10^5$ .
7. **Answer choice (A) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.00768 in scientific notation, change it into a decimal that is in between 1 and 10: 0.00768 becomes 7.68. To get from 7.68 to 0.00768, we need to move the decimal point 3 times to the left. Therefore, we can write 0.00768 as  $7.68 \times 10^{-3}$ .

- 8. Answer choice (A) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The positive six exponent tells us to move the decimal point in 5, or 5.0, six places to the right. Therefore,  $5 \times 10^6 = 5,000,000$ .
- 9. Answer choice (C) is the correct answer.** Change  $\frac{1}{8}$  into a decimal by dividing the numerator by the denominator to get 0.125. Change 0.125 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.125 in scientific notation, change it into a decimal that is in between 1 and 10: 0.125 becomes 1.25. To get from 1.25 to 0.125, we need to move the decimal point 1 time to the left. Therefore, we can write 0.125 as  $1.25 \times 10^{-1}$ .
- 10. Answer choice (D) is the correct answer.** Change  $\frac{3}{50}$  into a decimal by dividing the numerator by the denominator to get 0.06. Change 0.06 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.06 in scientific notation, change it into a decimal that is in between 1 and 10: 0.06 becomes 6. To get from 6 to 0.06, we need to move the decimal point 2 times to the left. Therefore, we can write 0.06 as  $6 \times 10^{-2}$ .
- 11. Answer choice (B) is the correct answer.** Change  $\frac{2}{400}$  into a decimal by dividing the numerator by the denominator to get 0.005. Change 0.005 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.005 in scientific notation, change it into a decimal that is in between 1 and 10: 0.005 becomes 5. To get from 5 to 0.005, we need to move the decimal point 3 times to the left. Therefore, we can write 0.005 as  $5 \times 10^{-3}$ .
- 12. Answer choice (C) is the correct answer.** Change  $\frac{48}{24,000}$  into a decimal by dividing the numerator by the denominator to get 0.002. Change 0.002 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.002 in scientific notation, change it into a decimal that is in between 1 and 10: 0.002 becomes 2. To get from 2 to 0.002, we need to move the decimal point 3 times to the left. Therefore, we can write 0.002 as  $2 \times 10^{-3}$ .

- 13. Answer choice (D) is the correct answer.** Write  $8.6 \times 10^6$  in standard form by moving the decimal point 6 places to the right:  $8.6 \times 10^6 = 8,600,000$ . Write  $6.2 \times 10^5$  in standard form by moving the decimal point 5 places to the right:  $6.2 \times 10^5 = 620,000$ . Subtract 8,600,000 minus 620,000 to get 7,980,000. Write 7,980,000 in scientific notation to get  $7.98 \times 10^6$ .
- 14. Answer choice (B) is the correct answer.** Write  $5.5 \times 10^4$  in standard form by moving the decimal point 4 places to the right:  $5.5 \times 10^4 = 55,000$ . Write  $2.3 \times 10^2$  in standard form by moving the decimal point 2 places to the right:  $2.3 \times 10^2 = 230$ . Add 55,000 and 230 to get 55,230. Write 55,230 in scientific notation to get  $5.523 \times 10^4$ .
- 15. Answer choice (C) is the correct answer.** Write  $7.6 \times 10^{-5}$  in standard form by moving the decimal point 5 places to the left:  $7.6 \times 10^{-5} = 0.000076$ . Write  $2.5 \times 10^{-7}$  in standard form by moving the decimal point 7 places to the left:  $2.5 \times 10^{-7} = 0.00000025$ . Add 0.000076 and 0.00000025 to get 0.00007625. Write 0.00007625 in scientific notation to get  $7.625 \times 10^{-5}$ .
- 16. Answer choice (D) is the correct answer.** Write  $4.85 \times 10^{-2}$  in standard form by moving the decimal point 2 places to the left:  $4.85 \times 10^{-2} = 0.0485$ . Write  $7.15 \times 10^{-4}$  in standard form by moving the decimal point 4 places to the left:  $7.15 \times 10^{-4} = 0.000715$ . Subtract 0.0485 minus 0.000715 to get 0.047785. Write 0.047785 in scientific notation to get  $4.7785 \times 10^{-2}$ .
- 17. Answer choice (B) is the correct answer.** Divide 3.6 by 9 to get 0.4. Divide  $10^6$  by  $10^3$  by subtracting the exponents to get  $10^3$ . Multiply 0.4 by  $10^3$  to get  $0.4 \times 10^3$ . Remember that  $0.4 \times 10^3$  is not written in scientific notation because 0.4 is not in between 1 and 10. Change  $0.4 \times 10^3$  into scientific notation to get  $4 \times 10^2$ .
- 18. Answer choice (B) is the correct answer.** Multiply 1.5 by 5 to get 7.5. Multiply  $10^4$  by  $10^2$  by adding the exponents to get  $10^6$ . Multiply 7.5 by  $10^6$  to get  $7.5 \times 10^6$ .
- 19. Answer choice (C) is the correct answer.** Multiply 5 by 3.2 to get 16. Multiply  $10^{-3}$  by  $10^{-1}$  by adding the exponents to get  $10^{-4}$ . Multiply 16 by  $10^{-4}$  to get  $16 \times 10^{-4}$ . Remember that  $16 \times 10^{-4}$  is not written in scientific notation because 16 is not in between 1 and 10. Change  $16 \times 10^{-4}$  into scientific notation to get  $1.6 \times 10^{-3}$ .
- 20. Answer choice (C) is the correct answer.** Divide 5.4 by 1.8 to get 3. Divide  $10^{-5}$  by  $10^{-2}$  by subtracting the exponents to get  $10^{-3}$ . Multiply 3 by  $10^{-3}$  to get  $3 \times 10^{-3}$ .

### Scientific Notation Set 2

- 1. Answer choice (C) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left.

The positive six exponent tells us to move the decimal point in 6.72 six places to the right. Therefore,  $6.72 \times 10^6 = 6,720,000$ .

2. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 300,000 in scientific notation, change it into a decimal that is in between 1 and 10: 300,000 becomes 3. To get from 3 to 300,000, we need to move the decimal point 5 times to the right. Therefore, we can write 300,000 as  $3 \times 10^5$ .
3. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The negative three exponent tells us to move the decimal point in 4.36 three places to the left. Therefore,  $4.36 \times 10^{-3} = 0.00436$ .
4. **Answer choice (C) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.068 in scientific notation, change it into a decimal that is in between 1 and 10: 0.068 becomes 6.8. To get from 6.8 to 0.068, we need to move the decimal point 2 times to the left. Therefore, we can write 0.068 as  $6.8 \times 10^{-2}$ .
5. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The negative four exponent tells us to move the decimal point in 9, or 9.0, four places to the left. Therefore,  $9 \times 10^{-4} = 0.0009$ .
6. **Answer choice (A) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 4,807 in scientific notation, change it into a decimal that is in between 1 and 10: 4,807 becomes 4.807. To get from 4.807 to 4,807, we need to move the decimal point 3 times to the right. Therefore, we write 4,807 as  $4.807 \times 10^3$ .
7. **Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.0000204 in scientific notation, change it into a decimal that is in between 1 and 10: 0.0000204 becomes 2.04. To get from 2.04 to 0.0000204, we need to move the decimal point 5 times to the left. Therefore, we can write 0.0000204 as  $2.04 \times 10^{-5}$ .

- 8. Answer choice (B) is the correct answer.** A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. The positive two exponent tells us to move the decimal point in 8, or 8.0, two places to the right. Therefore,  $8 \times 10^2 = 800$ .
- 9. Answer choice (C) is the correct answer.** Change  $\frac{2}{5}$  into a decimal by dividing the numerator by the denominator to get 0.4. Change 0.4 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.4 in scientific notation, change it into a decimal that is in between 1 and 10: 0.4 becomes 4. To get from 4 to 0.4, we need to move the decimal point 1 time to the left. Therefore, we can write 0.4 as  $4 \times 10^{-1}$ .
- 10. Answer choice (B) is the correct answer.** Change  $\frac{7}{1000}$  into a decimal by dividing the numerator by the denominator to get 0.007. Change 0.007 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.007 in scientific notation, change it into a decimal that is in between 1 and 10: 0.007 becomes 7. To get from 7 to 0.007, we need to move the decimal point 3 times to the left. Therefore, we can write 0.007 as  $7 \times 10^{-3}$ .
- 11. Answer choice (C) is the correct answer.** Change  $\frac{4}{50,000}$  into a decimal by dividing the numerator by the denominator to get 0.00008. Change 0.00008 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.00008 in scientific notation, change it into a decimal that is in between 1 and 10: 0.00008 becomes 8. To get from 8 to 0.00008, we need to move the decimal point 5 times to the left. Therefore, we can write 0.00008 as  $8 \times 10^{-5}$ .
- 12. Answer choice (D) is the correct answer.** Change  $\frac{360}{4000}$  into a decimal by dividing the numerator by the denominator to get 0.09. Change 0.09 into scientific notation. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.09 in scientific notation, change it into a decimal that is in between 1 and 10: 0.09 becomes 9. To get from 9 to 0.09, we need to move the decimal point 2 times to the left. Therefore, we can write 0.09 as  $9 \times 10^{-2}$ .

- 13. Answer choice (C) is the correct answer.** Write  $6.1 \times 10^5$  in standard form by moving the decimal point 5 places to the right:  $6.1 \times 10^5 = 610,000$ . Write  $3.4 \times 10^3$  in standard form by moving the decimal point 3 places to the right:  $3.4 \times 10^3 = 3,400$ . Add 610,000 plus 3,400 to get 613,400. Write 613,400 in scientific notation to get  $6.134 \times 10^5$ .
- 14. Answer choice (A) is the correct answer.** Write  $9.8 \times 10^6$  in standard form by moving the decimal point 6 places to the right:  $9.8 \times 10^6 = 9,800,000$ . Write  $4.1 \times 10^4$  in standard form by moving the decimal point 4 places to the right:  $4.1 \times 10^4 = 41,000$ . Subtract 9,800,000 minus 41,000 to get 9,759,000. Write 9,759,000 in scientific notation to get  $9.759 \times 10^6$ .
- 15. Answer choice (D) is the correct answer.** Write  $6.5 \times 10^{-2}$  in standard form by moving the decimal point 2 places to the left:  $6.5 \times 10^{-2} = 0.065$ . Write  $9.45 \times 10^{-1}$  in standard form by moving the decimal point 1 place to the left:  $9.45 \times 10^{-1} = 0.945$ . Add 0.065 and 0.945 to get 1.01. Write 1.01 in scientific notation to get  $1.01 \times 10^0$ .
- 16. Answer choice (C) is the correct answer.** Write  $8.6 \times 10^{-1}$  in standard form by moving the decimal point 1 place to the left:  $8.6 \times 10^{-1} = 0.86$ . Write  $4 \times 10^{-3}$  in standard form by moving the decimal point 3 places to the left:  $4 \times 10^{-3} = 0.004$ . Subtract 0.86 minus 0.004 to get 0.856. Write 0.856 in scientific notation to get  $8.56 \times 10^{-1}$ .
- 17. Answer choice (B) is the correct answer.** Divide 4.2 by 7 to get 0.6. Divide  $10^5$  by  $10^2$  by subtracting the exponents to get  $10^3$ . Multiply 0.6 by  $10^3$  to get  $0.6 \times 10^3$ . Remember that  $0.6 \times 10^3$  is not written in scientific notation because 0.6 is not in between 1 and 10. Change  $0.6 \times 10^3$  into scientific notation to get  $6 \times 10^2$ .
- 18. Answer choice (C) is the correct answer.** Multiply 2.4 by 3 to get 7.2. Multiply  $10^6$  by  $10^3$  by adding the exponents to get  $10^9$ . Multiply 7.2 by  $10^9$  to get  $7.2 \times 10^9$ .
- 19. Answer choice (A) is the correct answer.** Multiply 8.2 by 4 to get 32.8. Multiply  $10^{-4}$  by  $10^{-2}$  by adding the exponents to get  $10^{-6}$ . Multiply 32.8 by  $10^{-6}$  to get  $32.8 \times 10^{-6}$ . Remember that  $32.8 \times 10^{-6}$  is not written in scientific notation because 32.8 is not in between 1 and 10. Change  $32.8 \times 10^{-6}$  into scientific notation to get  $3.28 \times 10^{-5}$ .
- 20. Answer choice (B) is the correct answer.** Divide 6.4 by 1.6 to get 4. Divide  $10^{-4}$  by  $10^{-6}$  by subtracting the exponents to get  $10^2$ . Multiply 4 by  $10^2$  to get  $4 \times 10^2$ .
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### Quantitative Comparisons Set 1

- Answer choice (A) is the correct answer.**  $3^2$  equals  $3 \cdot 3$  which equals 9.  $2^3$  equals  $2 \cdot 2 \cdot 2$  which equals 8. Column A is greater than Column B.
- Answer choice (C) is the correct answer.** To change a negative exponent to a positive exponent, flip the fraction upside down and change the exponents from negative to positive. Therefore Column B becomes  $\left(\frac{2}{3}\right)^5$  which is equal to Column A.
- Answer choice (A) is the correct answer.** For Column A, subtract 100 minus 64 first to get 36. The square root of 36 equals 6. For Column B, take the square root of 100 which is 10 and subtract the square root of 64 which is 8 to get 2. Column A is greater than Column B.
- Answer choice (B) is the correct answer.** In Column A, simplify the exponential terms on the top and bottom of the fraction to get  $\frac{9(27 - 9)}{81(9 + 3)}$ . Simplify what is inside the parentheses on the top and bottom of the fraction to get  $\frac{9(18)}{81(12)}$ . Simplify 9 over 81 which equals 1 over 9 and 18 over 12 which equals 3 over 2 to get  $\frac{1(3)}{9(2)}$ . Simplify the fraction to get  $\frac{3}{18}$  which equals  $\frac{1}{6}$ . Column B is greater than Column A.
- Answer choice (D) is the correct answer.** Change Column B from a root to a fractional exponent:  $\sqrt[3]{a^5} = a^{\frac{5}{3}}$ . Since we don't know what  $a$  is, we cannot determine if Column A or Column B is greater. For example, if  $a = 0$ , then Column A and B are equal. If  $a = 10$ , then Column B is greater than Column A because 10 raised to a larger exponent will result in a larger number.
- Answer choice (A) is the correct answer.** A negative number raised to an even exponent results in a positive number. Column B is negative because the negative is not being raised to the fourth power. Since a positive number is always greater than a negative number, Column A is greater than Column B.
- Answer choice (C) is the correct answer.** For Column A, add the exponents to get  $x^{10}$ . For Column (B), multiply the exponents to get  $x^{10}$ . Column A and B are equals.
- Answer choice (B) is the correct answer.** Simplify Column A:  $2\sqrt{5} \cdot 2\sqrt{3} = 4\sqrt{15}$ .  $4\sqrt{15}$  is less than  $5\sqrt{17}$  because 4 is less than 5 and  $\sqrt{15}$  is less than  $\sqrt{17}$ . Column B is greater than Column A.

- 9. Answer choice (B) is the correct answer.** Raising something to the one-half is the same as taking the square root. The square root of 144 is 12, so Column A equals 12. Column B is greater than Column A.
- 10. Answer choice (D) is the correct answer.** Since we don't know what  $x$  equals, we cannot determine which Column is greater. For example, if  $x = 0$ , then the two columns are equal. If  $x = 10$ , Column B is greater than Column A because 10 raised to a larger number will result in a larger answer.
- 11. Answer choice (A) is the correct answer.** Since  $\sqrt{26}$  is greater than  $\sqrt{25}$ , and  $\sqrt{25}$  equals 5, then  $\sqrt{26}$  is greater than 5. This means that  $3\sqrt{26}$  is greater than  $3 \cdot 5$  which equals 15. Column A is greater than Column B.
- 12. Answer choice (A) is the correct answer.** Simplify Column A by multiplying 5 and 6 to get 30. Then multiply  $10^3$  by  $10^4$  by adding the exponents to get  $10^7$ . Therefore, Column A equals  $30 \times 10^7$  which is greater than  $3 \times 10^7$ . Column A is greater than Column B.
- 13. Answer choice (B) is the correct answer.** Simplify Column A by subtracting the exponents for each variable to get  $\frac{a^6}{b^8 c^4}$ . Simplify Column B by subtracting the exponents for each variable to get  $\frac{a^6 c^4}{b^8}$ . Since  $a$ ,  $b$ , and  $c$  are all greater than 1, Column B is greater than Column A because the  $c^4$  is on the top of the fraction instead of the bottom.
- 14. Answer choice (A) is the correct answer.** Simplify Column A by dividing 4.9 by 0.7 to get 7. Divide 5.4 by 1.8 to get 3. Divide  $10^5$  by  $10^2$  by subtracting the exponents to get  $10^3$ . Multiply 7 by  $10^3$  to get  $7 \times 10^3$ . Since  $10^3$  is greater than  $10^2$ , Column A is greater than Column B.
- 15. Answer choice (C) is the correct answer.** Write Column B with a base of 4:  $16^6 = (4^2)^6 = 4^{12}$ . Column A is equal to Column B.

### Quantitative Comparisons Set 2

- 1. Answer choice (C) is the correct answer.** Column A =  $(-4) \cdot (-4) \cdot (-4) = -64$ . Column B =  $-(4 \cdot 4 \cdot 4) = -64$ . Therefore, Column A and Column B are equal.
- 2. Answer choice (B) is the correct answer.** Negative exponents DO NOT make things negative. Therefore, Column B is positive. Since a positive is always greater than a negative, Column B is greater than Column A.

- 3. Answer (A) choice is the correct answer.**  $3\sqrt{17}$  is greater than  $3\sqrt{16}$ , and  $\sqrt{16}=4$ , so  $3\sqrt{16}$  is greater than  $3 \cdot 4$  or 12.  $2\sqrt{35}$  is less than  $2\sqrt{36}$ , and  $\sqrt{36}=6$ , so  $2\sqrt{35}$  is less than  $2 \cdot 6$  or 12. Therefore, Column A is greater than Column B.
- 4. Answer choice (B) is the correct answer.** Simplify  $4^2$  which equals 16,  $3^2$  which equals 9,  $6^2$  which equals 36, and  $2^2$  which equals 4. Now we have  $\frac{16(9)}{36(4)}$ . 16 over 4 equals 4, and 9 over 36 equals 1 over 4. Therefore, we have  $\frac{4}{4}$ . Which equals 1, so Column B is greater than Column A.
- 5. Answer choice (A) is the correct answer.** Since  $a$  is in between 0 and 1,  $a^3$  is greater than  $a^5$ . Use  $a = \frac{1}{2}$  as an example:  $\left(\frac{1}{2}\right)^5 = \frac{1}{32}$  and  $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$ , so Column A is greater than Column B.
- 6. Answer choice (C) is the correct answer.**  $\left(\frac{1}{4}\right)^2 = \frac{1}{16}$  and  $\left(\frac{1}{2}\right)^4 = \frac{1}{16}$ , so Column A and Column B are equal.
- 7. Answer choice (A) is the correct answer.** Simplify Column A by subtracting the exponents to get  $x^9$ . Since  $x > 1$ ,  $x^9$  is greater than  $x^4$ , so Column A is greater than Column B.
- 8. Answer choice (A) is the correct answer.** The square root of 9 equals 3, the square root of 25 equals 5.  $3 + 5 = 8$ , so Column A equals 8. For Column B, you need to add 9 and 25 before taking the square root.  $9 + 25 = 34$ , so Column B equals  $\sqrt{34}$ .  $\sqrt{34} < \sqrt{64}$  which means  $\sqrt{34} < 8$ , so Column A is greater than Column B.
- 9. Answer choice (B) is the correct answer.** To change a negative exponent to a positive exponent, flip the fraction upside down and change the exponents from negative to positive. Therefore,  $16^{-\frac{5}{4}}$   
 $= \left(\frac{1}{16}\right)^{\frac{5}{4}} = \sqrt[4]{\frac{1}{16}^5}$ . Take the fourth root of  $\frac{1}{16}$  which equals  $\frac{1}{2}$ . Raise  $\frac{1}{2}$  to the fifth power to get  $\frac{1}{32}$ . Therefore, Column B is greater than Column A.
- 10. Answer choice (A) is the correct answer.** Anything raised to the 0 power equals 1. Therefore,  $60^0 = 1$ , so Column A is greater than Column B.
- 11. Answer choice (A) is the correct answer.**  $\sqrt{50} > \sqrt{49}$ , so  $\sqrt{50} > 7$ .  $\sqrt{65} > \sqrt{64}$ , so  $\sqrt{65} > 8$ . Therefore,  $\sqrt{50} + \sqrt{65} > 7 + 8$ , so  $\sqrt{50} + \sqrt{65} > 15$ . Column A is greater than Column B.

**12. Answer choice (D) is the correct answer.** Simplify Column A by first raising everything in the top parentheses to the 2nd power and everything in the bottom parentheses to the negative 3rd power to get  $\frac{x^6 y^{-8}}{x^9 y^3}$ . Simplify by subtracting the exponents for each variable and flipping the

terms with negative exponents:  $\frac{x^6 y^{-8}}{x^9 y^3} = \frac{x^{-3} y^{-11}}{1} = \frac{1}{x^3 y^{11}}$ . Since we don't know what  $x$  and  $y$  are, we cannot determine the relationship between Column A and B.

**13. Answer choice (B) is the correct answer.** Change  $2 \times 10^{-2}$  into standard form by moving the decimal point two places to the left to get 0.02. Change 0.02 into a fraction: 0.02 can be read as “two hundredths” which equals  $\frac{2}{100}$ . Therefore, Column B is greater than Column A.

**14. Answer choice (B) is the correct answer.** In Column A, change  $6.5 \times 10^3$  into standard form by moving the decimal point three places to the right to get 6,500, and change  $4 \times 10^2$  into standard form by moving the decimal point two places to the right to get 400. Add 6,500 and 400 to get 6,900 for Column A. Write Column B in standard form by moving the decimal point 5 times to the right to get 1,050,000. Therefore, Column B is greater than Column A.

**15. Answer choice (C) is the correct answer.** To change a negative exponent to a positive exponent, flip the fraction upside down and change the exponents from negative to positive. Therefore,

$$\left(\frac{1}{8}\right)^{-\frac{1}{3}} = 8^{\frac{1}{3}}, \text{ so Column A and Column B are equal.}$$

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## **MATH COURSE 3**

### **Simplifying Expressions Set 1**

- 1. Answer choice (A) is the correct answer.** Combine the  $x$  terms by adding the coefficients:  $6x - 3x = 3x$ . Combine the  $y$  terms by adding the coefficients:  $7y + 4y = 11y$ . Add the terms together to get  $3x + 11y$ .
- 2. Answer choice (D) is the correct answer.** Combine the  $a$  terms by adding the coefficients:  $a + a = 2a$ . Combine the  $b$  terms by adding the coefficients:  $-b - b = -2b$ . Add the terms together to get  $2a - 2b$ .
- 3. Answer choice (B) is the correct answer.** Combine the  $x^2$  terms by adding the coefficients:  $5x^2 - 3x^2 = 2x^2$ . Combine the  $x$  terms by adding the coefficients:  $4x - 8x = -4x$ . Add the terms together to get  $2x^2 - 4x$ .

4. **Answer choice (C) is the correct answer.** Combine the  $k^2$  terms by adding the coefficients:  $6k^2 - 8k^2 = -2k^2$ . We cannot combine any other terms, so add the terms together to get  $-3k^3 - 2k^2 + 2k$ .
5. **Answer choice (A) is the correct answer.** Combine the  $a^2b$  terms by adding the coefficients:  $9a^2b + 5a^2b = 14a^2b$ . Combine the  $b^2a$  terms by adding the coefficients:  $4b^2a - 7b^2a = -3b^2a$ . Add the terms together to get  $14a^2b - 3b^2a$ .
6. **Answer choice (B) is the correct answer.** Distribute the 8 to get  $8w^2 + 16w - 5w^2 + 7w$ . Combine the  $w^2$  terms by adding the coefficients:  $8w^2 - 5w^2 = 3w^2$ . Combine the  $w$  terms by adding the coefficients:  $16w + 7w = 23w$ . Add the terms together to get  $3w^2 + 23w$ .
7. **Answer choice (C) is the correct answer.** Distribute the 3 and the  $-6$  to get  $6k + 3h - 24h + 12k$ . Combine the  $k$  terms by adding the coefficients:  $6k + 12k = 18k$ . Combine the  $h$  terms by adding the coefficients:  $3h - 24h = -21h$ . Add the terms together to get  $18k - 21h$ .
8. **Answer choice (B) is the correct answer.** Distribute the  $3a$  and the  $-6a$  to get  $6a - 15a^2 - 24a^2 - 6a$ . Combine the  $a$  terms by adding the coefficients:  $6a - 6a = 0$ . Combine the  $a^2$  terms by adding the coefficients:  $-15a^2 - 24a^2 = -39a^2$ . Combine the terms together to get  $-39a^2$ .
9. **Answer choice (D) is the correct answer.** Distribute the  $8p$  and the  $6q$  to get  $32pq + 8p^2 + 12pq - 18q^2$ . Combine the  $pq$  terms by adding the coefficients:  $32pq + 12pq = 44pq$ . We cannot combine any other terms, so add the terms together to get  $8p^2 + 44pq - 18q^2$ .
10. **Answer choice (A) is the correct answer.** Distribute the negative to get  $4r^3t^5 - 6t^3r^5 - 3t^3r^5 + r^3t^5$ . Combine the  $r^3t^5$  terms together by adding the coefficients:  $4r^3t^5 + r^3t^5 = 5r^3t^5$ . Combine the  $t^3r^5$  terms together by adding the coefficients:  $-6t^3r^5 - 3t^3r^5 = -9t^3r^5$ . Add the terms together to get  $5r^3t^5 - 9t^3r^5$ .
11. **Answer choice (B) is the correct answer.** Distribute the  $2m$  to get  $7m^2n^4 + 5m^4n^2 - 8m^4n^2 + 4m^2n^4$ . Combine the  $m^2n^4$  terms by adding the coefficients:  $7m^2n^4 + 4m^2n^4 = 11m^2n^4$ . Combine the  $m^4n^2$  terms by adding the coefficients:  $5m^4n^2 - 8m^4n^2 = -3m^4n^2$ . Add the terms together to get  $11m^2n^4 - 3m^4n^2$ .
12. **Answer choice (C) is the correct answer.** Distribute the  $-2xy^2$  and the  $4xy$  to get  $-4x^3y^2 + 10x^2y^3 + 4x^2y^3 + 12x^3y^2$ . Combine the  $x^3y^2$  terms by adding the coefficients:  $-4x^3y^2 + 12x^3y^2 = 8x^3y^2$ . Combine the  $x^2y^3$  terms by adding the coefficients:  $10x^2y^3 + 4x^2y^3 = 14x^2y^3$ . Add the terms together to get  $8x^3y^2 + 14x^2y^3$ .

**Simplifying Expressions Set 2**

- 1. Answer choice (D) is the correct answer.** Combine the  $x$  terms by adding the coefficients:  $5x - 9x = -4x$ . Combine the  $y$  terms by adding the coefficients:  $-3y + 4y = y$ . Add the terms together to get  $-4x + y$ .
- 2. Answer choice (A) is the correct answer.** Combine the  $k$  terms by adding the coefficients:  $k - k = 0$ . Combine the  $h$  terms by adding the coefficients:  $-h - h = -2h$ . Add the terms together to get  $-2h$ .
- 3. Answer choice (C) is the correct answer.** Combine the  $b^2$  terms by adding the coefficients:  $7b^2 + b^2 = 8b^2$ . Combine the  $b$  terms by adding the coefficients:  $6b - 9b = -3b$ .
- 4. Answer choice (D) is the correct answer.** Combine the  $h^4$  terms by adding the coefficients:  $-6h^4 - 2h^4 = -8h^4$ . Combine the  $h^2$  terms by adding the coefficients:  $10h^2 + 3h^2 = 13h^2$ . Add the terms together to get  $-8h^4 + 13h^2$ .
- 5. Answer choice (B) is the correct answer.** Combine the  $a^2b$  terms by adding the coefficients:  $-7a^2b + 4a^2b = -3a^2b$ . Combine the  $b^2a$  terms by adding the coefficients:  $7b^2a - 5b^2a = 2b^2a$ . Add the terms together to get  $-3a^2b + 2b^2a$ .
- 6. Answer choice (A) is the correct answer.** Distribute the  $3v$  to get  $12v - 3v^2 - 6v^2 + 2v$ . Combine the  $v^2$  terms by adding the coefficients:  $-3v^2 - 6v^2 = -9v^2$ . Combine the  $v$  terms by adding the coefficients:  $12v + 2v = 14v$ . Add the terms together to get  $-9v^2 + 14v$ .
- 7. Answer choice (B) is the correct answer.** Distribute the 2 and 5 to get  $2x - 4y + 15x - 20y$ . Combine the  $x$  terms by adding the coefficients:  $2x + 15x = 17x$ . Combine the  $y$  terms by adding the coefficients:  $-4y - 20y = -24y$ . Add the terms together to get  $17x - 24y$ .
- 8. Answer choice (C) is the correct answer.** Distribute the  $4z$  and  $-z$  to get  $28z - 12z^2 - 8z^2 + 12z$ . Combine the  $z^2$  terms by adding the coefficients:  $-12z^2 - 8z^2 = -20z^2$ . Combine the  $z$  terms by adding the coefficients:  $28z + 12z = 40z$ . Add the terms together to get  $-20z^2 + 40z$ .
- 9. Answer choice (C) is the correct answer.** Distribute the  $10m$  and  $-n$  to get  $10m^2 + 50mn - 8n^2 - 12mn$ . Combine the  $mn$  terms by adding the coefficients:  $50mn - 12mn = 38mn$ . We cannot combine any other terms, so add the terms together to get  $10m^2 + 38mn - 8n^2$ .
- 10. Answer choice (A) is the correct answer.** Distribute the negative to get  $9u^4v^2 + 11u^2v^4 - 3u^2v^4 + 7u^4v^2$ . Combine the  $u^4v^2$  terms by adding the coefficients:  $9u^4v^2 + 7u^4v^2 = 16u^4v^2$ . Combine the  $u^2v^4$  terms by adding the coefficients:  $11u^2v^4 - 3u^2v^4 = 8u^2v^4$ . Add the terms together to get  $16u^4v^2 + 8u^2v^4$ .

- 11. Answer choice (B) is the correct answer.** Distribute the  $-a$  to get  $6a^3b^6 + 4a^6b^3 - a^6b^3 - 4a^3b^6$ . Combine the  $a^3b^6$  terms by adding the coefficients:  $6a^3b^6 - 4a^3b^6 = 2a^3b^6$ . Combine the  $a^6b^3$  terms by adding the coefficients:  $4a^6b^3 - a^6b^3 = 3a^6b^3$ . Add the terms together to get  $2a^3b^6 + 3a^6b^3$ .
- 12. Answer choice (D) is the correct answer.** Distribute the  $p^2q^2$  and the  $2pq^2$  to get  $4p^4q^2 - 5p^2q^4 + 2p^2q^4 - 10p^4q^2$ . Combine the  $p^4q^2$  terms by adding the coefficients:  $4p^4q^2 - 10p^4q^2 = -6p^4q^2$ . Combine the  $p^2q^4$  terms by adding the coefficients:  $-5p^2q^4 + 2p^2q^4 = -3p^2q^4$ . Add the terms together to get  $-6p^4q^2 - 3p^2q^4$ .
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### Basic Algebra Set 1

- 1. Answer choice (C) is the correct answer.** Subtract 16 from both sides to get  $-2x = -4$ . Divide both sides by  $-2$  to get  $x = 2$ .
- 2. Answer choice (D) is the correct answer.** Subtract 18 from both sides to get  $-\frac{2}{3}x = -6$ . Divide both sides by  $-\frac{2}{3}$  to get  $x = 9$ .
- 3. Answer choice (C) is the correct answer.** Add  $x$  to both sides to get  $4x - 3 = 17$ . Add 3 to both sides to get  $4x = 20$ . Divide both sides by 4 to get  $x = 5$ .
- 4. Answer choice (B) is the correct answer.** Subtract  $8x$  from both sides to get  $-3x + 6 = 18$ . Subtract 6 from both sides to get  $-3x = 12$ . Divide both sides by  $-3$  to get  $x = -4$ .
- 5. Answer choice (C) is the correct answer.** Multiply both sides of the equation  $x + y = 3$  by 2:  $2(x + y) = 2(3)$ . Distribute the 2 on the left side and simplify the right side:  $2x + 2y = 6$ .
- 6. Answer choice (A) is the correct answer.** Divide both sides of the equation  $6x + 6y = 12$  by 6:  $\frac{6x + 6y}{6} = \frac{12}{6}$ . Simplify each side of the equation by dividing each term by 6 to get  $x + y = 2$ .
- 7. Answer choice (D) is the correct answer.** Divide both sides of the equation  $4x - 6y = 18$  by 2:  $\frac{4x - 6y}{2} = \frac{18}{2}$ . Simplify each side of the equation by dividing each term by 2 to get  $2x - 3y = 9$ .
- 8. Answer choice (D) is the correct answer.** Add  $4y$  to both sides in the equation  $3x = 10 - 4y$  to get  $3x + 4y = 10$ . Multiply both sides of the equation by 2:  $2(3x + 4y) = 2(10)$ . Distribute the 2 on the left side of the equation and simplify the right side:  $6x + 8y = 20$ .

- 9. Answer choice (B) is the correct answer.** In order for both sides of the equation to be equal,  $a$  must equal 5. If you plug in 5 for  $a$  in the equation  $5x = ax$ , you get  $5x = 5x$ , so both sides of the equation are equal.
- 10. Answer choice (D) is the correct answer.** In order for both sides of the equation to be equal,  $b$  must equal 7. If you plug in 7 for  $b$  in the equation  $7a - 7 = ba - b$ , you get  $7a - 7 = 7a - 7$ , so both sides of the equation are equal.
- 11. Answer choice (C) is the correct answer.** Divide both sides of the equation by  $x$  to get  $16 = a^2$ . Take the square root of both sides to get that  $a = 4$  or  $-4$ .
- 12. Answer choice (C) is the correct answer.** Add 7 to both sides of the equation to get  $m + 7 = 5 + n + 7$ . Combine 5 and 7 to get  $m + 7 = n + 12$ .
- 13. Answer choice (B) is the correct answer.** Distribute the 3 to get  $a = 18 - 3b$ . To find  $a - 3$ , subtract 3 from both sides of the equation:  $a - 3 = 18 - 3b - 3$ . Combine 18 and  $-3$  to get  $a - 3 = 15 - 3b$ .
- 14. Answer choice (A) is the correct answer.** Multiply both sides of the equation by 4:  $4x = 4(3y - 2)$ . Distribute the 4 to get  $4x = 12y - 8$ .
- 15. Answer choice (D) is the correct answer.** Square both sides of the equation to get  $x^2 = (-6y)^2$ . Simplify the right side to get  $x^2 = 36y^2$ .
- 16. Answer choice (D) is the correct answer.** Distribute the  $a$  to get  $ab - ac = 120$ . Since  $ac = 40$ , replace  $ac$  with 40 in the equation:  $ab - 40 = 120$ . Add 40 to both sides to get  $ab = 160$ .
- 17. Answer choice (A) is the correct answer.** Distribute the  $3x$  to get  $6xy + 3xz = 90$ . Since  $6xy = 30$ , replace  $6xy$  with 30 in the equation:  $30 + 3xz = 90$ . Subtract 30 from both sides:  $3xz = 60$ . Divide both sides by 3:  $xz = 20$ .
- 18. Answer choice (B) is the correct answer.** Distribute the  $4x$  to get  $4xy + 4x = xz + 4x$ . Subtract  $4x$  from both sides:  $4xy = xz$ . Since  $4xy = xz$  and  $4xy = 12$ , then  $xz = 12$ .

### Basic Algebra Set 2

- 1. Answer choice (B) is the correct answer.** Subtract 24 from both sides of the equation to get  $-3x = -9$ . Divide both sides by  $-3$  to get  $x = 3$ .

2. **Answer choice (B) is the correct answer.** Subtract 4 from both sides of the equation to get  $-\frac{5}{4}x = 20$ . Divide both sides by  $-\frac{5}{4}$ , which is the same as multiplying both sides by  $-\frac{4}{5}$ , to get  $x = -16$ .
3. **Answer choice (C) is the correct answer.** Add  $2x$  to both sides of the equation to get  $7x + 3 = 24$ . Subtract 3 from both sides to get  $7x = 21$ . Divide both sides by 7 to get  $x = 3$ .
4. **Answer choice (D) is the correct answer.** Subtract  $5x$  from both sides of the equation to get  $4x - 4 = 16$ . Add 4 to both sides to get  $4x = 20$ . Divide both sides by 4 to get  $x = 5$ .
5. **Answer choice (D) is the correct answer.** Multiply both sides of the equation  $x - y = 7$  by 3:  $3(x - y) = 3(7)$ . Distribute the 3 on the left side and simplify the right side:  $3x - 3y = 21$ .
6. **Answer choice (A) is the correct answer.** Divide both sides of the equation  $4x + 4y = 24$  by 4:  $\frac{4x + 4y}{4} = \frac{24}{4}$ . Simplify each side of the equation by dividing each term by 4 to get  $x + y = 6$ .
7. **Answer choice (A) is the correct answer.** Divide both sides of the equation  $8x + 4y = -10$  by 2:  $\frac{8x + 4y}{2} = \frac{-10}{2}$ . Simplify each side of the equation by dividing each term by 2 to get  $4x + 2y = -5$ .
8. **Answer choice (C) is the correct answer.** First, get the  $x$  and  $y$  terms on the same side of the equation by adding  $15y$  to both sides to get  $10x + 15y = 25$ . Divide both sides of the equation  $10x + 15y = 25$  by 5:  $\frac{10x + 15y}{5} = \frac{25}{5}$ . Simplify each side of the equation by dividing each term by 5 to get  $2x + 3y = 5$ .
9. **Answer choice (A) is the correct answer.** In order for both sides of the equation to be equal,  $a$  must equal  $-3$ . If you plug in  $-3$  for  $a$  in the equation  $-3x = ax$ , you get  $-3x = -3x$ , so both sides of the equation are equal.
10. **Answer choice (A) is the correct answer.** In order for both sides of the equation to be equal,  $t$  must equal 4. If you plug in 4 for  $t$  in the equation  $4r - 4 = tr - t$ , you get  $4r - 4 = 4r - 4$ , so both sides of the equation are equal.
11. **Answer choice (D) is the correct answer.** Divide both sides of the equation by  $x$  to get  $-25 = m^2$ . To solve for  $m$ , take the square root of both sides to get  $m = \pm \sqrt{-25}$ . The square root of  $-25$  is not a real number, so answer choices (A), (B), and (C) are incorrect.

- 12. Answer choice (B) is the correct answer.** Add 10 to both sides of the equation to get  $p + 10 = q - 2 + 10$ . Combine  $-2$  and  $10$  to get  $p + 10 = q + 8$ .
- 13. Answer choice (A) is the correct answer.** Add 3 to both sides of the equation to get  $a + 3 = -2(4 - b) + 3$ . Simplify the right side of the equation by first distributing to get  $a + 3 = -8 + 2b + 3$ . Simplify the right side of the equation by combining  $-8$  and  $3$  to get  $a + 3 = 2b - 5$ .
- 14. Answer choice (D) is the correct answer.** Multiply both sides of the equation by  $-2$  to get  $-2x = -2(8 - 6y)$ . Distribute the  $-2$  on the right side of the equation to get  $-2x = -16 + 12y$ . Rearrange the right side of the equation to get  $-2x = 12y - 16$ .
- 15. Answer choice (A) is the correct answer.** First square both sides of the equation to get  $x^2 = 25y^2$ . Then multiply both sides of the equation by  $-1$  to get  $-x^2 = -25y^2$ .
- 16. Answer choice (B) is the correct answer.** Distribute the  $a$  to get  $ab + ac = 250$ . Since  $ac = 130$ , we can replace  $ac$  with  $130$  in the equation:  $ab + 130 = 250$ . Subtract  $130$  from both sides to get  $ab = 120$ .
- 17. Answer choice (C) is the correct answer.** Distribute the  $2x$  to get  $2xy - 2xz = 140$ . Since  $2xy = 100$ , we can replace  $2xy$  with  $100$  in the equation:  $100 - 2xz = 140$ . Subtract  $100$  from both sides to get  $-2xz = 40$ . Get rid of the negative sign by dividing both sides by  $-1$  to get  $2xz = -40$ .
- 18. Answer choice (C) is the correct answer.** Distribute the  $3x$  to get  $3xy + 6x = -xz + 6x$ . Subtract  $6x$  from both sides to get  $3xy = -xz$ . Since  $3xy = 6$ , we can replace  $3xy$  with  $6$  in the equation:  $6 = -xz$ . Get rid of the negative sign by dividing both sides by  $-1$  to get  $xz = -6$ .
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### Isolating Variables Set 1

- 1. Answer choice (B) is the correct answer.** Isolate  $m$  by subtraction  $n$  from both sides of the equation:  $m = 18 - n$ .
- 2. Answer choice (D) is the correct answer.** Isolate  $b$  by first subtracting  $a$  from both sides of the equation:  $-b = 3 - a$ . Get rid of the negative sign in front of the  $b$  by dividing each term by  $-1$  (this will change the sign of each term):  $b = -3 + a$ . Rearrange the terms on the right side to get  $b = a - 3$ .
- 3. Answer choice (C) is the correct answer.** Isolate  $x$  by first adding  $y$  to both sides:  $5x = 5 + y$ . Divide both sides by  $5$ :  $x = \frac{5 + y}{5}$ .
- 4. Answer choice (A) is the correct answer.** To isolate  $w$ , divide both sides of the equation by  $lh$ :

$$w = \frac{V}{lh}.$$

5. **Answer choice (B) is the correct answer.** To isolate  $w$ , first subtract  $2l$  from both sides of the equation:  $P - 2l = 2w$ . Divide both sides by 2 by dividing each term by 2:  $\frac{P}{2} - l = w$ .
6. **Answer choice (A) is the correct answer.** To isolate  $b$ , first subtract  $6a$  from both sides of the equation:  $-2b = 12 - 6a$ . Divide both sides by  $-2$  by dividing each term by  $-2$ :  $b = -6 + 3a$ . Rearrange the right side of the equation:  $b = 3a - 6$ .
7. **Answer choice (D) is the correct answer.** To isolate  $b$ , first divide both sides of the equation by one-third which is the same as multiplying both sides by 3:  $3V = bh$ . Next, divide both sides by  $h$ :  $\frac{3V}{h} = b$ .
8. **Answer choice (D) is the correct answer.** To isolate  $r$ , first divide both sides of the equation by  $\pi$ :  $\frac{A}{\pi} = r^2$ . Next, take the square root of both sides:  $\pm \sqrt{\frac{A}{\pi}} = r$ .
9. **Answer choice (C) is the correct answer.** To isolate  $x$ , first multiply both sides of the equation by  $6y$ :  $6zy = x^2$ . Next, take the square root of both sides:  $\pm \sqrt{6zy} = x$ .
10. **Answer choice (C) is the correct answer.** To isolate  $b$ , first divide both sides of the equation by five-halves which is the same as multiplying both sides by two-fifths:  $\frac{2}{5}a = 4 - b$ . Next, subtract 4 from both sides:  $\frac{2}{5}a - 4 = -b$ . Get rid of the negative by dividing both sides by  $-1$  (this flips the sign of each term):  $-\frac{2}{5}a + 4 = b$ . Rearrange the terms on the left side of the equation:  $4 - \frac{2}{5}a = b$ .

### Isolating Variables Set 2

1. **Answer choice (D) is the correct answer.** Isolate  $a$  by subtracting  $b$  from both sides of the equation to get  $a = 2 - b$ .
2. **Answer choice (A) is the correct answer.** Isolate  $y$  by first subtracting  $x$  from both sides of the equation to get  $-y = -x$ . Get rid of the negative sign in front of the  $y$  by dividing both sides by  $-1$  to get  $y = x$ .

3. **Answer choice (A) is the correct answer.** Isolate  $m$  by first adding  $n$  to both sides of the equation to get  $8m = 80 + n$ . Divide both sides by 8:  $m = \frac{80 + n}{8}$ .
4. **Answer choice (C) is the correct answer.** To isolate  $h$ , divide both sides of the equation by  $2\pi r$  to get  $h = \frac{V}{2\pi r}$ .
5. **Answer choice (B) is the correct answer.** To isolate  $R$ , divide both sides of the equation by  $I$  to get  $R = \frac{E}{I}$ .
6. **Answer choice (D) is the correct answer.** To isolate  $y$ , first subtract  $5x$  from both sides of the equation to get  $-5y = 15 - 5x$ . Divide both sides by  $-5$  by dividing each term by  $-5$  to get  $y = -3 + x$ . Rearrange the terms on the right side to get  $y = x - 3$ .
7. **Answer choice (B) is the correct answer.** Divide both sides of the equation by  $4\pi$ :  $r^2 = \frac{A}{4\pi}$ . Take the square root of both sides:  $r = \pm \sqrt{\frac{A}{4\pi}}$ . Take out the 4 by finding the square root:  $r = \pm \frac{1}{2} \sqrt{\frac{A}{\pi}}$ .
8. **Answer choice (A) is the correct answer.** Isolate  $t$  by first multiplying both sides of the equation by  $p^2$ :  $Ap^2 = 1 + t$ . Subtract 1 from both sides:  $t = Ap^2 - 1$ .
9. **Answer choice (C) is the correct answer.** Isolate  $s$  by first multiplying both sides of the equation by 3:  $3V = s^2h$ . Divide both sides by  $h$ :  $s^2 = \frac{3V}{h}$ . Take the square root of both sides:  $s = \pm \sqrt{\frac{3V}{h}}$ .
10. **Answer choice (B) is the correct answer.** Isolate  $y$  by first multiplying both sides of the equation by 3:  $3x = y + 2$ . Subtract 2 from both sides:  $3x - 2 = y$ .
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### Writing Equations and Expressions Set 1

1. **Answer choice (C) is the correct answer.** Since Vishak has 6 dollars less than Hasti, Hasti has 6 *more* dollars than Vishak, so we need to *add* 6 dollars to the amount of money Vishak has,  $x$ . Therefore, Hasti has  $6 + x$  dollars.

2. **Answer choice (B) is the correct answer.** Since Chris is 17 years *younger* than Nancy, we need to *subtract* 17 years from Nancy’s age,  $n$ . Therefore, Chris’s age now is  $n - 17$ . To find Chris’s age three years *ago*, *subtract* three from his age now:  $n - 17 - 3 = n - 20$
3. **Answer choice (A) is the correct answer.** First, we write *six times a number* by *multiplying 6 by a number  $x$* :  $6x$ . We want *eight less* than that, so we need to *subtract 8* from  $6x$  to get  $6x - 8$ .
4. **Answer choice (A) is the correct answer.** First, we write *twice a number* by *multiplying 2 by a number  $n$* :  $2n$ . Next, we want *4 more* than that, so we *add 4* to  $2n$ :  $2n + 4$ . Finally, we know that this expression *is 16* which means this expression *equals 16*:  $2n + 4 = 16$ .
5. **Answer choice (D) is the correct answer.** Set up an equation to represent, “the product of one fourth and a number is equal to half of the number decreased by four”:  $\frac{1}{4}x = \frac{1}{2}x - 4$ . Solve the equation:  $-\frac{1}{4}x = -4 \rightarrow x = 16$ .
6. **Answer choice (A) is the correct answer.** Set up an equation to represent, “the product of a number and  $-2$  is equal to the cube of 2 increased by 6”:  $-2x = 2^3 + 6$ . Solve the equation:  $-2x = 8 + 6 \rightarrow -2x = 14 \rightarrow x = -7$ .
7. **Answer choice (C) is the correct answer.** A quarter is worth 25 cents which equals 0.25 dollars. To find the value of  $q$  quarters, multiply the value of one quarter, 0.25, by the number of quarters,  $q$ , to get  $0.25q$ .
8. **Answer choice (B) is the correct answer.** A dime is worth 10 cents which equals 0.1 dollars. To find the value of  $d - 5$  dimes, multiply the value of one dime, 0.1, by the number of dimes,  $d - 5$  to get  $0.1(d - 5)$ . Distribute the 0.1 to get  $0.1d - 0.5$ .
9. **Answer choice (C) is the correct answer.** A nickel is worth 5 cents which equals 0.05 dollars. A penny is worth 1 cent which equals 0.01 dollars. To find the value of  $n$  nickels and  $p + 8$  pennies, multiply the value of one nickel times the number of nickels, multiply the value of one penny times the number of pennies, and add the two expressions together to get  $0.05n + 0.01(p + 8)$ . Distribute the 0.01 to get  $0.05n + 0.01p + 0.08$ .
10. **Answer choice (C) is the correct answer.** Let  $x$  represent the number of quarters that Mo has. Since Mo has *6 more* dimes than quarters, he has  $x + 6$  dimes. Therefore, the value of his quarters and dimes equals  $0.25x + 0.1(x + 6)$ . The problem says that Mo’s quarters and dimes equal \$3.75, so set the expression equal to 3.75 to get  $0.25x + 0.1(x + 6) = 3.75$
11. **Answer choice (B) is the correct answer.** Set up an equation using  $x$  as the number of dimes. Since Tara has *twice as many* nickels as dimes, she has  $2x$  nickels. Therefore, the total value of her dimes and nickels equals  $0.1x + 0.05(2x)$ . We know that the total value should equal \$4.00, so set

the expression equal to 4 to get  $0.1x + 0.05(2x) = 4$ . Solve the equation:  $0.1x + 0.1x = 4 \rightarrow 0.2x = 4 \rightarrow x = 20$ . Since  $x$  represents the number of dimes, Tara has 20 dimes.

- 12. Answer choice (C) is the correct answer.** First, write an expression for Arianna's present age. Since Arianna is 8 years younger than Isaac, subtract 8 from Isaac's age to get Arianna's age: Arianna's age =  $x - 8$ . Write expressions for Isaac's and Arianna's ages in 5 years by adding 5 to each of their ages: Isaac's age in five years equals  $x + 5$  and Arianna's age in five years equals  $x - 8 + 5$  which equals  $x - 3$ . Combine their future ages together:  $x + 5 + x - 3 = 2x + 2$ .
- 13. Answer choice (A) is the correct answer.** Let  $x$  represent the number of quarters that Kenny has. Since Kenny has twice as many pennies as quarters, he has  $2x$  pennies. Therefore, the value of Kenny's pennies and quarters equals  $0.01(2x) + 0.25x$ . We know that the total value should equal \$5.40, so set the expression equal to 5.40 to get  $0.01(2x) + 0.25x = 5.40$ .
- 14. Answer choice (B) is the correct answer.** Set up an equation using  $x$  as the number of quarters. Since Sheila has three times as many nickels as quarters, she has  $3x$  nickels. Therefore, the total value of her quarters and nickels equals  $0.25x + 0.05(3x)$ . We know that the total value should equal \$2.00, so set the expression equal to 2 to get  $0.25x + 0.05(3x) = 2$ . Solve the equation:  $0.25x + 0.15x = 2 \rightarrow 0.4x = 2 \rightarrow x = 5$ . Since  $(0.05)3x$  represents the value of the nickels, plug in 5 for  $x$  into  $0.05(3x)$  to find the value of the nickels:  $0.05(3 \cdot 5) = \$0.75$ .
- 15. Answer choice (B) is the correct answer.** Since Candi washed 8 more windows than Jeff, Jeff washed 8 fewer windows than Candi. Write an expression for the number of windows Jeff washed by subtracting 8 from the number of windows Candi washed,  $c$ : Jeff washed  $c - 8$  windows. Together they washed 28 windows, so add the number of windows they each washed together and set that equal to 28:  $c + c - 8 = 28$ . Combine like terms:  $2c - 8 = 28$ .
- 16. Answer choice (A) is the correct answer.** Sarah ate twice as many cookies as Shawn, so write an expression for the number of cookies Sarah ate by multiplying the number of cookies Shawn ate,  $s$ , by two: Sarah ate  $2s$  cookies. Together they ate 30 cookies, so add the number of cookies they each ate together and set that equal to 30:  $s + 2s = 30$ . Combine like terms:  $3s = 30$ .
- 17. Answer choice (C) is the correct answer.** Write an expression for the width in terms of the length,  $l$ . Since the width is "four more than half of the length," add four to half of the length to get that the width equals  $0.5l + 4$ . Find the perimeter by adding two widths plus two lengths:  $l + l + 0.5l + 4 + 0.5l + 4$ . Combine like terms to get that the perimeter equals  $3l + 8$ .
- 18. Answer choice (B) is the correct answer.** Plan A costs \$20 a month plus \$0.30 per text message. Set up an expression for the cost of Plan A using  $x$  as the number of text messages:  $20 + 0.3x$ . Plan B costs \$50 per month, so the expression for the cost of Plan B is just 50. We want to know when the plans will cost the same amount, so set the expression for Plan A and Plan B equal to each other and solve for  $x$ :  $20 + 0.3x = 50 \rightarrow 0.3x = 30 \rightarrow x = 100$  text messages.

- 19. Answer choice (B) is the correct answer.** Let  $x$  equal the number of apples in the bowl. If there are half as many apples as oranges, this means there are twice as many oranges as apples. Therefore, there are  $2x$  oranges in the bowl. Add the number of apples and oranges and set it equal to 30 total pieces of fruit:  $x + 2x = 30$ . Solve the equation:  $3x = 30 \rightarrow x = 10$ . Therefore, there are 10 apples and 20 oranges. To make the number of apples and oranges in the bowl the same, we will need to remove 10 oranges.
- 20. Answer choice (A) is the correct answer.** Since the number of dogs with 3 spots and the number of dogs with 5 spots is the same, let  $x$  equal the number of dogs with 3 spots and the number of dogs with 5 spots. Write an equation that says, “the total number of spots equals 32,” and solve:  $3x + 5x = 32 \rightarrow 8x = 32 \rightarrow x = 4$ . Therefore, there are four dogs with 5 spots.

### Writing Equations and Expressions Set 2

- 1. Answer choice (A) is the correct answer.** Since the Tigers have half as many players as the Sharks have, the Sharks have *twice* as many players as the Tigers have, so to find the number of players initially on the Sharks, multiply the number of players on the Tigers by 2 to get  $2p$ . Three new players join the Sharks, so we *add* three to the initial number of players to get  $2p + 3$ .
- 2. Answer choice (D) is the correct answer.** Since Seth is 3 years older than Marisa, Marisa is 3 years *younger* than Seth. Therefore, to find Marisa’s age, *subtract* 3 from Seth’s age to get  $s - 3$ .
- 3. Answer choice (B) is the correct answer.** First, write *six times a number* by *multiplying 6 by a number*  $x$ :  $6x$ . We want *10 less than* that, so subtract 10 from  $6x$ :  $6x - 10$ .
- 4. Answer choice (C) is the correct answer.** First, write *the sum of a number and 1* by adding 1 and a number  $n$ :  $n + 1$ . We want *four times the sum* so multiply the sum by 4:  $4(n + 1)$ . Finally, this is 24, so set it *equal* to 24:  $4(n + 1) = 24$ .
- 5. Answer choice (D) is the correct answer.** Set up an equation to represent, “the product of two thirds and a number is equal to the number decreased by twenty four”:  $\frac{2}{3}x = x - 24$ . Solve the equation:  $-\frac{1}{3}x = -24 \rightarrow x = 72$ .
- 6. Answer choice (D) is the correct answer.** Set up an equation to represent “the product of a number and 3 increased by 6 equals the cube of 3”:  $3x + 6 = 3^3$ . Solve the equation:  $3x + 6 = 27 \rightarrow 3x = 21 \rightarrow x = 7$ .

7. **Answer choice (C) is the correct answer.** A nickel is worth 5 cents which equals 0.05 dollars. To find the value of  $n$  nickels, multiply the value of one nickel, 0.05, by the number of nickels,  $n$ , to get  $0.05n$ .
8. **Answer choice (B) is the correct answer.** A quarter is worth 25 cents which equals 0.25 dollars. To find the value of  $q + 4$  quarters, multiply the value of one quarter, 0.25, by the number of quarters,  $q + 4$  to get  $0.25(q + 4)$ . Distribute the 0.25 to get  $0.25q + 1$ .
9. **Answer choice (A) is the correct answer.** A dime is worth 10 cents which equals 0.1 dollars. A nickel is worth 5 cents which equals 0.05 dollars. To find the value of  $2d$  dimes, and  $n - 4$  nickels, multiply the value of one dime by the number of dimes, multiply the value of one nickel by the number of nickels, and add the two expressions to get  $0.1(2d) + 0.05(n - 4)$ . Simplify the expression to get  $0.2d + 0.05n - 0.2$ .
10. **Answer choice (A) is the correct answer.** Set up an equation using  $x$  as the number of dimes. Since Tara has *three times as many* quarters as dimes, she has  $3x$  quarters. Therefore, the total value of her dimes and quarters equals  $0.1x + 0.25(3x)$ . We know that the total value should equal \$3.40, so set the expression equal to 3.40 to get  $0.1x + 0.25(3x) = 3.40$ .
11. **Answer choice (D) is the correct answer.** Set up an equation using  $x$  as the number of nickels. Since Saahil has *8 fewer* dimes than nickels, he has  $x - 8$  dimes. Therefore, the total value of his dimes and nickels equals  $0.05x + 0.1(x - 8)$ . We know Saahil has \$2.20, so set the expression equal to 2.20 to get  $0.05x + 0.1(x - 8) = 2.20$ .
12. **Answer choice (D) is the correct answer.** Since Wesley has half as many dimes as nickels, he has twice as many nickels as dimes. Set up an equation using  $x$  as the number of dimes. Since he has *twice as many* nickels as dimes, he has  $2x$  nickels. Therefore, the total value of his dimes and nickels equals  $0.1x + 0.05(2x)$ . We know this equals \$4.40, so set the expression equal to 4.40 and solve for  $x$ :  $0.1x + 0.05(2x) = 4.40 \rightarrow 0.1x + 0.1x = 4.40 \rightarrow 0.2x = 4.40 \rightarrow x = 22$ . Therefore, Wesley has 22 dimes and 44 nickels, so he has 66 total coins.
13. **Answer choice (B) is the correct answer.** Set up an equation using  $x$  as the number of quarters. Since Courtney has *four times as many* nickels as quarters, she has  $4x$  nickels. Therefore, the total value of her coins equals  $0.25x + 0.05(4x)$ . We know she has \$3.15, so set the expression equal to 3.15 and solve:  $0.25x + 0.05(4x) = 3.15 \rightarrow 0.25x + 0.2x = 3.15 \rightarrow 0.45x = 3.15 \rightarrow x = 7$ . Therefore, Courtney has 7 quarters. The value of her quarters =  $7(0.25) = \$1.75$ .
14. **Answer choice (A) is the correct answer.** First, write an expression for Aaliyah's present age. Since Aaliyah is *3 years older* than Janae, *add* 3 to Janae's age to get Aaliyah's age:  $j + 3$ . Write an expression for Janae's and Aaliyah's ages 3 years ago by subtracting 3 from each of their ages: Janae's age three years ago equals  $j - 3$  and Aaliyah's age 3 years ago equals  $j + 3 - 3$  which equals  $j$ . Combine their ages three years ago:  $j - 3 + j = 2j - 3$ .

- 15. Answer choice (C) is the correct answer.** Since Chloe won 10 *more* dollars than Gavin, add 10 to the amount Gavin won to get that Chloe won  $g + 10$  dollars. Therefore, the total amount they won equals  $g + g + 10$  which equals  $2g + 10$ . The problem said they won a total of \$90, so set the expression equal to 90 to get  $2g + 10 = 90$ .
- 16. Answer choice (B) is the correct answer.** Since Avery received *half as many* text messages as Shriya, multiply the number of text messages Shriya received by one-half to get that Avery received  $\frac{1}{2}s$  text messages. Combine the number of text messages they received:  $s + \frac{1}{2}s = \frac{3}{2}s$ . Since they received a total of 75 messages, set the expression equal to 75:  $\frac{3}{2}s = 75$ .
- 17. Answer choice (D) is the correct answer.** Since the width is 10 less than twice the length, we can write the width as  $2l - 10$ . Add the sides to find the perimeter:  $l + l + 2l - 10 + 2l - 10$ . Combine like terms to get that the perimeter equals  $6l - 20$ .
- 18. Answer choice (B) is the correct answer.** Let  $w$  equal the width. Since the length is five more inches than the width, the length is  $w + 5$ . Set up an equation for the perimeter which equals 78:  $w + w + w + 5 + w + 5 = 78$ . Combine like terms and solve:  $4w + 10 = 78 \rightarrow 4w = 68 \rightarrow w = 17$  inches. Find the length by adding 5 to the width:  $17 + 5 = 22$  inches.
- 19. Answer choice (C) is the correct answer.** First, set up an equation to find the original number of boys and girls in the class. Let  $b$  equal the number of boys. Since there are three times as many girls, there are  $3b$  girls. There are a total of 40 students, so  $b + 3b = 40$ . Solve the equation for  $b$ :  $4b = 40 \rightarrow b = 10$ . So originally, there were 10 boys and 30 girls. Therefore, 20 girls need to leave the class in order for the number of boys and girls to be equal.
- 20. Answer choice (C) is the correct answer.** Since the number of bicycles and cars is the same, let  $x$  equal the number of bicycles and the number of cars. Cars have 4 wheels and bicycles have 2 wheels. Write an equation that says, “the total number of wheels equals 48,” and solve:  $4x + 2x = 48 \rightarrow 6x = 48 \rightarrow x = 8$ . Therefore, there are 8 bicycles in the lot.
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### Inequalities Set 1

- 1. Answer choice (D) is the correct answer.** Divide each side of the inequality by 4 to get  $x < 5$ .
- 2. Answer choice (B) is the correct answer.** Divide both sides of the inequality by  $-7$  to get  $x > -3$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*.

3. **Answer choice (D) is the correct answer.** Subtract 5 from both sides of the inequality to get  $-x > -2$ . Divide both sides of the inequality by  $-1$  to get  $x < 2$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*.
4. **Answer choice (A) is the correct answer.** Add 6 to both sides of the inequality to get:  $2x \leq -2$ . Divide both sides of the inequality by 2 to get  $x \leq -1$ .
5. **Answer choice (A) is the correct answer.** Add  $5x$  to both sides of the inequality to get  $7 \geq 8x - 25$ . Add 25 to both sides of the inequality to get  $32 \geq 8x$ . Divide both sides of the inequality by 8 to get  $x \leq 4$ .
6. **Answer choice (B) is the correct answer.** Subtract 3 from all three parts of the inequality to get  $6 < 3x < 3$ . Divide each part of the inequality by 3 to get  $2 < x < 1$ .
7. **Answer choice (A) is the correct answer.** Solve the inequality by adding 8 to all 3 parts of the inequality to get  $0 \leq 4x \leq 4$ . Divide each part of the inequality by 4 to get  $0 \leq x \leq 1$ . To graph this inequality, we want two *solid circles* at 0 and 1 because we have a *less than or equal to* and a *greater than or equal to sign*. Since  $x$  is in *between 0 and 1*, we want the line to be in *between 0 and 1*. Therefore, answer choice (A) is the correct answer.
8. **Answer choice (B) is the correct answer.** Solve the inequality by subtracting 7 from both sides of the inequality to get  $10x < -30$ . Divide both sides by 10 to get  $x < -3$ . To graph this inequality, we want an *open circle* at  $-3$  because we have a *less than* sign. Since  $x$  is *less than*  $-3$ , we want a line to the *left* of  $-3$ . Therefore, answer choice (B) is the correct answer.
9. **Answer choice (C) is the correct answer.** Since  $y = 4x$  and  $-2 < x < 3$ , the smallest value of  $y$  is when  $x$  is its smallest. Therefore, the smallest value of  $y$  equals  $4(-2)$  which equals  $-8$ . The largest value of  $y$  is when  $x$  is its largest. Therefore, the largest value of  $y$  equals  $4(3)$  which equals 12. Therefore,  $y$  is in between  $-8$  and 12.
10. **Answer choice (B) is the correct answer.** Since  $y = -x + 5$  and  $-4 \leq x < 5$ , the smallest value of  $y$  is when  $x$  is at its largest because of the negative sign in front of the  $x$ . Therefore, the smallest value of  $y$  equals  $-5 + 5$  which equals 0. Since  $x$  cannot equal 5,  $y$  cannot equal 0, so  $y > 0$ . The largest value of  $y$  is when  $x$  is at its smallest. Therefore, the largest value of  $y$  equals  $-(-4) + 5$  which equals 9. Since  $x$  can equal  $-4$ ,  $y$  can equal 9. So  $y \leq 9$ . Put the two inequalities together to get  $0 < y \leq 9$ .
11. **Answer choice (B) is the correct answer.** Since  $y = x^2$ ,  $y$  will be positive for every  $x$  value except 0. If  $x = 0$ ,  $y = 0^2$  which equals 0. Therefore, 0 is the minimum value of  $y$ .

- 12. Answer choice (C) is the correct answer.** Since  $b = 2a^2 - a$ ,  $b$  will be greater if  $a = -8$  than if  $a = 8$  because we subtract  $a$  from  $2a^2$ , and when we subtract a negative, it turns to a positive. If  $a$  equals  $-8$ ,  $b$  equals  $2(-8)^2 - (-8)$  which equals  $2(64) + 8$  which equals  $128 + 8$  which equals  $136$ .

### Inequalities Set 2

- 1. Answer choice (C) is the correct answer.** Divide both sides of the inequality by 3 to get  $x \geq -6$ .
- 2. Answer choice (D) is the correct answer.** Divide both sides of the inequality by  $-9$  to get  $x > 4$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*.
- 3. Answer choice (B) is the correct answer.** Subtract 2 from both sides of the inequality to get  $x < -10$ .
- 4. Answer choice (A) is the correct answer.** Subtract 9 from both sides of the inequality to get  $-4x > -16$ . Divide both sides by  $-4$  to get  $x < 4$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*.
- 5. Answer choice (B) is the correct answer.** Subtract  $4x$  from both sides of the inequality to get  $4 \geq 4x - 8$ . Add 8 to both sides to get  $12 \geq 4x$ . Divide both sides by 4 to get  $x \leq 3$ .
- 6. Answer choice (A) is the correct answer.** Subtract 5 from all three parts of the inequality to get  $0 < -2x < 10$ . Divide all three parts of the inequality by  $-2$  to get  $0 > x > -5$  which can be written as  $-5 < x < 0$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*.
- 7. Answer choice (A) is the correct answer.** Divide both sides of the inequality by  $-4$  to get  $x > 6$ . REMEMBER: when multiplying or dividing both sides of an inequality by a *negative number*, you need to *flip the inequality sign*. To graph this inequality, we want an *open circle* at 6 because we have a *greater than* sign. Since  $x$  is *greater than* 6, we want the line to be to the *right of* 6. Therefore, answer choice (A) is the correct graph.
- 8. Answer choice (A) is the correct answer.** Solve the inequality by first adding  $5x$  to both sides to get  $x - 2 \geq 5$ . Add 2 to both sides to get  $x \geq 7$ . To graph this inequality, we want a *solid circle* at 7 because we have a *greater than or equal to* sign. Since  $x$  is *greater than or equal to* 7, we want the line to be to the *right of* 7. Therefore, answer choice (A) is the correct graph.
- 9. Answer choice (D) is the correct answer.** Since  $y = x^2$  and  $-2 < x < 6$ , the smallest value of  $y$  is when  $x$  equals 0 ( $x^2$  is positive for all values of  $x$  except 0). Therefore, the smallest value of  $y$

equals  $0^2$  which equals 0. The largest value of  $y$  is when  $x$  equals 6. Therefore, the largest value of  $y$  equals  $6^2$  which equals 36. Therefore,  $y$  is in between 0 and 36:  $0 \leq y < 36$

- 10. Answer choice (B) is the correct answer.** Since  $y = 3x - 2$  and  $-1 < x < 4$ , the smallest value of  $y$  is when  $x$  is at its smallest value. Therefore, the smallest value of  $y$  equals  $3(-1) - 2 = -5$ . The largest value of  $y$  is when  $x$  is at its largest value. Therefore, the largest value of  $y$  equals  $3(4) - 2 = 10$ . Therefore,  $y$  is in between  $-5$  and  $10$ :  $-5 < y < 10$
- 11. Answer choice (C) is the correct answer.** Since  $y = |x|$ ,  $y$  will be positive for every  $x$  value *except* 0. Therefore, the smallest value of  $y$  is when  $x = 0$ . Therefore, the minimum value of  $y$  equals  $|0|$  which equals 0.
- 12. Answer choice (D) is the correct answer.** Since  $y = \frac{1}{x} + 4$ , as  $x$  gets bigger  $y$  gets smaller, and as  $x$  gets smaller,  $y$  gets bigger (because we are dividing by  $x$ ). Therefore, the maximum value of  $y$  is when  $x$  is at its smallest, so the maximum value of  $y$  is when  $x = \frac{1}{4}$ :  $y = \frac{1}{(\frac{1}{4})} + 4 \rightarrow y = 4 + 4 \rightarrow y = 8$
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### Absolute Value Set 1

- 1. Answer choice (C) is the correct answer.** Since the absolute value of any number except 0 is positive,  $|5|$  equals 5 and  $|-5|$  also equals 5.
- 2. Answer choice (D) is the correct answer.** The absolute value of a number can never be negative. Therefore, there is no solution.
- 3. Answer choice (C) is the correct answer.** Divide both sides of the equation by 2 to get  $|x| = 4$ . Since the absolute value of any number except 0 is positive,  $|4|$  equals 4 and  $|-4|$  also equals 4.
- 4. Answer choice (B) is the correct answer.** If  $|x + 5| = 0$ , then  $x + 5$  must equal 0. Set  $x + 5$  equal to 0 and solve:  $x + 5 = 0 \rightarrow x = -5$ .
- 5. Answer choice (B) is the correct answer.** Since  $|x - 4| = 4$ ,  $x - 4$  can equal 4 or  $-4$ . If  $x - 4 = 4$ , then  $x = 8$ . If  $x - 4 = -4$ , then  $x = 0$ .
- 6. Answer choice (B) is the correct answer.** Since  $|2x + 1| = 7$ ,  $2x + 1$  can equal 7 or  $-7$ . If  $2x + 1 = 7$ , then  $2x = 6$ , and  $x = 3$ . If  $2x + 1 = -7$ , then  $2x = -8$ , and  $x = -4$ .
- 7. Answer choice (A) is the correct answer.** Divide both sides of the equation by 4 to get  $|1 - x| = 4$ . This means  $1 - x$  can equal 4 or  $-4$ . If  $1 - x = 4$ , then  $x = -3$ . If  $1 - x = -4$ , then  $x = 5$ .

8. **Answer choice (A) is the correct answer.** Divide both sides of the equation by  $-2$  to get  $|3 - x| = 7$ . This means  $3 - x$  can equal  $7$  or  $-7$ . If  $3 - x = 7$ , then  $x = -4$ . If  $3 - x = -7$ , then  $x = 10$ .
9. **Answer choice (B) is the correct answer.** Subtract  $3$  from both sides to get  $-2|x + 1| = -10$ . Divide both sides by  $-2$  to get  $|x + 1| = 5$ . This means  $x + 1$  can equal  $5$  or  $-5$ . If  $x + 1 = 5$ , then  $x = 4$ . If  $x + 1 = -5$ , then  $x = -6$ .
10. **Answer choice (D) is the correct answer.** Subtract  $3$  from both sides to get  $|x + 1| = -1$ . The absolute value of a number can never be negative. Therefore, there is no solution.

### Absolute Value Set 2

1. **Answer choice (D) is the correct answer.** The absolute value of a number can never be negative. Therefore, there is no solution.
2. **Answer choice (D) is the correct answer.** Since the absolute value of any number except  $0$  is positive,  $|17|$  equals  $17$  and  $|-17|$  also equals  $17$ .
3. **Answer choice (B) is the correct answer.** Divide both sides of the equation by  $-3$  to get  $|x| = 3$ . Since the absolute value of any number except  $0$  is positive,  $|3|$  equals  $3$  and  $|-3|$  also equals  $3$ .
4. **Answer choice (C) is the correct answer.** If  $|x + 3| = 0$ , then  $x + 3$  must equal  $0$ . Set  $x + 3$  equal to  $0$  and solve:  $x + 3 = 0 \rightarrow x = -3$ .
5. **Answer choice (D) is the correct answer.** If  $|x - 8| = 1$ , then  $x - 8 = 1$  or  $-1$ . If  $x - 8 = 1$ , then  $x = 9$ . If  $x - 8 = -1$ , then  $x = 7$ .
6. **Answer choice (C) is the correct answer.** Isolate the absolute value by dividing both sides by  $3$  to get  $|4 - x| = 7$ . Since  $|4 - x| = 7$ ,  $4 - x$  can equal  $7$  or  $-7$ . If  $4 - x = 7$ , then  $x = -3$ . If  $4 - x = -7$ , then  $x = 11$ .
7. **Answer choice (A) is the correct answer.** If  $|3x - 3| = 12$ , then  $3x - 3$  can equal  $12$  or  $-12$ . If  $3x - 3 = 12$ , then  $3x = 15$  and  $x = 5$ . If  $3x - 3 = -12$ , then  $3x = -9$  and  $x = -3$ .
8. **Answer choice (C) is the correct answer.** Isolate the absolute value by dividing both sides by  $-3$  to get  $|5 - x| = 7$ . If  $|5 - x| = 7$ , then  $5 - x$  can equal  $7$  or  $-7$ . If  $5 - x = 7$ , then  $x = -2$ . If  $5 - x = -7$ , then  $x = 12$ .
9. **Answer choice (B) is the correct answer.** Isolate the absolute value by subtracting  $4$  from both sides to get  $3|x - 2| = 24$ . Then divide both sides by  $3$  to get  $|x - 2| = 8$ . If  $|x - 2| = 8$ , then  $x - 2$  can equal  $8$  or  $-8$ . If  $x - 2 = 8$ ,  $x = 10$ . If  $x - 2 = -8$ ,  $x = -6$ .

- 10. Answer choice (D) is the correct answer.** Isolate the absolute value by adding 4 to both sides to get  $2|x + 7| = -6$ . Divide both sides by 2 to get  $|x + 7| = -3$ . Since the absolute value of any number can never be negative, there is no solution.
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### Absolute Value Inequalities Set 1

- 1. Answer choice (C) is the correct answer.** If  $x > 8$ , then the absolute value of  $x$  is also greater than 8. If  $x < -8$ , then the absolute value of  $x$  is also greater than 8 because absolute value turns everything positive except 0.
- 2. Answer choice (D) is the correct answer.** The absolute value of any number is always greater than or equal to 0. Therefore, the absolute value of any number will *always* be greater than  $-3$ , so  $x$  can equal all real numbers.
- 3. Answer choice (D) is the correct answer.** The absolute value of any number is always greater than or equal to 0. Therefore, the absolute value of any number will *never* be less than or equal to  $-6$ , so there is no solution.
- 4. Answer choice (A) is the correct answer.** Since  $|3 - x| > 4$ , then  $3 - x$  can be greater than 4 or less than  $-4$ . Solve  $3 - x > 4$  to get  $x < -1$ . Solve  $3 - x < -4$  to get  $x > 7$ . Answer choice (A) is the only number that is either less than  $-1$  or greater than 7.
- 5. Answer choice (D) is the correct answer.** Since  $|3x + 3| \leq 6$ , then  $3x + 3$  can be less than or equal to 6 or greater than or equal to  $-6$ . Solve  $3x + 3 \leq 6$  to get  $x \leq 1$ . Solve  $3x + 3 \geq -6$  to get  $x \geq -3$ . Therefore, the solution to the inequality is  $-3 \leq x \leq 1$ . Answer choice (D) is NOT within the solution set.
- 6. Answer choice (A) is the correct answer.** Since  $|-4x| \geq 16$ , then  $-4x$  can be greater than or equal to 16 or less than or equal to  $-16$ . Solve  $-4x \geq 16$  to get  $x \leq -4$ . Solve  $-4x \leq -16$  to get  $x \geq 4$ . Therefore,  $x \leq -4$  or  $x \geq 4$ .
- 7. Answer choice (B) is the correct answer.** Since  $|-2x + 8| > 2$ , then  $-2x + 8$  can be greater than 2 or less than  $-2$ . Solve  $-2x + 8 > 2$  to get  $x < 3$ . Solve  $-2x + 8 < -2$  to get  $x > 5$ . Therefore,  $x < 3$  or  $x > 5$ .
- 8. Answer choice (B) is the correct answer.** Get the absolute value by itself by first subtracting 3 from both sides to get  $-2|x + 1| < -18$ . Then divide both sides by  $-2$  to get  $|x + 1| > 9$ . Since  $|x + 1| > 9$ , then  $x + 1$  can be greater than 9 or less than  $-9$ . Solve  $x + 1 > 9$  to get  $x > 8$ . Solve  $x + 1 < -9$  to get  $x < -10$ . Therefore,  $x < -10$  or  $x > 8$ .

- 9. Answer choice (A) is the correct answer.** Get the absolute value by itself by first adding 12 to both sides to get  $3|2x - 2| \geq 12$ . Then divide both sides by 3 to get  $|2x - 2| \geq 4$ . Since  $|2x - 2| \geq 4$ , then  $2x - 2$  can be greater than or equal to 4 or less than or equal to  $-4$ . Solve  $2x - 2 \geq 4$  to get  $x \geq 3$ . Solve  $2x - 2 \leq -4$  to get  $x \leq -1$ . Therefore,  $x \geq 3$  or  $x \leq -1$ .
- 10. Answer choice (A) is the correct answer.** Since  $|4x| < 8$ , then  $4x$  can be less than 8 or greater than  $-8$ . Solve  $4x < 8$  to get  $x < 2$ . Solve  $4x > -8$  to get  $x > -2$ . To graph this inequality, we want an *open circle* at  $-2$  and  $2$  because we have a *less than* sign and a *greater than* sign. Since  $x > -2$  and  $x < 2$ , then  $x$  is in between  $-2$  and  $2$ . Therefore, we want a line in between  $-2$  and  $2$ , so graph (A) is the correct graph.
- 11. Answer choice (D) is the correct answer.** Since  $|2x + 5| \geq 7$ , then  $2x + 5$  can be greater than or equal to 7 or less than or equal to  $-7$ . Solve  $2x + 5 \geq 7$  to get  $x \geq 1$ . Solve  $2x + 5 \leq -7$  to get  $x \leq -6$ . To graph this inequality, we want a *solid circle* at both  $-6$  and  $1$  because we have a *greater than or equal to* sign and a *less than or equal to* sign. Since  $x \leq -6$ , we want a line to the *left* of  $-6$ . Since  $x \geq 1$ , we want a line to the *right* of  $1$ . Therefore, graph (D) is the correct graph.
- 12. Answer choice (D) is the correct answer.** Get the absolute value by itself by dividing both sides by one third to get  $|x + 5| > -3$ . Since the absolute value of any number is always greater than or equal to zero, the absolute value of  $x + 5$  will *always* be greater than  $-3$ . Therefore, we want every number on the number line filled in, so answer choice (D) is the correct graph.
- 13. Answer choice (C) is the correct answer.** The graph tells us that  $x$  can be anything greater than 1 or less than  $-1$ . This is the solution to the inequality  $|x| > 1$ .
- 14. Answer choice (A) is the correct answer.** The graph tells us that  $x$  can be anything greater than  $-8$  and less than 2. Find the middle of  $-8$  and 2 which is  $-3$ . Since  $-8$  and 2 are both 5 units away from  $-3$ , this means that the graph represents any numbers that are *less than* 5 units from  $-3$ . This means that the difference between  $x$  and  $-3$  has to be *less than* 5 units. We can write this as  $|x - (-3)| < 5$  which simplifies to  $|x + 3| < 5$ .
- 15. Answer choice (D) is the correct answer.** The graph tells us that  $x$  can be anything less than or equal to  $-2$  or anything greater than or equal to 1. Find the middle of  $-2$  and 1 which is  $-0.5$ . Since  $-2$  and 1 are both 1.5 units away from  $-0.5$ , this means that the graph represents any numbers that are *at least* 1.5 units away from  $-0.5$ . This means that the difference between  $x$  and  $-0.5$  has to be *greater than or equal to* 1.5. We can write this as  $|x - (-0.5)| \geq 1.5$  which simplifies to  $|x + 0.5| \geq 1.5$ . The answer choices don't have decimals, so multiply everything by 2 to get  $|2x + 1| \geq 3$

**Absolute Value Inequalities Set 2**

- 1. Answer choice (B) is the correct answer.** If  $x \leq 4$ , then the absolute value of  $x$  is also less than or equal to 4. If  $x \geq -4$ , then the absolute value of  $x$  is also less than or equal to 4 because absolute value turns everything positive except 0.
- 2. Answer choice (C) is the correct answer.** The absolute value of any number except 0 is always greater than 0. However, the absolute value of 0 equals 0, so it is not greater than 0. Therefore, any number *except* 0 works in the equation, so the solution set is  $x > 0$  or  $x < 0$ .
- 3. Answer choice (D) is the correct answer.** The absolute value of any number is always greater than or equal to 0. Therefore, the absolute value of any number will *never* be less than or equal to  $-10$ , so there is no solution.
- 4. Answer choice (B) is the correct answer.** Since  $|2x + 6| \leq 10$ , then  $2x + 6$  can be less than or equal to 10 or greater than or equal to  $-10$ . Solve  $2x + 6 \leq 10$  to get  $x \leq 2$ . Solve  $2x + 6 \geq -10$  to get  $x \geq -8$ . Answer choice (B) is the only number that is greater than or equal to  $-8$  and less than or equal to 2.
- 5. Answer choice (C) is the correct answer.** Since  $|5 - 4x| > 8$ , then  $5 - 4x$  can be greater than 8 or less than  $-8$ . Solve  $5 - 4x > 8$  to get  $x < -0.75$ . Solve  $5 - 4x < -8$  to get  $x > 3.25$ . Answer choice (C) is NOT greater than 3.25 or less than  $-0.75$ , so answer choice (C) is NOT a possible value of  $x$ .
- 6. Answer choice (A) is the correct answer.** Divide both sides of the inequality by  $-1$  to get  $|3x| \leq 18$ . Since  $|3x| \leq 18$ , then  $3x$  can be less than or equal to 18 or greater than or equal to  $-18$ . If  $3x \leq 18$ , then  $x \leq 6$ . If  $3x \geq -18$ , then  $x \geq -6$ . Therefore,  $-6 \leq x \leq 6$ .
- 7. Answer choice (C) is the correct answer.** Since  $|8 - 4x| > 4$ , then  $8 - 4x$  can be greater than 4 or less than  $-4$ . Solve  $8 - 4x > 4$  to get  $x < 1$ . Solve  $8 - 4x < -4$  to get  $x > 3$ . Therefore,  $x < 1$  or  $x > 3$ .
- 8. Answer choice (C) is the correct answer.** Subtract 3 from both sides of the inequality to get  $-2|5 - x| \leq 6$ . Divide both sides of the equation by  $-2$  to get  $|5 - x| \geq -3$ . The absolute value of every number is greater than or equal to 0, therefore, the absolute value of every number is greater than  $-3$ , so  $x$  can be any real number.
- 9. Answer choice (A) is the correct answer.** Add 14 to both sides of the inequality to get  $7|\frac{1}{2}x + 1| < 14$ . Divide both sides by 7 to get  $|\frac{1}{2}x + 1| < 2$ . Therefore,  $\frac{1}{2}x + 1$  can be less than 2 or greater than  $-2$ . Solve  $\frac{1}{2}x + 1 < 2$  to get  $x < 2$ . Solve  $\frac{1}{2}x + 1 > -2$  to get  $x > -6$ . Therefore,  $-6 < x < 2$ .
- 10. Answer choice (C) is the correct answer.** Solve the inequality by setting  $-3x$  greater than 9 and less than  $-9$ . Solve  $-3x > 9$  to get  $x < -3$ . Solve  $-3x < -9$  to get  $x > 3$ . Therefore,  $x < -3$  or  $x > 3$ . Since we have a *less than* and a *greater than* sign, we want *two open circles* at  $-3$  and 3. Since  $x$  is

less than  $-3$ , we want a line to the *left* of  $-3$ . Since  $x$  is *greater than*  $3$ , we want a line to the *right* of  $3$ . Therefore, graph (C) is the correct answer.

- 11. Answer choice (C) is the correct answer.** The absolute value of every number *except*  $0$  is positive. Therefore, the only way to make the inequality  $|2x + 8| \leq 0$  true is to make  $2x + 8$  equal to  $0$ . Set  $2x + 8 = 0$  and solve to get  $x = -4$ . Since the only solution is  $x = -4$ , we want a closed circle at  $-4$ . Therefore, graph (C) is the correct graph.
- 12. Answer choice (A) is the correct answer.** Multiply both sides of the inequality by negative three-halves to get  $|x - 3| < 3$ . Therefore  $x - 3 < 3$  or  $x - 3 > -3$ . Solve  $x - 3 < 3$  to get  $x < 6$ . Solve  $x - 3 > -3$  to get  $x > 0$ . Therefore,  $0 < x < 6$ . Since we have a *less than* and a *greater than* sign, we want two *open circles* at  $0$  and  $6$ . Since  $x$  is *between*  $0$  and  $6$ , we want a line in between  $0$  and  $6$ . Therefore, graph (A) is the correct graph.
- 13. Answer choice (A) is the correct answer.** The graph tells us that  $x$  can be anything greater than or equal to  $-4$  or less than  $4$ . This is the solution to the inequality  $|2x| \leq 8$  because if you set  $2x \leq 8$  you get  $x \leq 4$ , and if you set  $2x \geq -8$ , you get  $x \geq -4$ .
- 14. Answer choice (B) is the correct answer.** The graph tells us that  $x$  can be anything less than or equal to  $-1$  or greater than or equal to  $5$ . Find the middle of  $-1$  and  $5$  which is  $2$ . Since  $-1$  and  $5$  are both  $3$  units away from  $2$ , this means that the graph represents any numbers that are *at least*  $3$  units from  $2$ . This means that the difference between  $x$  and  $2$  has to be *at least, or greater than or equal to*,  $3$  units. We can write this as  $|x - 2| \geq 3$
- 15. Answer choice (A) is the correct answer.** The graph tells us that  $x$  can be anything greater than  $0$  and less than  $7$ . Find the middle of  $0$  and  $7$  which is  $3.5$ . Since  $0$  and  $7$  are both  $3.5$  units away from  $3.5$ , this means that the graph represents any numbers that are *less than*  $3.5$  units away from  $3.5$ . This means that the difference between  $x$  and  $3.5$  has to be *less than to*  $3.5$ . We can write this as  $|x - 3.5| < 3.5$ . The answer choices don't have decimals, so multiply everything by  $2$  to get  $|2x - 7| < 7$
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### Foiling Set 1

- 1. Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILING, distributing, or using the box method to get  $x^2 + 3x + 4x + 12$ . Combine like terms to get  $x^2 + 7x + 12$ .
- 2. Answer choice (B) is the correct answer.** Multiply the two binomials together by FOILING, distributing, or using the box method to get  $a^2 + 7a - 2a - 14$ . Combine like terms to get  $a^2 + 5a - 14$ .

3. **Answer choice (C) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $x^2 - 9x + 9x - 81$ . Combine like terms to get  $x^2 - 81$ .
4. **Answer choice (D) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $b^2 - 4b - b + 4$ . Combine like terms to get  $b^2 - 5b + 4$ .
5. **Answer choice (D) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $x^2 - 4xy + 4xy - 16y^2$ . Combine like terms to get  $x^2 - 16y^2$ .
6. **Answer choice (A) is the correct answer.** Rewrite  $(x - 7)^2$  as  $(x - 7)(x - 7)$ . Multiply the two binomials together by FOILing, distributing, or using the box method:  $x^2 - 7x - 7x + 49$ . Combine like terms to get  $x^2 - 14x + 49$ .
7. **Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $a^4 - a^2b^2 + a^2b^2 - b^4$ . Combine like terms to get  $a^4 - b^4$ .
8. **Answer choice (D) is the correct answer.** Rewrite  $(2m + 3)^2$  as  $(2m + 3)(2m + 3)$ . Multiply the two binomials together by FOILing, distributing, or using the box method to get  $4m^2 + 6m + 6m + 9$ . Combine like terms to get  $4m^2 + 12m + 9$ .
9. **Answer choice (B) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $24x^2 + 6x + 8x + 2$ . Combine like terms to get  $24x^2 + 14x + 2$ .
10. **Answer choice (C) is the correct answer.** Rewrite  $(3x + 4y)^2$  as  $(3x + 4y)(3x + 4y)$ . Multiply the two binomials together by FOILing, distributing, or using the box method to get  $9x^2 + 12xy + 12xy + 16y^2$ . Combine like terms to get  $9x^2 + 24xy + 16y^2$ .
11. **Answer choice (C) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $12p^2 - 4p - 27p + 9$ . Combine like terms to get  $12p^2 - 31p + 9$ .
12. **Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $10x^2 + 20x - 12x - 24$ . Combine like terms to get  $10x^2 + 8x - 24$ .
13. **Answer choice (B) is the correct answer.** Multiply the two polynomials together by distributing or using the box method to get  $k^3 + k^2 + 3k + 5k^2 + 5k + 15$ . Combine like terms to get  $k^3 + 6k^2 + 8k + 15$ .

- 14. Answer choice (D) is the correct answer.** Multiply the two polynomials together by distributing or using the box method to get  $4x^3 + 4x^2 - 6x - 6x^2 - 6x + 9$ . Combine like terms to get  $4x^3 - 2x^2 - 12x + 9$
- 15. Answer choice (C) is the correct answer.** Multiply  $(x - 3)$  and  $(x + 3)$  by FOILing, distributing, or using the box method to get  $x^2 + 3x - 3x - 9$ . Combine like terms to get  $x^2 - 9$ . Multiply  $(x^2 - 9)$  by  $(x + 3)$  by FOILing, distributing, or using the box method to get  $x^3 + 3x^2 - 9x - 27$

### Foiling Set 2

- 1. Answer choice (D) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $x^2 + 2x + 6x + 12$ . Combine like terms to get  $x^2 + 8x + 12$
- 2. Answer choice (C) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $a^2 - 2a - 5a + 10$ . Combine like terms to get  $a^2 - 7a + 10$
- 3. Answer choice (B) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $p^2 - 7p + 7p - 49$ . Combine like terms to get  $p^2 - 49$
- 4. Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $y^2 - 4y + 3y - 12$ . Combine like terms to get  $y^2 - y - 12$
- 5. Answer choice (C) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $25k^2 + 40k - 40k - 64$ . Combine like terms to get  $25k^2 - 64$
- 6. Answer choice (C) is the correct answer.** Rewrite  $(f - 1)^2$  as  $(f - 1)(f - 1)$ . Multiply the two binomials together by FOILing, distributing, or using the box method to get  $f^2 - f - f + 1$ . Combine like terms to get  $f^2 - 2f + 1$
- 7. Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $a^6 - a^3b^3 + a^3b^3 - b^6$ . Combine like terms to get  $a^6 - b^6$
- 8. Answer choice (B) is the correct answer.** Rewrite  $(5 - 4n)^2$  as  $(5 - 4n)(5 - 4n)$ . Multiply the two binomials together by FOILing, distributing, or using the box method to get  $25 - 20n - 20n + 16n^2$ . Combine like terms and rearrange the terms to get  $16n^2 - 40n + 25$
- 9. Answer choice (C) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $6b^2 + 54b + 5b + 45$ . Combine like terms to get

$$6b^2 + 59b + 45$$

- 10. Answer choice (D) is the correct answer.** Rewrite  $(6x - 2y)^2$  as  $(6x - 2y)(6x - 2y)$ . Multiply the two binomials together by FOILing, distributing, or using the box method to get  $36x^2 - 12xy - 12xy + 4y^2$ . Combine like terms to get  $36x^2 - 24xy + 4y^2$ .
- 11. Answer choice (B) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $24k^2 + 56k - 3k - 7$ . Combine like terms to get  $24k^2 + 53k - 7$ .
- 12. Answer choice (A) is the correct answer.** Multiply the two binomials together by FOILing, distributing, or using the box method to get  $9x^2 - 30x - 27x + 90$ . Combine like terms to get  $9x^2 - 57x + 90$ .
- 13. Answer choice (C) is the correct answer.** Multiply the two polynomials together by distributing or using box method to get  $x^3 - 2x^2 + 5x^2 - 10x + x - 2$ . Combine like terms to get  $x^3 + 3x^2 - 9x - 2$ .
- 14. Answer choice (D) is the correct answer.** Multiply the two polynomials together by distributing or using the box method to get  $6y^3 - 2y^2 - 12y + 6y^2 - 2y - 12$ . Combine like terms to get  $6y^3 + 4y^2 - 14y - 12$ .
- 15. Answer choice (D) is the correct answer.** Multiply  $(x + 2)$  and  $(x - 2)$  by FOILing, distributing, or using the box method to get  $x^2 - 2x + 2x - 4$ . Combine like terms to get  $x^2 - 4$ . Multiply  $(x^2 - 4)$  by  $(x - 4)$  by FOILing, distributing, or using the box method to get  $x^3 - 4x^2 - 4x + 16$ .
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### Foiling Word Problem Set 1

- 1. Answer choice (C) is the correct answer.** Multiply the left side of the equation to get  $x^2 + 7x + 12 = x^2 + kx + 12$ . In order for both sides of the equation to be equal,  $7x$  must equal  $kx$ . Set  $7x = kx$  and solve by dividing both sides by  $x$  to get that  $k = 7$ .
- 2. Answer choice (A) is the correct answer.** Multiply the left side of the equation to get  $x^2 + 3x - 10 = x^2 + 3x + c$ . In order for both sides of the equation to be equal,  $-10$  must equal  $c$ .
- 3. Answer choice (B) is the correct answer.** Multiply the left side of the equation to get  $8x^2 + 7x + 12 = ax^2 + 16x + 6$ . In order for both sides of the equation to be equal,  $8x^2$  must equal  $ax^2$ . Set  $8x^2 = ax^2$  and solve by dividing both sides by  $x^2$  to get that  $a = 8$ .
- 4. Answer choice (C) is the correct answer.** Write the left side of the equation as  $(x + 4)(x + 4)$  and multiply the binomials to get  $x^2 + 8x + 16 = x^2 + kx + 16$ . In order for both sides of the equation to be equal,  $8x$  must equal  $kx$ . Set  $8x = kx$  and solve by dividing both sides by  $x$  to get  $k = 8$ .

5. **Answer choice (D) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ . Rearrange the right side to get  $(x + y)^2 = x^2 + y^2 + 2xy$ . We know that  $x^2 + y^2 = 52$  and  $xy = 24$ , so plug these into the right side of the equation to get  $(x + y)^2 = 52 + 2(24)$ . Simplify to get  $(x + y)^2 = 52 + 48 = 100$ .
6. **Answer choice (A) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ , and since  $(x + y)^2 = 64$ , then  $x^2 + 2xy + y^2 = 64$ . We know that  $2xy = 30$ , so plug this into the left side of the equation to get  $x^2 + 30 + y^2 = 64$ . Subtract 30 from both sides to get  $x^2 + y^2 = 34$ .
7. **Answer choice (B) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ . Rearrange the right side to get  $(x + y)^2 = x^2 + y^2 + 2xy$ . We know that  $x^2 + y^2 = a$  and  $2xy = b$ , so plug these into the right side of the equation to get  $(x + y)^2 = a + b$ .
8. **Answer choice (B) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ , and since  $(x + y)^2 = k$ , then  $x^2 + 2xy + y^2 = k$ . We know that  $xy = j$ , so plug this into the left side of the equation to get  $x^2 + 2j + y^2 = k$ . Subtract  $2j$  from both sides to get  $x^2 + y^2 = k - 2j$ .
9. **Answer choice (B) is the correct answer.** Multiply the left side of the equation to get  $x^2 - 4x + bx - 4b = x^2 + mx - 8$ . In order for both sides of the equation to be equal,  $-4b$  must equal  $-8$ . Set  $-4b = -8$  and solve by dividing both sides by  $-4$  to get that  $b = 2$ . Now we can plug in 2 for  $b$ :  $x^2 - 4x + 2x - 4(2) = x^2 + mx - 8$ . Simplify the left side of the equation:  $x^2 - 2x - 8 = x^2 + mx - 8$ . In order for both sides of the equation to be equal,  $-2x$  must equal  $mx$ . Set  $-2x = mx$  and divide both sides by  $x$  to get  $m = -2$ .
10. **Answer choice (D) is the correct answer.** Multiply the left side of the equation to get  $x^2 + 5x + ax + 5a = x^2 + 8x + k$ . In order for both sides of the equation to be equal,  $5x + ax$  must equal  $8x$ . Set  $5x + ax = 8x$  and solve by subtracting  $5x$  from both sides to get  $ax = 3x$ , and then divide both sides by  $x$  to get  $a = 3$ . Now we can plug in 3 for  $a$ :  $x^2 + 5x + 3x + 5(3) = x^2 + 8x + k$ . Simplify the left side of the equation:  $x^2 + 8x + 15 = x^2 + 8x + k$ . In order for both sides of the equation to be equal,  $k$  must equal 15.

### Foiling Word Problems Set 2

1. **Answer choice (D) is the correct answer.** Multiply the left side of the equation to get  $x^2 - 15x + 56 = x^2 - 15x + c$ . In order for both sides of the equation to be equal,  $c$  must equal 56.
2. **Answer choice (C) is the correct answer.** Multiply the left side of the equation to get

$6x^2 + 21x + 15 = ax^2 + 21x + 15$ . In order for both sides of the equation to be equal,  $ax^2$  must equal  $6x^2$ . Set  $ax^2 = 6x^2$  and solve by dividing both sides by  $x^2$  to get  $a = 6$ .

3. **Answer choice (D) is the correct answer.** Multiply the left side of the equation to get  $x^2 + 7x - 18 = x^2 + 7x - b$ . In order for both sides of the equation to be equal,  $b$  must equal 18.
4. **Answer choice (B) is the correct answer.** Multiply the left side of the equation to get  $x^2 - 144 = x^2 + kx - 144$ . In order for both sides of the equation to be equal,  $kx$  must equal 0 because the left side of the equation does not have an  $x$  term. Set  $kx = 0$  and divide both sides by  $x$  to get  $k = 0$ .
5. **Answer choice (C) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ . Rearrange the right side to get  $(x + y)^2 = x^2 + y^2 + 2xy$ . We know that  $x^2 + y^2 = 25$  and  $2xy = 24$ , so plug these into the right side of the equation to get  $(x + y)^2 = 25 + 24$ . Simplify to get  $(x + y)^2 = 49$ .
6. **Answer choice (B) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ , and since  $(x + y)^2 = 121$ , then  $x^2 + 2xy + y^2 = 121$ . We know that  $xy = 30$ , so plug this into the left side of the equation to get  $x^2 + 2(30) + y^2 = 121$ . Simplify to get  $x^2 + 60 + y^2 = 121$ . Subtract 60 from both sides to get  $x^2 + y^2 = 61$ .
7. **Answer choice (A) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ , and since  $(x + y)^2 = r$ , then  $x^2 + 2xy + y^2 = r$ . We know that  $2xy = s$ , so plug this into the left side of the equation to get  $x^2 + s + y^2 = r$ . Subtract  $s$  from both sides to get  $x^2 + y^2 = r - s$ .
8. **Answer choice (D) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ . Rearrange the right side to get  $(x + y)^2 = x^2 + y^2 + 2xy$ . We know that  $x^2 + y^2 = w$  and  $xy = z$ , so plug these into the right side of the equation to get  $(x + y)^2 = w + 2z$ .
9. **Answer choice (D) is the correct answer.** Multiply the left side of the equation to get  $x^2 + 2x + bx + 2b = x^2 + 6x + m$ . In order for both sides of the equation to be equal,  $2x + bx$  must equal  $6x$ . Set  $2x + bx = 6x$  and solve by dividing both sides by  $x$  to get that  $2 + b = 6$ . Then subtract 2 from both sides to get  $b = 4$ . Now we can plug in 4 for  $b$ :  $x^2 + 2x + 4x + 2(4) = x^2 + 6x + m$ . Simplify the left side of the equation:  $x^2 + 6x + 8 = x^2 + 6x + m$ . In order for both sides of the equation to be equal, 8 must equal  $m$ .
10. **Answer choice (C) is the correct answer.** Multiply the left side of the equation to get  $ax^2 + 2x + ax + 2 = 3x^2 + kx + 2$ . In order for both sides of the equation to be equal,  $ax^2$  must equal  $3x^2$ . Set  $ax^2 = 3x^2$  and solve by dividing both sides by  $x^2$  to get  $a = 3$ . Now we can plug in 3 for  $a$ :  $3x^2 + 2x + 3x + 2 = 3x^2 + kx + 2$ . Simplify the left side of the equation:  $3x^2 + 5x + 2 = 3x^2 + kx + 2$ .

In order for both sides of the equation to be equal,  $kx$  must equal  $5x$ . Set  $kx = 5x$  and divide both sides by  $x$  to get  $k = 5$ .

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### Equivalent Expressions Set 1

- 1. Answer choice (B) is the correct answer.** Factor out a 4 from  $4x + 12$  to get  $4(x + 3)$ .
- 2. Answer choice (C) is the correct answer.** Factor out a  $3a$  from  $3a^2 - 6a$  to get  $3a(a - 2)$ .
- 3. Answer choice (A) is the correct answer.** Factor out a  $3a$  from  $6a^4 - 3a^2 + 9a$  to get  $3a(2a^3 - a + 3)$ .
- 4. Answer choice (D) is the correct answer.** To factor  $x^2 - 6x + 5$ , find two numbers that multiply to 5 and add to negative 6: the numbers are  $-1$  and  $-5$ . Therefore,  $x^2 - 6x + 5$  factors to  $(x - 1)(x - 5)$ . You could also multiply out each answer choice until you find one that is equivalent to  $x^2 - 6x + 5$ .
- 5. Answer choice (B) is the correct answer.** First, factor out a  $-1$  to get  $-(x^2 - x - 12)$ . To factor  $x^2 - x - 12$ , find two numbers that multiply to  $-12$  and add to  $-1$ : the numbers are  $-4$  and  $3$ . Therefore,  $x^2 - x - 12$  factors to  $(x - 4)(x + 3)$ . Don't forget about the  $-1$  that we factored out, so our final answer is  $-(x - 4)(x + 3)$ . You could also multiply out each answer choice until you find one that is equivalent to  $-x^2 + x + 12$ .
- 6. Answer choice (A) is the correct answer.** To factor  $8x^2 - 5x - 3$ , multiply 8 and  $-3$  to get  $-24$ . Then find two numbers that multiply to  $-24$  and add to  $-5$ : the numbers are  $-8$  and  $3$ . Split the middle term,  $-5x$ , into  $-8x$  and  $3x$  in our expression to get  $8x^2 - 8x + 3x - 3$ . Factor the first two terms separately and the second two terms separately to get  $8x(x - 1) + 3(x - 1)$  which equals  $(8x + 3)(x - 1)$ . You could also multiply out each answer choice until you find one that is equivalent to  $8x^2 - 5x - 3$ .
- 7. Answer choice (D) is the correct answer.** To factor  $x^2 - 4x + 4$ , find two numbers that multiply to 4 and add to negative  $-4$ : the numbers are  $-2$  and  $-2$ . Therefore,  $x^2 - 4x + 4$  factors to  $(x - 2)(x - 2)$  which equals  $(x - 2)^2$ . You could also multiply out each answer choice until you find one that is equivalent to  $x^2 - 4x + 4$ .
- 8. Answer choice (C) is the correct answer.**  $25x^2 - 4$  is a *difference of two squares*. To factor a *difference of two squares*, take the square root of each term: the square root of  $25x^2$  is  $5x$ , and the square root of 4 is 2. Now put the roots together in two sets of parentheses, one with a “ $-$ ” sign in between the roots and one with a “ $+$ ” sign in between the roots:  $(5x - 2)(5x + 2)$ . You could also multiply out each answer choice until you find one that is equivalent to  $25x^2 - 4$ .

9. **Answer choice (D) is the correct answer.** The formula for factoring the sum of two cubes is  $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ . Therefore,  $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$ . You could also multiply out each answer choice until you find one that is equivalent to  $a^3 + b^3$ .
10. **Answer choice (C) is the correct formula.**  $a^4 - 1$  is a *difference of two squares*. To factor a *difference of two squares*, take the square root of each term: the square root of  $a^4$  is  $a^2$ , and the square root of 1 is 1. Now put the roots together in two sets of parentheses, one with a “–” sign in between the roots and one with a “+” sign in between the roots:  $(a^2 - 1)(a^2 + 1)$ . We are not done factoring because  $(a^2 - 1)$  is a *difference of two squares*. Factor it the same way to get  $(a^2 - 1) = (a - 1)(a + 1)$ . Therefore  $(a^2 - 1)(a^2 + 1) = (a - 1)(a + 1)(a^2 + 1)$ . You could also multiply out each answer choice until you find one that is equivalent to  $a^4 - 1$ .

### Equivalent Expressions Set 2

1. **Answer choice (A) is the correct answer.** Factor out a 5 from  $20b + 5$  to get  $5(4b + 1)$ .
2. **Answer choice (B) is the correct answer.** Factor out a  $5m$  from  $10m^2 - 5m$  to get  $5m(2m - 1)$ .
3. **Answer choice (D) is the correct answer.** Factor out a  $2x$  from  $4x^4 + 2x^2 + 6x$  to get  $2x(2x^3 + x + 3)$ .
4. **Answer choice (A) is the correct answer.** To factor  $x^2 + 7x + 6$ , find two numbers that multiply to 6 and add to 7: the numbers are 6 and 1. Therefore,  $x^2 + 7x + 6$  factors to  $(x + 6)(x + 1)$ . You could also multiply out each answer choice until you find one that is equivalent to  $x^2 + 7x + 6$ .
5. **Answer choice (C) is the correct answer.** To factor  $-x^2 + 5x + 24$ , first factor out a  $-1$  to get  $-(x^2 - 5x - 24)$ . Now find two numbers that multiply to  $-24$  and add to  $-5$ : the numbers are  $-8$  and  $3$ . Therefore,  $x^2 - 5x - 24$  factors to  $(x - 8)(x + 3)$ , so  $-(x^2 - 5x - 24) = -(x - 8)(x + 3)$ . You could also multiply out each answer choice until you find one that is equivalent to  $-x^2 + 5x + 24$ .
6. **Answer choice (C) is the correct answer.** To factor  $6x^2 - 16x + 10$ , first factor out a 2 to get  $2(3x^2 - 8x + 5)$ . Next, multiply 3 and 5 to get 15. Then find two numbers that multiply to 15 and add to  $-8$ : the numbers are  $-3$  and  $-5$ . Split the middle term,  $-8x$ , into  $-3x$  and  $-5x$  in our expression to get  $2(3x^2 - 3x - 5x + 5)$ . Factor the first two terms in the parenthesis separately and the second two terms separately to get  $2[3x(x - 1) - 5(x - 1)]$  which equals  $2(3x - 5)(x - 1)$ . You could also multiply out each answer choice until you find one that is equivalent to  $6x^2 - 16x + 10$ .
7. **Answer choice (B) is the correct answer.** To factor  $x^2 + 8x + 16$ , find two numbers that multiply to 16 and add to 8: the numbers are 4 and 4. Therefore,  $x^2 + 8x + 16$  factors to  $(x + 4)(x + 4)$  which can be written as  $(x + 4)^2$ . You could also multiply out each answer choice until you find one that is equivalent to  $x^2 + 8x + 16$ .

- 8. Answer choice (B) is the correct answer.**  $9 - 36x^2$  is a *difference of two squares*. To factor a *difference of two squares*, take the square root of each term: the square root of 9 is 3, and the square root of  $36x^2$  is  $6x$ . Now put the roots together in two sets of parentheses, one with a “–” sign in between the roots and one with a “+” sign in between the roots:  $(3 - 6x)(3 + 6x)$ . You could also multiply out each answer choice until you find one that is equivalent to  $9 - 36x^2$ .
- 9. Answer choice (B) is the correct formula.**  $a^4 - b^4$  is a *difference of two squares*. To factor a *difference of two squares*, take the square root of each term: the square root of  $a^4$  is  $a^2$ , and the square root of  $b^4$  is  $b^2$ . Now put the roots together in two sets of parentheses, one with a “–” sign in between the roots and one with a “+” sign in between the roots:  $(a^2 - b^2)(a^2 + b^2)$ . We are not done factoring because  $(a^2 - b^2)$  is a *difference of two squares*. Factor it the same way to get  $(a^2 - b^2) = (a - b)(a + b)$ . Therefore  $(a^2 - b^2)(a^2 + b^2) = (a - b)(a + b)(a^2 + b^2)$ .
- 10. Answer choice (D) is the correct answer.** The formula for factoring the sum of two cubes is  $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ . Therefore,  $8a^3 + 1 = (2a + 1)((2a)^2 - 2a + 1^2)$  which simplifies to  $(2a + 1)(4a^2 - 2a + 1)$ . You could also multiply out each answer choice until you find one that is equivalent to  $8a^3 + 1$ .
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### Equations Equal to Zero Set 1

- 1. Answer choice (A) is the correct answer.** Subtract 7 from both sides of the equation to get  $y = -7$ .
- 2. Answer choice (A) is the correct answer.** In order for  $6a$  to equal 0,  $a$  must be 0 because 0 multiplied by any number equals 0.
- 3. Answer choice (C) is the correct answer.** In order for  $2x = x$ ,  $x$  must equal 0 because  $2 \cdot 0 = 0$ .
- 4. Answer choice (D) is the correct answer.** If  $(x + 3)(x - 3) = 0$ , then either  $x + 3 = 0$  or  $x - 3 = 0$ . If  $x + 3 = 0$ , then  $x = -3$ . If  $x - 3 = 0$ , then  $x = 3$ .
- 5. Answer choice (D) is the correct answer.** It is not possible to divide a nonzero number by another number and get 0. Remember that dividing something by 0 does not equal 0: it is undefined.
- 6. Answer choice (B) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set the numerator equal to zero and solve:  
 $x + 4 = 0 \rightarrow x = -4$ .
- 7. Answer choice (B) is the correct answer.** In order for the quotient of two numbers to equal 0, the divisor must equal 0.

- 8. Answer choice (D) is the correct answer.** It is not possible to get an answer of 0 when raising a nonzero number to an exponent. Remember that raising a nonzero number to a power of 0 equals 1, not 0.
- 9. Answer choice (D) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set the numerator equal to zero and solve:  $5 + x = 0 \rightarrow x = -5$ . If you plug in  $-5$  for  $x$  in the equation, it also makes the denominator 0. Therefore, there is no value of  $x$  that will make the left side of the equation equal 0.
- 10. Answer choice (A) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set each factor in the numerator equal to zero and solve. If  $x + 2 = 0$ , then  $x = -2$ . If  $x - 3 = 0$ , then  $x = 3$ . If you plug in  $-2$  for  $x$  in the equation, the denominator is also 0, so  $-2$  is not a solution. Therefore, only  $x = 3$  makes the equation true.
- 11. Answer choice (D) is the correct answer.** Factor the top of the equation to get  $(x + 4)(x - 4)$ . In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set each factor in the numerator equal to zero and solve. If  $x + 4 = 0$ , then  $x = -4$ . If  $x - 4 = 0$ , then  $x = 4$ .
- 12. Answer choice (D) is the correct answer.** Subtract 100 from both sides of the equation to get  $x^2 = -100$ . Since every real number squared equals a positive number, there is no real solution to the equation.
- 13. Answer choice (C) is the correct answer.** Divide both sides of the equation by  $-1$  to get  $x^2 = 9$ . Take the square root of both sides to get that  $x$  can equal 3 or  $-3$  (remember that  $(-3)^2 = 9$ ).
- 14. Answer choice (A) is the correct answer.** Factor the left side of the equation to get  $(x - 4)^2 = 0$ . Set  $x - 4 = 0$  and solve to get  $x = 4$ . You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.
- 15. Answer choice (C) is the correct answer.** Factor the left side of the equation to get  $(x + 1)(x - 7) = 0$ . Set each factor equal to zero and solve. If  $x + 1 = 0$ , then  $x = -1$ . If  $x - 7 = 0$ , then  $x = 7$ . You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.
- 16. Answer choice (A) is the correct answer.** Factor the left side of the equation to get  $(5x - 1)(x - 2) = 0$ . Set each factor equal to zero and solve. If  $5x - 1 = 0$ , then  $x = \frac{1}{5}$ . If  $x - 2 = 0$ , then  $x = 2$ . You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.

### Equations Equal to Zero Set 2

- 1. Answer choice (C) is the correct answer.** Add 9 to both sides of the equation to get  $y = 9$ .

2. **Answer choice (B) is the correct answer.** In order for  $3a^2$  to equal 0,  $a$  must be 0 because 0 multiplied by any number equals 0.
3. **Answer choice (D) is the correct answer.** In order for  $-8x = 9x$ ,  $x$  must equal 0 because  $-8 \cdot 0 = 0$  and  $9 \cdot 0 = 0$ , so  $-8 \cdot 0 = 9 \cdot 0$ .
4. **Answer choice (A) is the correct answer.** If  $(x + 5)(x + 10) = 0$ , then either  $x + 5 = 0$  or  $x + 10 = 0$ . If  $x + 5 = 0$ , then  $x = -5$ . If  $x + 10 = 0$ , then  $x = -10$ .
5. **Answer choice (B) is the correct answer.** 0 divided by any number other than 0 equals 0. Therefore, 0 divided by 4 equals 0.
6. **Answer choice (D) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set each factor in the numerator equal to zero and solve. If  $x - 2 = 0$ , then  $x = 2$ . If  $x - 9 = 0$ , then  $x = 9$ . Therefore,  $x$  can equal 2 or 9.
7. **Answer choice (A) is the correct answer.** Isolate  $x$  in the equation by subtracting  $y$  from both sides to get  $x = -y$ .
8. **Answer choice (D) is the correct answer.** It is not possible to get an answer of 0 when raising a nonzero number to an exponent. Remember that raising a nonzero number to a power of 0 equals 1, not 0.
9. **Answer choice (D) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set the numerator equal to zero and solve:  $x - 1 = 0 \rightarrow x = 1$ . If you plug in 1 for  $x$  in the equation, it also makes the denominator 0. Therefore, there is no value of  $x$  that will make the left side of the equation equal 0.
10. **Answer choice (C) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set each factor in the numerator equal to zero and solve. If  $x - 5 = 0$ , then  $x = 5$ . If  $x - 4 = 0$ , then  $x = 4$ . If you plug in 4 for  $x$  in the equation, the denominator is also 0, so 4 is not a solution. Therefore, only  $x = 5$  makes the equation true.
11. **Answer choice (D) is the correct answer.** In order to make a fraction 0, the numerator has to equal 0 without the denominator equaling zero. Set  $x^2 + 4 = 0$ . Subtract 4 from both sides to get  $x^2 = -4$ . Square root both sides to get  $x = \sqrt{-4}$ . Since the square root of a negative number is not a real number, there is no real value of  $x$  that makes this equation true.
12. **Answer choice (D) is the correct answer.** Solve the equation by taking the square root of both sides:  $-x = \sqrt{-25}$ . Since the square root of a negative number is not a real number, there is no real value of  $x$  that makes this equation true.

- 13. Answer choice (C) is the correct answer.** Add 144 to both sides to get  $x^2 = 144$ . Take the square root of both sides to get that  $x = 12$  or  $-12$  (remember that  $(-12)^2 = 144$ ).
- 14. Answer choice (B) is the correct answer.** Factor the left side of the equation to get  $(x + 2)(x + 2) = 0$ . Since the two factors are the same, set one equal to zero and solve:  $x + 2 = 0 \rightarrow x = -2$ . You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.
- 15. Answer choice (A) is the correct answer.** Factor the left side of the equation to get  $(x - 10)(x - 1) = 0$ . Set each factor equal to zero and solve. If  $x - 10 = 0$ ,  $x = 10$ . If  $x - 1 = 0$ ,  $x = 1$ . Therefore, the solutions are 10 and 1. You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.
- 16. Answer choice (A) is the correct answer.**  $(3x + 1)(x - 1) = 0$ . Set each factor equal to zero and solve. If  $3x + 1 = 0$ , then  $x = -\frac{1}{3}$ . If  $x - 1 = 0$ , then  $x = 1$ . You can also plug in the values in each answer choice for  $x$  and see which values make the equation true.
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### Function Notation Set 1

- 1. Answer choice (B) is the correct answer.** To find  $f(8)$ , plug in 8 for  $x$  in the original equation:  $f(8) = 8 + 4 = 12$ .
- 2. Answer choice (D) is the correct answer.** To find  $h(-5)$ , plug in  $-5$  for  $x$  in the original equation:  $h(-5) = -(-5)^3 = -(-125) = 125$ .
- 3. Answer choice (A) is the correct answer.** To find  $g(a + b)$ , plug in  $a + b$  for  $x$  in the original equation:  $g(a + b) = 15 - (a + b) = 15 - a - b$ .
- 4. Answer choice (D) is the correct answer.** Set  $h(x)$  equal to 3 in the original equation and solve for  $x$ :  $3 = x - 7 \rightarrow x = 10$ .
- 5. Answer choice (A) is the correct answer.** Set  $f(x)$  equal to  $-2$  in the original equation and solve for  $x$ :  $-2 = x^4 - 3 \rightarrow 1 = x^4 \rightarrow x = 1$  or  $-1$ .
- 6. Answer choice (C) is the correct answer.** Find  $f(1)$  by plugging in 1 for  $x$  in the original equation:  $f(1) = 10 - 2(1 + 1) = 10 - 2(2) = 10 - 4 = 6$ . Find  $f(-2)$  by plugging in  $-2$  for  $x$  in the original equation:  $f(-2) = 10 - 2(-2 + 1) = 10 - 2(-1) = 10 + 2 = 12$ . Add  $f(1)$  and  $f(2) = 6 + 12 = 18$ .
- 7. Answer choice (B) is the correct answer.** Find  $k(3)$  by plugging in 3 for  $x$  in the original equation:  $k(3) = 3^2 - 3 = 9 - 3 = 6$ . Find  $k(5)$  by plugging in 5 for  $x$  in the original equation:  $k(5) = 5^2 - 5 = 25 - 5 = 20$ . Subtract  $k(3)$  minus  $k(5)$ :  $6 - 20 = -14$ .

8. **Answer choice (C) is the correct answer.**  $g(6) = 6^2 = 36$ , and  $g(-6) = (-6)^2 = 36$ . Therefore,  $g(6) = g(-6)$ .
9. **Answer choice (B) is the correct answer.** Since  $f(x) = x$ , then  $f\left(\frac{1}{2}\right) = \frac{1}{2}$  and  $f\left(\frac{1}{4}\right) = \frac{1}{4}$ .  
Since  $g(x) = \frac{1}{x}$ , then  $g\left(\frac{1}{2}\right) = 2$  and  $g\left(\frac{1}{4}\right) = 4$ . Ordering these from least to greatest we get  $f\left(\frac{1}{4}\right) < f\left(\frac{1}{2}\right) < g\left(\frac{1}{2}\right) < g\left(\frac{1}{4}\right)$ .
10. **Answer choice (A) is the correct answer.** To find  $f(g(1))$ , first find  $g(1)$ :  $g(1) = 1 + 4 = 5$ . Now find  $f(5)$ :  $f(5) = 2(5) + 5 = 10 + 5 = 15$ .
11. **Answer choice (A) is the correct answer.** To find  $g(f(-2))$ , first find  $f(-2)$ :  $f(-2) = -3(-2) - 7 = 6 - 7 = -1$ . Now find  $g(-1)$ :  $g(-1) = (-1)^3 - 3 = -1 - 3 = -4$ .
12. **Answer choice (B) is the correct answer.** To find  $f(g(x))$ , plug in the expression that equals  $g(x)$  in for  $x$  in the  $f(x)$  equation:  $f(g(x)) = 5(x + 1) = 5x + 5$ .
13. **Answer choice (C) is the correct answer.** To find  $h(k(x))$ , plug in the expression that equals  $k(x)$  in for  $x$  in the  $h(x)$  equation:  $h(k(x)) = 11 - 3(6 - x) = 11 - 18 + 3x = -7 + 3x$ .
14. **Answer choice (D) is the correct answer.**  $f(g(x)) = (x^9)^2 = x^{18}$  and  $g(f(x)) = (x^2)^9 = x^{18}$ . Therefore,  $f(g(x)) = g(f(x))$ .
15. **Answer choice (C) is the correct answer.** If  $\sqrt{x} = x^3$ , then  $x$  can only equal 0 or 1.

### Function Notation Set 2

1. **Answer choice (D) is the correct answer.** To find  $f(6)$ , plug in 6 for  $x$  in the original equation:  $f(6) = 3(6) = 18$
2. **Answer choice (D) is the correct answer.** To find  $h(-3)$ , plug in  $-3$  for  $x$  in the original equation:  $h(-3) = (-3)^2 = 9$
3. **Answer choice (B) is the correct answer.** To find  $g(x + 1)$ , plug in  $x + 1$  for  $x$  in the original equation:  $g(x + 1) = -2(x + 1) - 5$ . Distribute the  $-2$  and simplify:  $g(x + 1) = -2x - 2 - 5 \rightarrow g(x + 1) = -2x - 7$
4. **Answer choice (A) is the correct answer.** Set  $k(x)$  equal to 0 in the original equation and solve for  $x$ :  $0 = 3 + x \rightarrow x = -3$ .

5. **Answer choice (D) is the correct answer.** Set  $f(x) = -4$  in the original equation and solve for  $x$ :  $-4 = x^2 \rightarrow x = \sqrt{-4}$ . Since the square root of a negative number is not a real number, there is no real value of  $x$  that satisfies the given conditions.
6. **Answer choice (D) is the correct answer.** Find  $f(3)$  by plugging in 3 for  $x$  in the original equation:  $f(3) = 7 - (10 - 3) \rightarrow f(3) = 7 - 7 \rightarrow f(3) = 0$ . Find  $f(-3)$  by plugging in  $-3$  for  $x$  in the original equation:  $f(-3) = 7 - (10 - (-3)) \rightarrow f(-3) = 7 - (13) \rightarrow f(-3) = -6$ . Find  $f(3) - f(-3)$ :  $0 - (-6) = 6$
7. **Answer choice (A) is the correct answer.** Find  $k(6)$  by plugging in 6 in for  $x$  in the original equation:  $k(6) = \frac{12 + 6}{3} \rightarrow k(6) = \frac{18}{3} \rightarrow k(6) = 6$ . Find  $k(-3)$  by plugging in  $-3$  for  $x$  in the original equation:  $k(-3) = \frac{12 + (-3)}{3} \rightarrow k(-3) = \frac{9}{3} \rightarrow k(-3) = 3$ . Find  $k(6) + k(-3)$ :  $6 + 3 = 9$
8. **Answer choice (C) is the correct answer.** To find  $g(-4)$ , plug in  $-4$  for  $x$  in the original equation:  $g(-4) = (-4)^2 - (-4) \rightarrow g(-4) = 16 + 4 \rightarrow g(-4) = 20$ . To find  $g(4)$ , plug in 4 for  $x$  in the original equation:  $g(4) = 4^2 - 4 \rightarrow g(4) = 16 - 4 \rightarrow g(4) = 12$ . Therefore, answer choice (C) is NOT true because  $g(-4) \neq g(4)$ .
9. **Answer choice (B) is the correct answer.** Since  $f(x) = x^2$ , then  $f\left(\frac{1}{2}\right) = \frac{1}{4}$  and  $f\left(-\frac{1}{2}\right) = \frac{1}{4}$  (both are positive because when you square a negative or positive number they become positive).  
Since  $g(x) = x^3$ , then  $g\left(\frac{1}{2}\right) = \frac{1}{8}$  and  $g\left(-\frac{1}{2}\right) = -\frac{1}{8}$ . Therefore, we get  
 $g\left(-\frac{1}{2}\right) < g\left(\frac{1}{2}\right) < f\left(-\frac{1}{2}\right) = f\left(\frac{1}{2}\right)$ .
10. **Answer choice (D) is the correct answer.** To find  $f(g(-3))$ , first find  $g(-3)$ :  $g(-3) = 12 \div (-3) = -4$ . Now find  $f(-4)$ :  $f(-4) = 4 - (-4) = 8$
11. **Answer choice (B) is the correct answer.** To find  $g(f(-0.5))$ , first find  $f(-0.5)$ :  $f(-0.5) = 2 - 8(-0.5)^2 \rightarrow f(-0.5) = 2 - 8(0.25) \rightarrow f(-0.5) = 2 - 2 = 0$ . Now find  $g(0)$ :  $g(0) = -0 = 0$
12. **Answer choice (D) is the correct answer.** To find  $f(g(x))$ , plug in the expression that equals  $g(x)$  in for  $x$  in the  $f(x)$  equation:  $f(g(x)) = -2(x - 2) \rightarrow f(g(x)) = -2x + 4$
13. **Answer choice (A) is the correct answer.** To find  $h(k(x))$ , plug in the expression that equals  $k(x)$  in for  $x$  in the  $h(x)$  equation:  $h(k(x)) = 4(3x + 1) - 6 \rightarrow h(k(x)) = 12x + 4 - 6 \rightarrow h(k(x)) = 12x - 2$
14. **Answer choice (B) is the correct answer.**  $f(x) \cdot g(x) = (x^{-4})(x^4) = x^0 = 1$ . Remember that anything to the 0 power equals 1, not 0. Therefore, answer choice (B) is NOT true.

- 15. Answer choice (C) is the correct answer.** The only integer values of  $x$  greater than  $-2$  that make  $f(x)$  a real number are  $-1$  and  $0$ :  $\sqrt{-(-1)} = \sqrt{1} = 1$  and  $\sqrt{-(0)} = \sqrt{0} = 0$ . If you plug in any other integer greater than  $-2$ , you will end up with a negative number under the square root which is not equal to a real number.
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### Symbol Problems Set 1

- 1. Answer choice (D) is the correct answer.** To find #3, replace  $y$  with 3 in the original equation: #3 =  $4(3) + 2 = 12 + 2 = 14$ .
- 2. Answer choice (A) is the correct answer.** To find  $\wedge(-2)\wedge$ , replace  $b$  with  $-2$  in the original equation:  $\wedge(-2)\wedge = (-2)^2 - (-2) = 4 + 2 = 6$ .
- 3. Answer choice (C) is the correct answer.** To find  $\langle 24 \rangle$ , replace  $a$  with 24 in the original equation:  $\langle 24 \rangle = 3(24) \div 8 = 72 \div 8 = 9$ .
- 4. Answer choice (D) is the correct answer.** To find  $-1 \leftrightarrow 4$ , replace  $a$  with  $-1$  and  $b$  with 4 in the original equation:  $-1 \leftrightarrow 4 = 3(4) - 2(-1) = 12 + 2 = 14$ .
- 5. Answer choice (B) is the correct answer.** To find  $a \sim b$ , replace  $c$  with  $a$  and  $d$  with  $b$  in the original equation:  $a \sim b = 4a + 2b$ .
- 6. Answer choice (A) is the correct answer.** To find  $d \sim c$ , replace  $c$  with  $d$  and  $d$  with  $c$  in the original equation;  $d \sim c = 4d + 2c$ .
- 7. Answer choice (A) is the correct answer.** Find  $\square 2$  by replacing  $n$  with 2 in the original equation:  $\square 2 = 2(2) + 3 = 4 + 3 = 7$ . Find  $\square 5$  by replacing  $n$  with 5 in the original equation:  $\square 5 = 2(5) + 3 = 10 + 3 = 13$ . Subtract  $\square 2$  minus  $\square 5$ :  $7 - 13 = -6$ .
- 8. Answer choice (A) is the correct answer.** To find the value of  $a$  if  $\square a = 11$ , replace  $\square n$  with  $\square a$  in the original equation and  $n$  with  $a$ :  $\square a = 2a + 3$ . Now replace  $\square a$  with 11 and solve:  $11 = 2a + 3 \rightarrow 8 = 2a \rightarrow a = 4$ .
- 9. Answer choice (C) is the correct answer.** Find  $\{0\}$  by replacing  $x$  with 0 in the original equation:  $\{0\} = 0^{-3} = \frac{1}{0}$ . Anytime you divide something by 0, the result is undefined.
- 10. Answer choice (D) is the correct answer.** To find the value of  $y$ , replace  $x \triangle y$  with  $-5$  and  $x$  with 2 in the original:  $-5 = \frac{2 + y}{2 - y}$ . Solve for  $y$  by multiplying both sides of the equation by  $2 - y$ :  $-5(2 -$

$y) = 2 + y \rightarrow -10 + 5y = 2 + y$ . Continue solving by subtracting  $y$  from both sides and then adding 10 to both sides:  $-10 + 4y = 2 \rightarrow 4y = 12 \rightarrow y = 3$ .

- 11. Answer choice (B) is the correct answer.** To find  $5 \triangle 9$ , replace  $x$  with 5 and  $y$  with 9 in the original equation:  $5 \triangle 9 = \frac{5 + 9}{5 - 9} = \frac{14}{-4}$ . Since  $\frac{14}{-4}$  does not simplify to an integer, answer choice (B) is NOT an integer.
- 12. Answer choice (D) is the correct answer.** To find  $7 \triangle 9$ , replace  $x$  with 7 and  $y$  with 9 in the original equation:  $7 \triangle 9 = \frac{7 + 9}{7 - 9} = \frac{16}{-2} = -8$ . Since  $-8$  is an integer, answer choice (D) is the correct answer.

### Symbol Problems Set 2

- 1. Answer choice (C) is the correct answer.** To find  $:: 4$ , plug in 4 for  $x$  in the original equation:  $:: 4 = 5(4) + 3 = 20 + 3 = 23$
- 2. Answer choice (A) is the correct answer.** To find  $*(-2)*$ , plug in  $-2$  for  $a$  in the original equation:  $*(-2)* = -2(-2)^2 = -2(4) = -8$
- 3. Answer choice (B) is the correct answer.** To find  $3 \diamond 1$ , plug in 3 for  $x$  and 1 for  $y$  in the original equation:  $3 \diamond 1 = 4(1) - 7(3) = 4 - 21 = -17$
- 4. Answer choice (A) is the correct answer.** To find  $-1 !! -1$  plug in  $-1$  for both  $a$  and  $b$  in the original equation:  $-1 !! -1 = (-1)^2 \div (-1) = 1 \div (-1) = -1$
- 5. Answer choice (C) is the correct answer.** To find  $-a \rightarrow b$  plug in  $-a$  for  $y$  and  $b$  for  $z$  in the original equation:  $-a \rightarrow b = 3(-a) - b = -3a - b$
- 6. Answer choice (B) is the correct answer.** To find  $2y \rightarrow 2z$  plug in  $2y$  for  $y$  and  $2z$  for  $z$  in the original equation:  $2y \rightarrow 2z = 3(2y) - 2z = 6y - 2z$
- 7. Answer choice (C) is the correct answer.** Find  $[[1]]$  and  $[[4]]$  separately and then subtract  $[[1]]$  minus  $[[4]]$ . Find  $[[1]]$  by plugging in 1 for  $n$  in the original equation:  $[[1]] = 18 - 6(1) = 12$ . Find  $[[4]]$  by plugging in 4 for  $n$  in the original equation:  $[[4]] = 18 - 6(4) = 18 - 24 = -6$ . Find  $[[1]] - [[4]]$ :  $12 - (-6) = 18$
- 8. Answer choice (B) is the correct answer.** To find the value of  $v$ , set  $[[n]]$  equal to  $[[v]]$  and  $n = v$  in the original equation:  $[[v]] = 18 - 6v$ . Now plug in 0 for  $[[v]]$  and solve for  $v$ :  $0 = 18 - 6v \rightarrow -18 = -6v \rightarrow v = 3$

- 9. Answer choice (C) is the correct answer.** To find the value of  $w$ , set  $[[n]]$  equal to  $[[w]]$  and  $n = w$  in the original equation:  $[[w]] = 18 - 6w$ . Now plug in 24 for  $[[w]]$  and solve for  $w$ :  $24 = 18 - 6w \rightarrow 6 = -6w \rightarrow w = -1$
- 10. Answer choice (C) is the correct answer.** Find  $||0||$  by plugging in 0 for  $y$  in the original equation:  $||0|| = \frac{1}{0^{-2}}$ . Change the negative exponent to a positive exponent to get  $||0|| = 0^2$  which equals 0. Therefore, answer choice (C) is false because  $||0||$  is NOT undefined.
- 11. Answer choice (C) is the correct answer.** I is true because  $c\Delta - c = c(-c)(c + (-c))$  and when you add  $c$  and  $-c$  you get 0. Therefore, when you multiply 0 by  $c$  and  $(-c)$ , the result is 0. II is true because flipping  $c$  and  $d$  does not change the equation:  $d\Delta c = dc(d + c) = cd(c + d)$ . III is NOT true because  $-c\Delta - d = (-c)(-d)(-c + (-d)) = cd(-c - d)$  which does not equal  $c\Delta d$ .
- 12. Answer choice (C) is the correct answer.** We cannot have a 0 in the bottom of a fraction. Therefore,  $x - y \neq 0$ , so  $x \neq y$ .
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### Quantitative Comparisons Set 1

- 1. Answer choice (A) is the correct answer.** Simplify Column B by distributing the 8 to get  $16a - 64$ . Column A and Column B both share a  $16a$ , so we want to compare the  $-8$  and the  $-64$  in the two columns. Since  $-8$  is greater than  $-64$ , Column A is greater than Column B.
- 2. Answer choice (B) is the correct answer.** Multiply the two binomials in Column A to get  $x^2 + x - 6$ . Column A and Column B both share  $x^2 + x$ , so we want to compare the  $-6$  and  $+6$ . Since  $+6$  is greater than  $-6$ , Column B is greater than Column A.
- 3. Answer choice (D) is the correct answer.** While we know that  $2x + 3y = 5$ , we cannot find the values of  $x$  and  $y$  without another equation. Therefore, we do not have enough information to determine the relationship between Column A and Column B.
- 4. Answer choice (D) is the correct answer.** Solve the given inequality to get  $x \geq -11$ . Since  $x$  can equal  $-11$  or anything greater than  $-11$ , we cannot compare it to Column B because if  $x = -11$ , then Column A is equals Column B; however, if  $x$  equals anything greater than  $-11$ , then Column A is greater than Column B. Therefore, we do not have enough information to determine the relationship between Column A and Column B.
- 5. Answer choice (A) is the correct answer.** Solve the absolute value equation by setting  $x - 3$  equal to 8 and  $-8$ . If  $x - 3 = 8$ , then  $x = 11$ . If  $x - 3 = -8$ , then  $x = -5$ . Therefore, the smallest possible value of  $x$  that satisfies the equation is  $-5$  which is larger than  $-6$ . Column A is greater than Column B.

6. **Answer choice (C) is the correct answer.** Since  $15^2 = (-15)^2$ , the given equation will be equal if we plug in 15 for  $x$  or  $-15$  for  $x$ .
7. **Answer choice (A) is the correct answer.** Start with Column A and find  $2x - y$  by dividing the given equation by 2:  $\frac{4x - 2y}{2} = \frac{-6}{2} \rightarrow 2x - y = -3$ . Next find Column B and find  $8x - 4y$  by multiplying the given equation by 2:  $2(4x - 2y) = 2(-6) \rightarrow 8x - 4y = -12$ . Since  $-3$  is greater than  $-12$ , Column A is greater than Column B.
8. **Answer choice (B) is the correct answer.** The minimum value of  $y$  is when  $x = 0$ . When  $x = 0$ ,  $y = 1$ . Since 2 is greater than 1, Column B is greater than Column A.
9. **Answer choice (C) is the correct answer.** Multiply the left side of the given equation to get  $x^2 - 3x + 3x - 9 = x^2 + ax - 9$ . Simplify the left side of the equation to get  $x^2 - 9 = x^2 + ax - 9$ . In order for both sides of the equation to be true,  $a$  must equal 0. Therefore, Columns A and B are equal.
10. **Answer choice (A) is the correct answer.** To make a fraction equal 0, the numerator must equal zero without the denominator equaling zero. Set each factor in the numerator equal to zero and solve. If  $x - 2 = 0$ , then  $x = 2$ . If  $x + 3 = 0$ , then  $x = -3$ . If  $x = 2$ , then the denominator also equals zero, so it is not a possible solution for  $x$ . Therefore,  $-3$  is the only value of  $x$  that makes the equation true. Since  $-3$  is greater than  $-5$ , Column A is greater than Column B.
11. **Answer choice (B) is the correct answer.** Set up an equation to find the number of dimes and quarters Carl has using  $x$  to represent the number of dimes. Since Carl has twice as many quarters as dimes, he has  $2x$  quarters. Therefore, the total value of his quarters and dimes is  $0.25(2x) + 0.1x$ . We know that Carl has a total of \$4.20, so set the expression equal to 4.20:  $0.25(2x) + 0.1x = 4.20$ . Solve the equation for  $x$ :  $0.5x + 0.1x = 4.2 \rightarrow 0.6x = 4.2 \rightarrow x = 7$ . Therefore, Carl has 7 dimes and 14 quarters. Find the value of his quarters by multiplying 14 by 0.25 to get \$3.50. Column B is greater than Column A.
12. **Answer choice (B) is the correct answer.** Set up an equation to find the number of dark chocolates using  $x$  to represent the number of dark chocolates. Since there are three times as many milk chocolates as dark chocolates, there are  $3x$  milk chocolates. There are 36 total chocolates, so  $x + 3x = 36$ . Solve the equation:  $4x = 36 \rightarrow x = 9$ . Since 12 is greater than 9, Column B is greater than Column A.
13. **Answer choice (B) is the correct answer.** Isolate  $b$  in the given equation by first subtracting  $a$  from both sides of the equation to get  $-b = -8 - a$ . Multiply both sides by  $-1$  to get  $b = 8 + a$ . Since  $a$  is greater than 0,  $8 + a$  is greater than  $8 - a$ . Therefore Column B is greater than Column A.

- 14. Answer choice (A) is the correct answer.** Solve the given inequality by setting  $2x + 4$  less than 6 and greater than  $-6$ . Solve  $2x + 4 < 6$  to get  $x < 1$ . Solve  $2x + 4 > -6$  to get  $x > -5$ . Since  $x$  has to be greater than  $-5$ , Column A is greater than Column B.
- 15. Answer choice (B) is the correct answer.** Find  $10 \oslash 6$  by replacing  $a$  with 10 and  $b$  with 6 in the given equation:  $10 \oslash 6 = 6 - 10 = -4$ . Since 4 is greater than  $-4$ , Column B is greater than Column A.

### Quantitative Comparisons Set 2

- 1. Answer choice (D) is the correct answer.** Foil out Column A:  $(x - 7)(x - 7) = x^2 - 14x + 49$ . Since we don't know if  $x$  is positive, negative, or 0, we cannot determine the relationship between  $x^2 - 14x + 49$  and  $x^2 + 49$ . If  $x$  is positive, Column B is greater. If  $x$  is negative, Column A is greater. If  $x = 0$ , the two columns are equal.
- 2. Answer choice (A) is the correct answer.** Since both  $a$  and  $b$  cannot equal 0,  $a^2$  and  $b^2$  will both be positive. The sum of two positive numbers is always greater than the difference between the same two positive numbers. Therefore, Column A is greater than Column B.
- 3. Answer choice (A) is the correct answer.** Solve the equation:  $\frac{1}{2}x - 3 = 7 \rightarrow \frac{1}{2}x = 10 \rightarrow x = 20$ . Column A is greater than Column B.
- 4. Answer choice (D) is the correct answer.** Solve the absolute value equation by setting  $x + 4$  equal to 10 and  $-10$ . If  $x + 4 = 10$ , then  $x = 6$ . If  $x + 4 = -10$ , then  $x = -14$ . If  $x = 6$ , the two columns are equal. However, if  $x = -14$ , Column B is greater than Column A. Therefore, we cannot determine the relationship between the two columns.
- 5. Answer choice (B) is the correct answer.** Solve the given inequality:  $2x - 3 < 1 \rightarrow 2x < 4 \rightarrow x < 2$ . Since  $x$  is less than 2, Column B is greater than Column A.
- 6. Answer choice (B) is the correct answer.** Isolate  $y$  in the given equation:  $x = y + 1 \rightarrow y = x - 1$ . Multiply both sides of the new equation by 3 to get  $3y = 3x - 3$ , so Column A equals  $3x - 3$ . Since Column A and B both have a  $3x$ , we just want to compare the  $-1$  and  $-3$ . Since  $-1$  is greater than  $-3$ , Column B is greater than Column A.
- 7. Answer choice (B) is the correct answer.**  $f(7) = 4 - 7^3 = 4 - 343 = -339$ .  $f(-7) = 4 - (-7)^3 = 4 - (-343) = 4 + 343 = 347$ . Therefore, Column B is greater than Column A because.
- 8. Answer choice (A) is the correct answer.** The maximum value of  $a$  is when  $b = -3$ , so the maximum value of  $a$  is  $10 - 3(-3) = 10 + 9 = 19$ . Since 19 is greater than 6, Column A is greater than Column B.

- 9. Answer choice (D) is the correct answer.** The absolute value of any number is greater than or equal to 0. Therefore,  $x$  can equal any real number, so we cannot determine the relationship between  $x$  and 4.
- 10. Answer choice (A) is the correct answer.** To make a fraction equal to 0, we need to make the numerator equal to zero, without the denominator equaling zero. Set each factor in the numerator equal to 0 and solve. If  $x - 4 = 0$ , then  $x = 4$ . If  $x - 1 = 0$ , then  $x = 1$ . If you plug  $-4$  in for  $x$ , the denominator is also zero. Therefore,  $-4$  is not a solution to the equation, so  $x = 1$  is the only solution. Since 1 is greater than  $-4$ , Column A is greater than Column B.
- 11. Answer choice (A) is the correct answer.** Let  $x$  represent the smaller number, so the larger number is  $x + 4$ . Set up an equation for the sum and solve:  $x + x + 4 = 64 \rightarrow 2x + 4 = 64 \rightarrow 2x = 60 \rightarrow x = 30$ . Therefore, the smaller number is 30, so Column A is greater than Column B.
- 12. Answer choice (C) is the correct answer.** Let  $x$  equal the number of hours Christina and Desi need to work to make the same amount. Christina makes  $50 + 5x$  dollars and Desi makes  $15x$  dollars. Set these equal and solve:  $50 + 5x = 15x \rightarrow 50 = 10x \rightarrow x = 5$ . Therefore, Christina and Desi need to work 5 hours to make the same amount of money, so Column A and Column B are equal.
- 13. Answer choice (B) is the correct answer.** Multiply the left side of the equation to get  $x^2 - 11x + 30 = x^2 - 11x - k$ . Therefore,  $-k$  must equal 30 for both sides of the equation to be true. If  $-k = 30$ , then  $k = -30$ , so Column B is greater than Column A.
- 14. Answer choice (B) is the correct answer.** Find the value of  $a$  by first replacing  $\langle x \rangle$  with  $\langle a \rangle$  and  $x$  with  $a$  in the original equation:  $\langle a \rangle = 5 + a$ . Now plug in 9 for  $\langle a \rangle$  and solve for  $a$ :  $9 = 5 + a \rightarrow a = 4$ . Therefore, Column B is greater than Column A.
- 15. Answer choice (C) is the correct answer.** Find Column A by plugging in 0 for  $y$  and solving for  $x$ :  $4x + 2(0) = 8 \rightarrow 4x = 8 \rightarrow x = 2$ . Find Column B by plugging in 1 for  $x$  and solving for  $y$ :  $4(1) + 2y = 8 \rightarrow 4 + 2y = 8 \rightarrow 2y = 4 \rightarrow y = 2$ . Therefore, Column A and Column B are equal.
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## MATH COURSE 4

### Basic and Conditional Probability Set 1

- 1. Answer choice (B) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. We want a number that is *no more than* 5. So we can choose 1, 2, 3, 4 or 5. Therefore, we have 5 favorable outcomes. Since we are choosing a number in between 1 and 20, we have 20 total outcomes. So the probability is  $5/20$  which simplifies to  $1/4$ .

2. **Answer choice (D) is the correct answer.** It doesn't matter if the first five times Gerald flipped the coin it landed on heads: we are only looking for the probability that the sixth flip lands on heads. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. The probability of a coin landing on heads is  $\frac{1}{2}$  because there is 1 way we can flip a heads and 2 total ways we can flip the coin (heads or tails).
3. **Answer choice (C) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. The favorable outcomes in this problem are choosing a blue or pink candy since we want the probability of NOT choosing red. There are 10 blue candies and 6 pink candies, so there are 16 favorable outcomes. There are 24 total outcomes because there are 24 total candies. Therefore, the probability equals  $\frac{16}{24}$  which simplifies to  $\frac{2}{3}$ .
4. **Answer choice (B) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. The favorable outcomes in this problem are choosing a gummy or a hard candy. There are 7 hard candies and 11 gummies, so there are 18 favorable outcomes. There are 30 total outcomes because there are 30 total pieces of candy. Therefore, the probability equals  $\frac{18}{30}$  which simplifies to  $\frac{3}{5}$ .
5. **Answer choice (B) is the correct answer.** It doesn't matter that Lucy chose a yellow marble because she put it back in the bag. We just want to find the probability that Ryan chooses a yellow marble. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. There are 4 yellow marbles, so there are 4 favorable outcomes. There are 18 total marbles, so there are 18 total outcomes. Therefore the probability is  $\frac{4}{18}$  which simplifies to  $\frac{2}{9}$ .
6. **Answer choice (C) is the correct answer.** If the probability of choosing a student who plays soccer is  $\frac{2}{5}$ , then  $\frac{2}{5}$  of the students play soccer. Find  $\frac{2}{5}$  of 30 by multiplying  $\frac{2}{5}$  by 30:  $\frac{2}{5} \cdot 30 = \frac{60}{5} = 12$ . Therefore, 12 students play soccer.
7. **Answer choice (D) is the correct answer.** In probability, the word *or* means *add*. To find the probability of event A *or* event C happening, add the probabilities of events A and C:  $0.35 + 0.45 = 0.8$ .
8. **Answer choice (A) is the correct answer.** Find the number of nickels and dimes in the bag by multiplying the probability of choosing a nickel or dime by the total number of coins:  $0.8 \cdot 60 = 48$ . Find the number of quarters by subtracting the number of nickels and dimes from the total number of coins:  $60 - 48 = 12$  quarters. One quarter equals \$0.25, so find the value of 12 quarters by multiplying 0.25 by 12:  $0.25 \cdot 12 = \$3.00$

9. **Answer choice (C) is the correct answer.** It doesn't matter that Cleo chose a 5: we just want to find the probability that Patty chooses a 5. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. We want to choose a 5, and there is only one way to choose a 5 from the numbers 1 through 10, so we have 1 favorable outcome. We are choosing a number between 1 and 10, so there are 10 total outcomes. Therefore, the probability is  $1/10$ .
10. **Answer choice (A) is the correct answer.** In probability, the word *or* means *add*. Therefore, the probability of A or B happening equals the probability of event A happening plus the probability of event B happening. Set  $P(A \text{ or } B)$  equal to  $P(A) + P(B)$ :  $0.9 = P(A) + 0.76$ . Subtract 0.76 from both sides to get  $P(A) = 0.14$ .

### Basic and Conditional Probability Set 2

1. **Answer choice (B) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. We want a number in between 1 and 30 inclusive that is *a multiple of 3*. So we can choose 3, 6, 9, 12, 15, 18, 21, 24, 27, or 30. Therefore, we have 10 favorable outcomes. Since we are choosing a number in between 1 and 30, we have 30 total outcomes. So the probability is  $10/30$  which simplifies to  $1/3$ .
2. **Answer choice (C) is the correct answer.** It doesn't matter that the first two rolls landed on 4: we are only looking for the probability that the next roll will be a 4. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. The probability of a die landing on 4 is  $1/6$  because there is 1 way we can roll a four out of 6 total ways we can roll the die.
3. **Answer choice (C) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. We want to pick a green or red block, so we have  $4 + 6 = 10$  favorable outcomes. There are  $15 + 6 + 4 = 25$  total blocks. Therefore, the probability of choosing a red or green block is  $10/25$  which equals  $2/5$ .
4. **Answer choice (D) is the correct answer.** To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. We do NOT want to land on a 4, so we can land on 1, 2, 3, 5 or 6. Therefore, we have 5 favorable outcomes. Since there are 6 sectors on the spinner, we have 6 total outcomes, so the probability is  $5/6$ .
5. **Answer choice (D) is the correct answer.** If the probability of hitting a blue section is 20%, then 20% of the sections are blue. Find the number of blue sections:  $20\% \text{ of } 10 = 0.2 \cdot 10 = 2$ . We want to know how many sections are NOT blue, so subtract the blue sections from the total section:  $10 - 2 = 8$ .

6. **Answer choice (C) is the correct answer.** Find the number of quarters in the bag by multiplying the probability of choosing a quarter by the total number of coins:  $0.4 \cdot 80 = 32$  quarters. Find the number of nickels and dimes by subtracting the number of quarters from the total number of coins:  $80 - 32 = 48$  nickels and dimes.
7. **Answer choice (A) is the correct answer.** We are just looking for the probability that Greg's coin lands on tails, so it does not matter that Harrison's coin landed on heads. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. When flipping a coin, there is one way to flip tails and two total ways to flip the coin. Therefore, the probability of flipping a tails is 1 out of 2 which equals 50%.
8. **Answer choice (A) is the correct answer.** In probability, the word *or* means *add*. To find the probability of event A *or* event B happening, add the probabilities of events A and B:  $0.3 + 0.6 = 0.9$ .
9. **Answer choice (C) is the correct answer.** Since Arianna put her quarter back into the jar after she chose it, that event does not affect the probability that Isaac chooses a quarter. To find the probability of a given event, divide the number of favorable outcomes by the number of total outcomes. Since there are 10 quarters, there are 10 favorable outcomes. There are  $10 + 5 + 15 = 30$  total coins, so there are 30 total outcomes. Therefore, the probability is  $10/30$  which simplifies to  $1/3$ .
10. **Answer choice (B) is the correct answer.** In probability, the word *or* means *add*. Therefore, the probability of B or C happening equals the probability of event B happening plus the probability of event C happening. Set  $P(B \text{ or } C)$  equal to  $P(B) + P(C)$ :  $0.3 = 0.04 + P(C)$ . Subtract 0.04 from both sides to get  $P(C) = 0.26$ .
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### Intermediate Probability Set 1

1. **Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probability of each event. The probabilities of flipping a heads or a tails are both  $\frac{1}{2}$ , so multiply  $\frac{1}{2}$  by itself six times:  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{64}$ .
2. **Answer choice (D) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling a 4 on a standard die is  $\frac{1}{6}$ , so multiply  $\frac{1}{6}$  times  $\frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$ .

3. **Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of answering one of the questions correctly is  $\frac{1}{4}$ , so multiply  $\frac{1}{4}$  times  $\frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$ .
4. **Answer choice (B) is the correct answer.** There are 36 possible ways you can roll two standard dice because each die has 6 sides and  $6 \cdot 6 = 36$ . To roll a sum of 4, you can roll a 1 and then a 3, a 3 and then a 1, or a 2 and then a 2. Therefore, there are 3 out of 36 ways to roll a sum of 4, so the probability is  $\frac{3}{36} = \frac{1}{12}$ .
5. **Answer choice (B) is the correct answer.** In probability, the word *and* means *multiply*. Therefore, the probability of A and B happening equals the probability of event A happening times the probability of event B happening. Set P(A and B) equal to P(A) • P(B):  $0.06 = 0.6 \cdot P(B)$ . Divide both sides by 0.6 to get P(B) = 0.1.
6. **Answer choice (D) is the correct answer.** In probability, the word *and* means *multiply*. Therefore, the probability of A and C happening equals the probability of event A happening times the probability of event C happening: P(A and C) = P(A) • P(B) =  $0.15 \cdot 0.4 = 0.06$ .
7. **Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling a 6 on a 12-sided die is  $\frac{1}{12}$ , and the probability of flipping a coin heads up is  $\frac{1}{2}$ . Therefore, the probability of both events happening is  $\frac{1}{12} \cdot \frac{1}{2}$ .
8. **Answer choice (C) is the correct answer.** There are 36 possible ways you can roll two standard dice because each die has 6 sides and  $6 \cdot 6 = 36$ . To roll a sum greater than 9, you can roll a 5 and then a 5, a 4 and then a 6, a 6 and then a 4, a 5 and then a 6, a 6 and then a 5, or a 6 and then a 6. Therefore, there are 6 out of 36 ways to roll a sum greater than 9, so the probability is  $\frac{6}{36} = \frac{1}{6}$ .
9. **Answer choice (C) is the correct answer.** The probability of answer choice (A) is  $0.3 \cdot 0.3 = 0.09$ . The probability of answer choice (B) is  $0.2 \cdot 0.8 = 0.16$ . The probability of answer choice (C) is  $0.5 \cdot 0.5 = 0.25$ . The probability of answer choice (D) is  $0.3 \cdot 0.8 = 0.24$ . Since answer choice (C) has the highest probability, it is most likely to happen.

- 10. Answer choice (A) is the correct answer.** The probability of answer choice (A) is  $\frac{5}{35} = \frac{1}{7}$ . The probability of answer choice (B) is  $\frac{8}{35}$ . The probability of answer choice (C) is  $\frac{10}{18} = \frac{5}{9}$ . The probability of answer choice (D) is  $\frac{12}{20} = \frac{3}{5}$ . Answer choice (A) has the lowest probability.
- 11. Answer choice (B) is the correct answer.** Find the probability of choosing a gumball or sour candy by subtracting the probability of choosing a lollipop or chocolate from 1:  $1 - \frac{4}{10} = \frac{6}{10}$ . Since there are twice as many sour candies as gumballs, the probability of choosing a sour candy is twice the probability of choosing a gumball. Therefore, the probability of choosing a sour candy is  $\frac{4}{10}$  and the probability of choosing a gumball is  $\frac{2}{10}$ . Change the probability of choosing a gumball into a percent:  $\frac{2}{10} = 20\%$ .
- 12. Answer choice (C) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling at least a 3 on a standard die is  $\frac{4}{6}$  which equals  $\frac{2}{3}$ , so multiply  $\frac{2}{3}$  times itself three times:  $\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} = \frac{8}{27}$ .
- 13. Answer choice (B) is the correct answer.** If the probability of NOT choosing a white marble is  $\frac{5}{7}$ , then the probability of choosing a white marbles is  $1 - \frac{5}{7} = \frac{2}{7}$ . This means for every 2 white marbles, we need 7 total marbles. Answer choice (B) says 4 white marbles and 10 other marbles which means there are 14 total marbles. Therefore, the probability of choosing a white marble for answer choice (B) is  $\frac{4}{14}$  which simplifies to  $\frac{2}{7}$ .
- 14. Answer choice (B) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. Choosing two blue marbles at the same time is the same as choosing one blue marble, keeping it, and then choosing another blue marble. The probability of choosing the first blue marble is  $\frac{6}{12} = \frac{1}{2}$ . Since the first marble is not replaced, the probability of choosing the second blue marble is  $\frac{5}{11}$ . Therefore, the probability that both marbles are blue is  $\frac{1}{2} \cdot \frac{5}{11}$ .
- 15. Answer choice (C) is the correct answer.** The probability of throwing three darts and hitting a black space each time has to be less than the probability of throwing two times and hitting a black space each time, so cross out answer choices (A) and (B) because they are greater than  $\frac{1}{9}$ . To find

the probability of multiple events, multiply the probabilities of each event. This means that the probability of throwing two darts and hitting a black space each time equals the probability of throwing one dart and hitting a black space times itself, or square. Therefore, we are looking for a number squared that equals  $\frac{1}{9}$ . Since  $\left(\frac{1}{3}\right)^2$  equals  $\frac{1}{9}$ , the probability of throwing one dart and hitting a black space equals  $\frac{1}{3}$ . Find the probability of throwing three darts and hitting a black space each time by multiplying  $\frac{1}{3}$  by itself three times:  $\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{27}$

### Intermediate Probability Set 2

- Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of answering one of the questions correctly is  $\frac{1}{4}$ , so multiply  $\frac{1}{4}$  by itself three times:  $\frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64}$ .
- Answer choice (D) is the correct answer.** In probability, the word *and* means *multiply*. Therefore, the probability of A and C happening equals the probability of event A happening times the probability of event C happening. Set P(A and C) equal to P(A) • P(C):  $0.1 = P(A) \cdot 0.2$  Divide both sides by 0.2 to get P(A) = 0.5.
- Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling a 2 on a standard die is  $\frac{1}{6}$ , so multiply  $\frac{1}{6}$  by  $\frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$ .
- Answer choice (D) is the correct answer.** In probability, the word *and* means *multiply*. Therefore, the probability of A and B happening equals the probability of event A happening times the probability of event B happening:  $P(A \text{ and } B) = P(A) \cdot P(B) \rightarrow P(A \text{ and } B) = 0.3 \cdot 0.6 \rightarrow P(A \text{ and } B) = 0.18$
- Answer choice (B) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of flipping a coin and flipping a tails is  $\frac{1}{2}$ , so multiply  $\frac{1}{2}$  itself five times:  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{32}$ .

- 6. Answer choice (C) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling less than a 5 on a standard die is  $\frac{4}{6}$  which equals  $\frac{2}{3}$ , so multiply  $\frac{2}{3}$  by  $\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$ .
- 7. Answer choice (A) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. In a standard deck of cards, half of the cards are red. Therefore, the probability of choosing a red card is  $\frac{1}{2}$ . Since we replaced the first card, we still have 52 cards to choose from when we choose our second card. There are 4 cards labeled with a 3 in a standard deck, so the probability of choosing a card labeled with a 3 is  $\frac{4}{52} = \frac{1}{13}$ . Multiply the probabilities together to get  $\frac{1}{2} \cdot \frac{1}{13}$ .
- 8. Answer choice (B) is the correct answer.** There are 36 possible ways you can roll two standard dice because each die has 6 sides and  $6 \cdot 6 = 36$ . To roll a sum of 3, you can roll a 1 and then a 2, or a 2 and then a 1. Therefore, there are 2 out of 36 ways to roll a sum of 3, so the probability is  $\frac{2}{36} = \frac{1}{18}$ .
- 9. Answer choice (C) is the correct answer.** Find the probability of each answer choice. To find the probability of multiple events, multiply the probabilities of each event. Since we are choosing two marbles at the same time, it is the same as choosing a marble, keeping it, and choosing another. Therefore, since we don't replace the first marble, we have one fewer marble on the second pick. The probability of choice (A) is  $\frac{8}{24} \cdot \frac{7}{23} = \frac{56}{552}$ . The probability for choice (B) is  $\frac{12}{24} \cdot \frac{11}{23} = \frac{121}{552}$ . The probability for choice (C) is  $\frac{4}{24} \cdot \frac{6}{23} = \frac{24}{552}$ . The probability for choice (D) is  $\frac{8}{24} \cdot \frac{6}{23} = \frac{48}{552}$ . The events in choice (C) have the *smallest* probability, so they are the *least likely* to happen.
- 10. Answer choice (D) is the correct answer.** Find the probability of each answer choice. The probability of choice (A) is  $\frac{2}{8} = \frac{1}{4}$ . The probability of choice (B) is  $\frac{4}{12} = \frac{1}{3}$ . The probability of choice (C) is  $\frac{2}{20} = \frac{1}{10}$ . The probability of choice (D) is  $\frac{8}{20} = \frac{4}{10}$ .  $\frac{4}{10}$  is the greatest fraction, so the probability of choice (D) happening is the highest.

- 11. Answer choice (C) is the correct answer.** Since there are three times as many heart cards as star cards, then the number of stars is one-third of the number of heart cards. Therefore, the probability of choosing a star card is one-third of the probability of choosing a heart card, so the probability of choosing a star card =  $\frac{2}{5} \cdot \frac{1}{3} = \frac{2}{15}$ . The probabilities of choosing each type of card must add to 1, so subtract the probability of choosing a heart card and the probability of choosing a star card from 1 to find the probability of choosing a triangle card
- $$1 - \frac{2}{5} - \frac{2}{15} = \frac{7}{15} \text{ or } 7 \text{ out of } 15$$
- 12. Answer choice (C) is the correct answer.** To find the probability of multiple events, multiply the probabilities of each event. The probability of rolling at most a 5 on a standard die is  $\frac{5}{6}$ , so multiply  $\frac{5}{6}$  by itself three times:  $\frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216}$ .
- 13. Answer choice (B) is the correct answer.** The number of marbles in the bag must be a multiple of the denominator of the probability or else we will have a fractional amount of purple marbles. Therefore, the only possible number of marbles is 20 because 20 is a multiple of 5.
- 14. Answer choice (B) is the correct answer.** Find the probability of each answer choice. To find the probability of multiple events, multiply the probabilities of each event. Since we are choosing two marbles at the same time, it is the same as choosing a marble, keeping it, and choosing another. Therefore, since we don't replace the first marble, we have one fewer marble on the second pick. For the first marble, we have a  $\frac{4}{20}$  or  $\frac{1}{5}$  chance of choosing a red marble, but for the second marble we only have a  $\frac{3}{19}$  chance. Therefore, the probability of choosing two red marbles is  $\frac{1}{5} \cdot \frac{3}{19}$
- 15. Answer choice (C) is the correct answer.** The probability of the spinner landing on red two times has to be greater than the probability of the spinner landing on red three, so cross out answer choices (A) and (B) because they are less than  $\frac{1}{8}$ . To find the probability of multiple events, multiply the probabilities of each event. This means that the probability of the spinner landing on red three times equals the probability of landing on red once times itself three times, or cubed. Therefore, we are looking for a number cubed that equals  $\frac{1}{8}$ . Since  $\left(\frac{1}{2}\right)^3$  equals  $\frac{1}{8}$ , the

probability of landing on a red space once is  $\frac{1}{2}$ . Find the probability of landing on a red space twice by multiplying  $\frac{1}{2}$  by itself:  $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

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### Expected Value Set 1

- Answer choice (B) is the correct answer.** To find the expected number of rolls that land on 4, multiply the probability of rolling a 4 by the total number of rolls:  $\frac{1}{6} \cdot 30 = 5$
- Answer choice (C) is the correct answer.** To find the expected number of heads, multiply the probability of flipping a heads by the total number of flips:  $\frac{1}{2} \cdot 50 = 25$
- Answer choice (D) is the correct answer.** To find the expected number of stripes, multiply the number of stripes in the left column by the probability in the right column, and then add the results: Row 1:  $2 \cdot 0.2 = 0.4$  Row 2:  $3 \cdot 0.3 = 0.9$  Row 3:  $4 \cdot 0.1 = 0.4$  Row 4:  $5 \cdot 0.4 = 2$ . Add the results:  $0.4 + 0.9 + 0.4 + 2 = 3.7$
- Answer choice (C) is the correct answer.** To find the expected number of heads, multiply the number of heads in the left column by the probability in the right column, and then add the results: Row 1:  $0 \cdot 1/16 = 0$  Row 2:  $1 \cdot 4/16 = 4/16$  Row 3:  $2 \cdot 6/16 = 12/16$  Row 4:  $3 \cdot 4/16 = 12/16$  Row 5:  $4 \cdot 1/16 = 4/16$ . Add the results:  $0 + \frac{4}{16} + \frac{12}{16} + \frac{12}{16} + \frac{4}{16} = \frac{32}{16} = 2$
- Answer choice (B) is the correct answer.** To find the expected number of heads, multiply the probability of flipping a heads by the total number of flips:  $\frac{1}{2} \cdot 27 = 13.5$

### Expected Value Set 2

- Answer choice (B) is the correct answer.** To find the expected number of rolls that land on 3, multiply the probability of rolling a 3 by the total number of rolls:  $\frac{1}{6} \cdot 24 = 6$
- Answer choice (A) is the correct answer.** To find the expected number of heads, multiply the probability of flipping a heads by the total number of flips:  $\frac{1}{2} \cdot 36 = 18$ .

3. **Answer choice (C) is the correct answer.** To find the expected number of dots, multiply the number of dots in the left column by the probability in the right column, and then add the results:  
Row 1:  $1 \cdot 0.2 = 0.2$  Row 2:  $2 \cdot 0.1 = 0.2$  Row 3:  $3 \cdot 0.4 = 1.2$  Row 4:  $4 \cdot 0.2 = 0.8$  Row 5:  $5 \cdot 0.1 = 0.5$  Add the results:  $0.2 + 0.2 + 1.2 + 0.8 + 0.5 = 2.9$
4. **Answer choice (B) is the correct answer.** To find the expected number of tails, multiply the probability of flipping a tails by the total number of flips:  $\frac{1}{2} \cdot 61 = 30.5$ .
5. **Answer choice (C) is the correct answer.** To find the expected number of tails, multiply the number of tails in the left column by the probability in the right column, and then add the results:  
Row 1:  $0 \cdot 1/32 = 0$  Row 2:  $1 \cdot 5/32 = 5/32$  Row 3:  $2 \cdot 10/32 = 20/32$  Row 4:  $3 \cdot 10/32 = 30/32$   
Row 5:  $4 \cdot 5/32 = 20/32$  Row 6:  $5 \cdot 1/32 = 5/32$  Add the results:  $0 + \frac{5}{32} + \frac{20}{32} + \frac{30}{32} + \frac{20}{32} + \frac{5}{32} = \frac{80}{32} = 2 - \frac{16}{32} = 2.5$
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### Permutations and Combinations Set 1

1. **Answer choice (C) is the correct answer.** To find the total number of outfits, multiply the number of shirts by the number of skirts:  $4 \cdot 3 = 12$ .
2. **Answer choice (A) is the correct answer.** To find the total number of ways to choose one soda, one candy, and one popcorn, multiply the number of sodas, the number of candies, and the number of popcorns you can choose from:  $7 \cdot 5 \cdot 2 = 70$
3. **Answer choice (D) is the correct answer.** Since Penny can choose a number between 1 and 9 for each digit of her code and repeat numbers, she can choose from 9 numbers for each digit in her code. Therefore, to find the total number of codes she can create, multiply 9 by itself 5 times:  $9 \cdot 9 \cdot 9 \cdot 9 \cdot 9$
4. **Answer choice (C) is the correct answer.** Since Rohan can choose a letter for each digit of his password, but he CANNOT repeat letters, he can choose from 26 letters for the first digit, then from 25 letters for the second digit, then from 24 letters for the third digit and so on. Therefore, the total number of passwords he can create is  $26 \cdot 25 \cdot 24 \cdot 23 \cdot 22 \cdot 21$
5. **Answer choice (A) is the correct answer.** Since the first and last digit of Mason's password must be vowels, and letters CANNOT repeat, he can choose from 5 vowels for the first digit and 4 vowels for the last digit. Therefore, the number of ways he can choose the two vowels is  $5 \cdot 4$ . Now he has three more letters to choose. Since he has already chosen two letters, he can choose from 24 letters for the third letter, then from 23 letters for the fourth letter, and from 22 letters for

the fifth letter. Therefore, the number of ways he can choose the last three letters is  $24 \cdot 23 \cdot 22$ . Multiply the number of ways he can choose the vowels by the number of ways he can choose the last three letters to get  $5 \cdot 4 \cdot 24 \cdot 23 \cdot 22$

6. **Answer choice (B) is the correct answer.** Suzan can answer each question in 4 ways since each question has 4 answer choices. Therefore, to find the number of ways she can fill in all 5 answers, multiply 4 by itself 5 times:  $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 4^5$
7. **Answer choice (D) is the correct answer.** Since Barry needs to choose from a number in between 0 and 9 inclusive for the first three characters and the numbers can repeat, he has 10 ways to choose each of the first three characters. Therefore, the number of way he can choose the first three characters is  $10 \cdot 10 \cdot 10 = 10^3$ . Since Barry needs to choose a letter for the next four characters and the letters can repeat, he has 26 ways to choose each of the next four characters. Therefore, the number of ways he can choose the next four characters is  $26 \cdot 26 \cdot 26 \cdot 26 = 26^4$ . Multiply the number of ways Barry can choose the first three characters by the number of ways Barry can choose the last four characters to get  $10^3 \cdot 26^4$
8. **Answer choice (C) is the correct answer.** We want to arrange the letters of WARM in different orders. When choosing the first letter, we have 4 letters to choose from. When choosing the second letter, we have the remaining 3 letters to choose from. When choosing the third letter, we have the remaining 2 letters to choose from, and for the last letter we only have the remaining letter to choose from. Find the total ways we can arrange the numbers by multiply  $4 \cdot 3 \cdot 2 \cdot 1 = 24$ .
9. **Answer choice (C) is the correct answer.** We want to arrange the numbers 1, 2, 3, 4, 5 in different orders. When choosing the first number, we have 5 numbers to choose from. When choosing the second number, we have the remaining 4 numbers to choose from. When choosing the third number, we have the remaining 3 numbers to choose from. When choosing the fourth number we have the remaining 2 numbers to choose from, and when choosing the last number we only have the remaining number to choose from. Find the total ways we can arrange the numbers by multiplying  $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$ .
10. **Answer choice (A) is the correct answer.** Since Nancy has to go to the store, we need to choose 2 more people from Joe, Terrance, Rob and Lucas. Since the order doesn't matter, we are looking for the number of 2 person *combinations* that we can choose from 4 people, so we want to find  $C(4, 2)$ . To find  $C(4, 2)$ , use the combination formula:  $C(n, r) = \frac{n!}{r!(n-r)!} = \frac{4!}{2!(4-2)!} = \frac{24}{2(2)} = \frac{24}{4} = 6$ . You can also list out all of the combinations of two people:
- (1) Joe, Terrance (2) Joe, Rob (3) Joe, Lucas  
(4) Terrance, Rob (5) Terrance, Lucas (6) Rob, Lucas
11. **Answer choice (C) is the correct answer.** We want to choose 3 people from 8 members to fill three positions. For the first position, we have 8 members to choose from. For the second position,

we only have the remaining 7 members to choose from. For the third position, we only have the remaining 6 members to choose from. Find the total number of ways we can fill the three slots by multiplying  $8 \cdot 7 \cdot 6 = 336$ .

- 12. Answer choice (B) is the correct answer.** The first and last books on the shelf have to be history books, and there are two history books to choose from. When choosing the history book to go in the first slot, we have 2 choices. When choosing the history book to go in the last slot, we only have 1 choice since we've already used the other history book. Therefore, to find the number of ways we can arrange the two history books, multiply  $2 \cdot 1$  to get 2. For the math books, we have to arrange 3 of them. For the first slot, we have 3 books to choose from, for the second slot, we only have 2 books to choose from since we've already used one of the books to fill the first slot, and for the third slot we have 1 book to choose from. Therefore, to find the number of ways we can arrange the math books, multiply  $3 \cdot 2 \cdot 1$  to get 6. Multiply the number of ways we can arrange the history books by the number of ways we can arrange the math books:  $2 \cdot 6 = 12$ .

- 13. Answer choice (C) is the correct answer.** Since the order that Romy chooses the two pieces of candy doesn't matter, we are looking for the number of 2 candy *combinations* that Romy can choose from 5 pieces, so we want to find  $C(5, 2)$ . To find  $C(5, 2)$ , use the combination formula:

$C(n, r) = \frac{n!}{r!(n-r)!} = \frac{5!}{2!(5-2)!} = \frac{120}{2(6)} = \frac{120}{12} = 10$ . You can also list out all of the combinations of two candies, using the numbers 1, 2, 3, 4, and 5 to represent the five pieces of candy.

(1, 2) (1, 3) (1, 4), (1, 5)  
 (2, 3) (2, 4) (2, 5)  
 (3, 4) (3, 5)  
 (4, 5)

- 14. Answer choice (A) is the correct answer.** We want to arrange 6 DVDs in different orders. When choosing the first DVD, we have 6 DVDs to choose from. When choosing the second DVD, we only have the remaining 5 DVDs to choose from. When choosing the third DVD, we only have the remaining 4 DVDs to choose from. This pattern continues and we have 3 options, 2 options, and 1 option for the next three DVDs. Therefore, the total number of ways we can choose the 6 DVDs is  $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$ .

- 15. Answer choice (B) is the correct answer.** Since the order in which Mr. McLaughlin chooses the boys and girls doesn't matter, we are solving a *combination* problem. Start with the boys: Mr. McLaughlin wants to choose 2 boys out of 4 boys, so we want to find  $C(4, 2)$ . To find  $C(4, 2)$ , use the combination formula:  $C(n, r) = \frac{n!}{r!(n-r)!} = \frac{4!}{2!(4-2)!} = \frac{24}{2(2)!} = \frac{24}{4} = 6$ . Next find the girls: Mr. McLaughlin wants to choose 2 girls out of 3 girls, so we want to find  $C(3, 2)$ . To find  $C(3, 2)$ , use the combination formula:  $C(n, r) = \frac{n!}{r!(n-r)!} = \frac{3!}{2!(3-2)!} = \frac{6}{2(1)!} = \frac{6}{2} = 3$ . Multiply the

number of ways that Mr. McLaughlin can choose the boys by the number of ways Mr. McLaughlin can choose the girls:  $6 \cdot 3 = 18$ .

### Permutations and Combinations Set 2

- 1. Answer choice (C) is the correct answer.** To find the total number of outfits, multiply the number of shirts by the number of pairs of jeans:  $6 \cdot 2 = 12$ .
- 2. Answer choice (D) is the correct answer.** To find the total number of ways to choose one sauce, one topping, and one cheese, multiply the number of sauces, the number of toppings, and the number of cheeses you can choose from:  $3 \cdot 6 \cdot 4 = 72$
- 3. Answer choice (D) is the correct answer.** Since Barry can choose a number between 0 and 5 for each digit of his password, he can choose from 6 numbers for the first digit of his password. However, since he cannot repeat numbers, he can only choose from 5 numbers for the next digit, 4 numbers for the next digit, and 3 numbers for the final digit. Therefore, total number of passwords he can create is  $6 \cdot 5 \cdot 4 \cdot 3$
- 4. Answer choice (B) is the correct number.** Since Kelly is choosing a letter for each digit of her code, and since she can repeat letters, she has 26 letters to choose from for each digit. Therefore, to find the total number of codes she can make, multiply 26 by itself 5 times:  $26 \cdot 26 \cdot 26 \cdot 26 \cdot 26 = 26^5$
- 5. Answer choice (A) is the correct answer.** Since the first and last characters have to be *different* letters, Angela cannot repeat letters. So for the first letter she has 26 choices, but for the second letter she only has 25 choices. Therefore, she has  $26 \cdot 25$  ways to choose the two letters. For the numbers, she also cannot repeat since she needs different numbers. She has 10 numbers to choose from for the first number, then 9, then 8. Therefore, the number of ways she can choose the three numbers is  $10 \cdot 9 \cdot 8$ . Multiply the number of ways to choose the two letters by the number of ways to choose the two numbers to get  $26 \cdot 10 \cdot 9 \cdot 8 \cdot 25$
- 6. Answer choice (A) is the correct answer.** Each question has 3 answer choices, so there are 3 ways to answer each question. Therefore, to find the number of ways to answer 7 questions, multiply 3 by itself 7 times:  $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^7$
- 7. Answer choice (D) is the correct answer.** Since Garret can repeat numbers and is choosing a number in between 0 and 9 inclusive, he can choose from 10 numbers each time. Therefore, the number of ways he can choose 3 numbers is  $10 \cdot 10 \cdot 10 = 10^3$ . Since Garret cannot repeat letters and he is choosing vowels, he has 5 vowels to choose from for the first letter, 4 vowels to choose from for the second letter, and 3 vowels to choose from for the third letter. Therefore, the number of ways he can choose the 3 letters is  $5 \cdot 4 \cdot 3$ . Multiply the number of ways he can choose the numbers by the number of ways he can choose the letters to get  $10^3 \cdot 5 \cdot 4 \cdot 3$

- 8. Answer choice (D) is the correct answer.** We want to arrange 5 letters in different orders, so when choosing the first letter, we have 5 letters to choose from. When choosing the second letter, we only have the remaining 4 letters to choose from. When choosing the third letter, we only have the remaining 3 letters to choose from. When choosing the fourth letter, we only have 2 remaining letters to choose from. When choosing the final letter, we only have 1 remaining letter to choose from. Therefore, the number of ways to arrange the 5 letters is  $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$
- 9. Answer choice (B) is the correct answer.** We want to arrange the numbers 0, 1, 2, 3, 4, 5, 6, so we have 7 numbers to arrange in different orders. When choosing the first number, we have 7 numbers to choose from. When choosing the second number, we only have the remaining 6 numbers to choose from. When choosing the third number, we only have 5 numbers to choose from. This pattern continues for the fourth, fifth, sixth, and seventh number. Therefore, the number of ways we can arrange 7 the numbers equals  $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$  which equals  $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2$  because anything multiplied by 1 equals itself.
- 10. Answer choice (A) is the correct answer.** Since the order in which Mr. Brown chooses the students doesn't matter, we are solving a *combination* problem. Mr. Brown wants to choose 4 students out of 6 students, so we want to find  $C(6, 4)$ . To find  $C(6, 4)$ , use the combination formula:
- $$C(n, r) = \frac{n!}{r!(n-r)!} = \frac{6!}{4!(6-4)!} = \frac{720}{24(2)!} = \frac{720}{48} = 15.$$
- 11. Answer choice (D) is the correct answer.** We want to arrange four runners in four spots, so in the first spot, we have 4 runners to choose from. In the second spot, we have the 3 remaining runners to choose from. In the third spot, we have the 2 remaining runners to choose from. In the last spot, we only have the 1 remaining runner to choose from. Therefore, the number of ways the four runners can be arranged is  $4 \cdot 3 \cdot 2 \cdot 1 = 24$
- 12. Answer choice (C) is the correct answer.** Since the colors must alternate, we need to start with a blue shoe, so for the first blue shoe, we have 3 options. The next shoe is red, so we have 2 options. The next shoe is blue, so we have the 2 remaining blue shoes as options. The fourth shoe is red, so we have 1 red shoe left to choose from, and the fifth shoe is blue, so we have 1 blue shoe left to choose from. Therefore, the total number of options we have is  $3 \cdot 2 \cdot 2 \cdot 1 \cdot 1 = 12$
- 13. Answer choice (C) is the correct answer.** For the first place spot, we have 7 runners to choose from. For the second place spot, we only have the remaining 6 runners to choose from. For the third place spot, we only have the 5 remaining runners to choose from. Therefore, the total number of arrangements equals  $7 \cdot 6 \cdot 5 = 210$
- 14. Answer choice (B) is the correct answer.** Since the order in which Mrs. James chooses the kids doesn't matter, we are solving a *combination* problem. Mrs. James wants to choose 3 kids out of 6

kids, so we want to find  $C(6, 3)$ . To find  $C(6, 3)$ , use the combination formula:  $C(n, r) = \frac{n!}{r!(n-r)!}$

$$= \frac{6!}{3!(6-3)!} = \frac{720}{6(3)!} = \frac{720}{36} = 20.$$

- 15. Answer choice (A) is the correct answer.** Since the order of the shirts doesn't matter, we are solving a *combination* problem. Since Harold has to bring his lucky striped shirt and his red shirt, he only needs to choose 3 out of 5 shirts, so we want to find  $C(5, 3)$ . To find  $C(5, 3)$ , use the combination formula:  $C(n, r) = \frac{n!}{r!(n-r)!} = \frac{5!}{3!(5-3)!} = \frac{120}{6(2)!} = \frac{120}{12} = 10$ . You can also write out all of the combinations, using the numbers 1, 2, 3, 4, 5 to represent the five shirts:

(1, 2, 3) (1, 2, 4) (1, 2, 5) (1, 3, 4) (1, 3, 5) (1, 4, 5)  
 (2, 3, 4) (2, 3, 5) (2, 4, 5)  
 (3, 4, 5)

### Mean, Median, Mode, and Range Set 1

- 1. Answer choice (B) is the correct answer.** The mean of a set of data is equal to the sum of the numbers divided by the number of terms:  $\frac{-80 + 50 + 13 + 17 + (-20) + 14}{6} = -1$
- 2. Answer choice (B) is the correct answer.** The median of a set of data is the middle number when the numbers are in order from least to greatest:  $-80, -20, 13, 14, 17, 50$  because there are two middle numbers, 13 and 14, take the average of 13 and 14 to get 13.5
- 3. Answer choice (D) is the correct answer.** The mode of a set of data is the number that appears the most. Since each number in the data set appears only once, there is no mode.
- 4. Answer choice (D) is the correct answer.** The range of a set of data equals the difference between the highest and lowest number:  $50 - (-80) = 50 + 80 = 130$
- 5. Answer choice (A) is the correct answer.** The interquartile range of a set of data is the difference between quartile 3 and quartile 1. Order the numbers from least to greatest, and find quartile 1 by finding the median of the first half of the data:  $-80, -20, 13, 14, 17, 50 \rightarrow$  quartile 1 is the median of  $-80, -20, 13$  which is  $-20$ . Order the numbers from least to greatest, and find quartile 3 by finding the median of the second half of the data:  $-80, -20, 13, 14, 17, 50 \rightarrow$  quartile 3 is the median of  $14, 17, 50$  which is  $17$ . Find the difference between quartile 3 and quartile 1:  $17 - (-20) = 17 + 20 = 37$

6. **Answer choice (C) is the correct answer.** First find the median. The median of a set of data is the middle number when the numbers are in order from least to greatest: 6, 70, 70, 73, 74, 75, 76 the median is 73. Next, find the mode. The mode of a set of data is the number that appears the most: the mode is 70. Find the mean of the median and mode. The mean of a set of data is equal to the sum of the numbers divided by the number of terms:  $\frac{73 + 70}{2} = 71.5$
7. **Answer choice (B) is the correct answer.** Since 6 is an outlier, the mean does not represent the data well. The range is smaller than most of the numbers, so it does not represent the data well. The interquartile range is smaller than all of the numbers but 6, so it does not represent the data well. Therefore, the median represents the data best because it is the middle number.
8. **Answer choice (D) is the correct answer.** If you add 5 to every number in the data set, the mean, median, and mode each increase by 5. However, the range stays the same because we are adding 5 to the highest and lowest number, so the difference between the numbers does not change.
9. **Answer choice (A) is the correct answer.** If you subtract 7 from every number in the data set, the mean, median, and mode each decrease by 7, and the range stays the same. Therefore, answer choice (A) is the correct answer.
10. **Answer choice (C) is the correct answer.** Find the original median. The median of a set of data is the middle number when the numbers are in order from least to greatest: 6, 70, 70, 73, 74, 75, 76 the median is 73. If we add another integer to the data set, we will have an even number of terms. Therefore, the median will be the average between the two middle numbers. No matter what integer we add, 73 will always be one of the middle numbers. Therefore, in order for the median to stay at 73, we need to add a 73 to the data set. If we add any other number, the median will change.

### Mean, Median, Mode, and Range Set 2

1. **Answer choice (A) is the correct answer.** The mean of a data set equals the sum of the numbers divided by the number of terms:  $\frac{-45 + 40 + (-45) + 17 + (-4) + (-40) + (-7)}{7} = -12$
2. **Answer choice (C) is the correct answer.** The median of a set of data is the middle number when the numbers are in order from least to greatest: -45, -45, -40, -7, -4, 17, 40 the middle number is -7
3. **Answer choice (A) is the correct answer.** The mode of a set of data is the number that appears the most. Since -45 appears twice, which is more than any other number, -45 is the mode.
4. **Answer choice (D) is the correct answer.** The range of a set of data equals the difference between the highest and lowest number:  $40 - (-45) = 40 + 45 = 85$

5. **Answer choice (D) is the correct answer.** The interquartile range of a set of data is the difference between quartile 3 and quartile 1. Order the numbers from least to greatest, and find quartile 1 by finding the median of the first half of the data:  $-45, -45, -40, -7, -4, 17, 40 \rightarrow$  quartile 1 is the median of  $-45, -45, -40$  which is  $-45$ . Order the numbers from least to greatest, and find quartile 3 by finding the median of the second half of the data:  $-45, -45, -40, -7, -4, 17, 40 \rightarrow$  quartile 3 is the median of  $-4, 17, 40$  which is  $17$ . Find the difference between quartile 3 and quartile 1:  $17 - (-45) = 17 + 45 = 62$
6. **Answer choice (B) is the correct answer.** First find the median. The median of a set of data is the middle number when the numbers are in order from least to greatest:  $40, 40, 41, 43, 45, 46, 47$  the median is  $43$ . Next, find the range. The range is equal to the difference between the highest and lowest number:  $47 - 40 = 7$ . Find the mean of the median and range. The mean of a set of data is equal to the sum of the numbers divided by the number of terms:  $\frac{43 + 7}{2} = 25$
7. **Answer choice (A) is the correct answer.** The mean best represents the data because there is no outlier and the mean is the average of the data. The mode does not best represent the data because the mode is the smallest number in this data set. The range and interquartile range do not best represent the data because they are both smaller than every number in the data set.
8. **Answer choice (C) is the correct answer.** If you add 8 to every number in the data set, the mean, median, and mode each increase by 8. However, the interquartile range stays the same because we are adding 8 to every number, so quartile 1 and quartile 3 will each increase by 8. Therefore, the difference between quartile 1 and quartile 3 does not change.
9. **Answer choice (D) is the correct answer.** The range is the difference between the highest and lowest number. Therefore, the range of the original data set is  $47 - 40 = 7$ . If we double every number, the highest number becomes 94 and the lowest becomes 80. Therefore, the new range is  $94 - 80 = 14$ . Therefore, the range does not stay the same.
10. **Answer choice (B) is the correct answer.** The median of a set of data is the middle number when the numbers are in order from least to greatest:  $40, 40, 41, 43, 45, 46, 47$  so the median of the original set is  $43$ . If another number is added, we will have 8 numbers, so the median will be the average of the middle 2 numbers. If we add 45 to the set, we now have  $40, 40, 41, 43, 45, 45, 46, 47$ , so the two middle numbers are  $43$  and  $45$ . The average of  $43$  and  $45$  is  $44$ , so the median is  $44$ . Therefore, we need to add 45 to the set which is greater than 44.
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## Average Word Problems Set 1

1. **Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average of 2 numbers is 16, then the sum =  $16 \cdot 2 = 32$ . Find the second number by subtracting the first number from the sum:  $32 - 4 = 28$
2. **Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum by multiplying the average by three:  $48 \cdot 3 = 144$  inches.
3. **Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average of 2 numbers is 70, then the sum must equal  $70 \cdot 2 = 140$ . This means that  $x + y = 140$ . If you rearrange the equation in answer choice (A), you will get  $x + y = 140$ :  $70 - x = y - 70 \rightarrow 140 - x = y \rightarrow x + y = 140$ .
4. **Answer choice (C) is the correct answer.** If the average of three numbers is 20, let each number in the set equal 20 (the average of 20, 20, and 20 equals 20). So originally, our set of numbers is 20, 20, 20. Decrease two of the numbers by 6 to get 20, 14, 14. Find the average of 20, 14, and 14:  
 $average = \frac{20 + 14 + 14}{3} = \frac{48}{3} = 16$ .
5. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms. Find Toby's scoring average by dividing the total points by the number of games:  $156 \div 13 = 12$  points.
6. **Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average age of 3 boys is 16, then the sum is  $16 \cdot 3 = 48$ . If the average age of 2 girls is 6, then the sum is  $2 \cdot 6 = 12$ . Add  $48 + 12$  to get a total sum of 60 for all five kids' ages. Find the average by dividing the total age of 60 by 5 kids:  $60 \div 5 = 12$

7. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Therefore, the average of the three numbers and the four numbers =  $\frac{sum\ of\ 3\ numbers + sum\ of\ 4\ numbers}{total\ number\ of\ terms} = \frac{x + y}{7}$ .
8. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Therefore, the average of Vida's 6 tests =  $\frac{435 + 75}{6} = \frac{510}{6} = 85$
9. **Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Use  $x$  to represent how much money Lydia made on Friday, plug in 40 for the average and set up the equation  $40 = \frac{30 + 45 + 20 + 50 + x}{5}$ . Solve the equation:  $40 = \frac{145 + x}{5} \rightarrow 200 = 145 + x \rightarrow x = \$55$ .
10. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Use  $x$  to represent the sum of Carla's two last quiz scores, plug in 86 for the average of the 6 tests and set up the equation  $87 = \frac{87 + 93 + 75 + 77 + x}{6}$ . Solve the equation:  $87 = \frac{332 + x}{6} \rightarrow 522 = 332 + x \rightarrow x = 190$ . Since  $x$  represents the sum of Carla's last two quiz scores, find the average of the last two quizzes by dividing the sum by 2:  $190 \div 2 = 95$
11. **Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Add 3 to 85 to get that Lisa's test average after her 5th test was 88. Find the sum of Lisa's first four tests by multiplying  $85 \cdot 4 = 340$ . Now set up and equation using  $x$  to represent Lisa's score on her fifth test and 88 as the average of all five tests:  $88 = \frac{340 + x}{5}$ . Solve the equation:  $440 = 340 + x \rightarrow x = 100$
12. **Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up the following equation and solve:  $75 = \frac{a + 5a + 1.5a}{3} \rightarrow 75 = \frac{7.5a}{3} \rightarrow 225 = 7.5a \rightarrow a = 30$ .

- 13. Answer choice (B) is the correct answer.** If you add or subtract the same number from every number in a set, then the average changes by the amount you added or subtracted. Therefore, if you subtract 6 inches from every piece of wood, the average decreased by 6:  $48 - 6 = 42$  inches.
- 14. Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of the first five numbers by multiplying  $5 \cdot 18 = 90$ . Set up an equation using  $x$  to represent the added number and use 20 as the average:  $20 = \frac{90 + x}{6}$ . Solve the equation:  $120 = 90 + x \rightarrow x = 30$ .
- 15. Answer choice (A) is the correct answer.** If you add or subtract the same number from every number in a set, then the average changes by the amount you added or subtracted. Therefore, to decrease the mean by 3, we need to subtract 3 from each number in the set.
- 16. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . If the average the plant grew in three weeks is 4 cm, find the sum by multiplying the average of 4 by 3 to get a total of 12 cm. We want to find the maximum height the plant could have grown in one week. Since the plant grew at least 1 cm each week, say the plant grew 1 cm the first week and 1 cm the second week. Set up an equation that says the total amount the plant grew equals the sum of the amount it grew each week, using  $x$  as the amount the plant grew during the first week:  
 $12 = 1 + 1 + x$ . Solve the equation to get that  $x = 10$  cm.
- 17. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Therefore, the average of  $a$ ,  $b$ , and  $c = \frac{sum\ of\ a\ and\ b\ +\ c}{3} = \frac{60 + 15}{3} = \frac{75}{3} = 25$ .
- 18. Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up an equation using  $x$  to represent the sum of the other two numbers  $30 = \frac{100 + x}{4}$ . Solve the equation:  $120 = 100 + x \rightarrow x = 20$ . Since  $x$  represents the sum of the other two numbers, divide 20 by 2 to get an average of 10.

- 19. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of  $x$ ,  $y$ ,  $z$  and 20 by multiplying the average by 4:  $12 \cdot 4 = 48$ . Now we know  $x + y + z + 20 = 48$ . Subtract 20 from both sides to get that  $x + y + z = 28$ . The average of  $x + 2$ ,  $y - 4$ , and  $z - 8 = \frac{x + 2 + y - 4 + z - 8}{3}$ . Rearrange the top:  $\frac{x + y + z + 2 - 4 - 8}{3}$ . We know  $x + y + z = 28$ , so plug in 28 for  $x + y + z$  and solve:  $\frac{28 + 2 - 4 - 8}{3} = \frac{18}{3} = 6$ .

- 20. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of all 4 numbers by multiplying 4 by the average:  $4(5x + 10) = 20x + 40$ . Subtract the sum of the first two numbers from the total sum to find the sum of the last two numbers:  $20x + 40 - (12x - 8) = 20x + 40 - 12x + 8 = 8x + 48$

### Average Word Problems Set 2

- 1. Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average of 2 numbers is 28, then the sum =  $28 \cdot 2 = 56$ . Find the second number by subtracting the first number from the sum:  $56 - 18 = 38$
- 2. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average of 3 numbers is 30, then the sum must equal  $30 \cdot 3 = 90$ . This means that  $a + b + c = 90$ . If you isolate  $a$ , you get  $a = 90 - b - c$ .
- 3. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average age of 23 people is  $x$ , then the sum =  $23 \cdot x = 23x$
- 4. Answer choice (B) is the correct answer.** If the average of four numbers is 0, let each number in the set equal 0 (the average of 0, 0, 0, and 0 equals 0). So originally, our set of numbers is 0, 0, 0, 0.

Increase two of the numbers by 4 and decrease the other two numbers by 12 to get 4, 4, -12, -12

Find the average of 4, 4, -12, and -12:  $average = \frac{4 + 4 + (-12) + (-12)}{4} = \frac{-16}{4} = -4$ .

5. **Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Therefore, find the average number of miles Arie ran by dividing 216 by 18 to get 12 miles.
6. **Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Therefore, the average of the twelve numbers =  $\frac{sum\ of\ five\ numbers + sum\ of\ seven\ numbers}{12} = \frac{86 + 10}{12} = \frac{96}{12} = 8$
7. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Find the average number of points Abiene scored in the 8 games by dividing her total number of points by 8:  $average = \frac{84 + 16 + 4}{8} = \frac{104}{8} = 13$  points
8. **Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of the four terms with an average of  $x$  is  $4x$ , and the sum of the two terms with an average of  $y$  is  $2y$ . Find the average of all six terms by dividing the sum of the six terms by 6:  $average = \frac{4x + 2y}{6}$
9. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Since  $b$  is three times  $a$ , use  $3a$  to represent  $b$ . Write an equation for the average of the 7 numbers using 50 as the average:  $50 = \frac{100 + 40 + 70 + 30 + 90 + a + 3a}{7}$ . Solve the equation for  $a$ :  $50 = \frac{330 + 4a}{7} \rightarrow 350 = 330 + 4a \rightarrow 20 = 4a \rightarrow a = 5$ . Since we want the value of  $b$ , multiply the value of  $a$  by 3:  $3 \cdot 5 = 15$
10. **Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Use  $x$  to represent

Emily's fifth test score, plug in 87 for the average of the 5 tests and set up the equation  $87 = \frac{98 + 86 + 75 + 95 + x}{5}$ . Solve the equation:  $87 = \frac{354 + x}{5} \rightarrow 435 = 354 + x \rightarrow x = 81$ .

- 11. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of the first six quizzes by multiplying  $6 \cdot 92 = 552$ . Set up an equation using  $2x$  to represent the seventh quiz score (since it counted twice) and use 88 as the average (since her average of 92 went down by 4 points). Don't forget to divide by 8 quizzes because the last quiz counted twice:  $88 = \frac{552 + 2x}{8}$ . Solve the equation:  $704 = 552 + 2x \rightarrow 2x = 152 \rightarrow x = 76$
- 12. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up and solve an equation for the average of the three terms:  $34 = \frac{4x + 3x + (-10x)}{3} \rightarrow 34 = \frac{-3x}{3} \rightarrow -3x = 102 \rightarrow x = -34$
- 13. Answer choice (C) is the correct answer.** If every number in a data set increases by 4, then the average goes up by 4. Therefore, the new average height of the plants is  $38 + 4 = 42$  inches
- 14. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of the original 3 numbers by multiplying  $4 \cdot 3 = 12$ . Set up an equation to find the average of the four numbers, using  $x$  to represent the added number and use  $-1$  as the average (since the new average is 5 less than the original average of 4):  $-1 = \frac{12 + x}{4}$ . Solve the equation:  $-4 = 12 + x \rightarrow x = -16$
- 15. Answer choice (B) is the correct answer.** If you add the same number or subtract the same number from every number in that set, the average changes by the number you added or subtracted. Therefore, to bring the average from 10 to 8, we need to subtract 2 from each number.
- 16. Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . If the average score of the five players is 42, find the sum by multiplying the average of 42 by 5 to get a sum of 210 points. We want to find the maximum

score one player could have scored. Since each player scored at least 30 points, say that four of the players each scored 30 points and the fifth player scored the maximum number of points. Set up an equation that says the total score of the four players equals 210, using  $x$  as the amount the maximum points scored by the fifth player:  $210 = 30 + 30 + 30 + 30 + x$ . Solve the equation to get  $x = 90$  points

**17. Answer choice (A) is the correct answer.** First, find the sum of  $a$  and  $b$  by dividing the equation  $2a + 2b = 40$  by two to get  $a + b = 20$ . The average of a set of numbers equals the sum of the

numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . So the average of  $a$ ,  $b$

$$\text{and } c = \frac{sum\ of\ a\ and\ b\ +\ c}{3} = \frac{20 + 7}{3} = \frac{27}{3} = 9$$

**18. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the

numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up an equation using

$x$  to represent the sum of the other half of the numbers:  $14 = \frac{100 + x}{10}$ . Solve the equation:  $140 = 100 + x \rightarrow x = 40$ .

**19. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the

numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to

get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of  $x$  and  $y = 50 \cdot 2 = 100$ , and the sum of  $w$  and  $z = 30 \cdot 2 = 60$ . Set up and solve an equation for the average of  $x + 10$ ,  $y - 18$ , and  $w + z +$

$$4: average = \frac{x + 10 + y - 18 + w + z + 4}{3} = \frac{x + y + w + z - 4}{3} = \frac{100 + 60 - 4}{3} = \frac{156}{3} = 52$$

**20. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the

numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to

get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of the two numbers that have an average of  $x - 5$  is  $2(x - 5) = 2x - 10$ . Find the sum of the other two numbers by subtracting  $2x - 10$  from the sum of the four numbers:  $4x + 24 - (2x - 10) = 4x + 24 - 2x + 10 = 2x + 34$ . Therefore,

the sum of the other two numbers is  $2x + 34$ , so the average is  $\frac{2x + 34}{2} = x + 17$

### Consecutive Numbers Set 1

**1. Answer choice (C) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 1$  represent the larger integer since the larger of two consecutive integers is 1 more than the smaller. Set up the

equation  $x + x + 1 = 37$  and solve:  $2x + 1 = 37 \rightarrow 2x = 36 \rightarrow x = 18$ . Therefore, the smaller number is 18.

2. **Answer choice (D) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 2$  represent the larger integer since the larger of two consecutive even integers is 2 more than the smaller. Set up the equation  $x + x + 2 = 14$  and solve:  $2x + 2 = 14 \rightarrow 2x = 12 \rightarrow x = 6$ . Therefore, the smaller number is 6 and the larger number is 8. Find the product of the two number:  $6 \cdot 8 = 48$ .
3. **Answer choice (B) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 2$  represent the larger integer since the larger of two consecutive odd integers is 2 more than the smaller. Set up the equation  $x + x + 2 = 44$  and solve:  $2x + 2 = 44 \rightarrow 2x = 42 \rightarrow x = 21$ . Therefore, the smaller number is 21 and the larger number is 23.
4. **Answer choice (B) is the correct answer.** Let  $x$  equal the smallest integer,  $x + 1$  equal the middle integer, and  $x + 2$  equal the largest number. Set up the equation:  $x + x + 1 + x + 2 = 60$  and solve:  $3x + 3 = 60 \rightarrow 3x = 57 \rightarrow x = 19$ . Therefore, the smallest integer is 19 and the middle integer is 20.
5. **Answer choice (A) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 1$ ,  $x + 2$ ,  $x + 3$ , and  $x + 4$ . Set up the equation  $x + x + 1 + x + 2 + x + 3 + x + 4 = 130$  and solve:  $5x + 10 = 130 \rightarrow 5x = 120 \rightarrow x = 24$ . Therefore, the smallest integer is 24 and the largest is  $24 + 4 = 28$ . The sum of 24 and 28 is 52.
6. **Answer choice (A) is the correct answer.** Let  $x$  equal the smallest integer. The other three integers equal  $x + 2$ ,  $x + 4$ , and  $x + 6$ . Set up the equation  $x + x + 2 + x + 4 + x + 6 = 60$  and solve  $4x + 12 = 60 \rightarrow 4x = 48 \rightarrow x = 12$ . Therefore, the smallest integer is 12.
7. **Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 2$ ,  $x + 4$ ,  $x + 6$ , and  $x + 8$ . Set up the equation  $x + x + 2 + x + 4 + x + 6 + x + 8 = 45$  and solve  $5x + 20 = 45 \rightarrow 5x = 25 \rightarrow x = 5$ . Therefore, the smallest integer is 5 and the largest integer is  $5 + 8 = 13$ .
8. **Answer choice (C) is the correct answer.** Find 5 consecutive odd numbers: 1, 3, 5, 7, 9. Then find the difference between the smallest and the largest:  $9 - 1 = 8$ .
9. **Answer choice (A) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 1$ ,  $x + 2$ ,  $x + 3$ , and  $x + 4$ . Set up the equation  $x + x + 1 + x + 2 + x + 3 + x + 4 = 0$  and solve:  $5x + 10 = 0 \rightarrow 5x = -10 \rightarrow x = -2$ . Therefore, the smallest integer is  $-2$ .
10. **Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 2$ ,  $x + 4$ ,  $x + 6$ , and  $x + 8$ . Set up the equation  $x + x + 2 + x + 4 + x + 6 + x + 8 = 5$  and solve:  $5x + 20 = 5 \rightarrow 5x = -15 \rightarrow x = -3$ . Therefore, the smallest integer is  $-3$  and the largest integer is  $-3 + 8 = 5$ .

- 11. Answer choice (D) is the correct answer.** Let  $x$  equal the smallest of five consecutive integers. Therefore, the largest is  $x + 4$ . Set up an equation that says, “the largest plus twice the smallest equals 16”:  $x + 4 + 2x = 16$ . Solve the equation  $3x + 4 = 16 \rightarrow 3x = 12 \rightarrow x = 4$ . Therefore, the smallest integer is 4.
- 12. Answer choice (A) is the correct answer.** Let  $x$  equal the smallest integer. Therefore, the largest is  $x + 4$ . Set up an equation that says, “the largest integer equals one-third of the smallest integer”:  $x + 4 = \frac{1}{3}x$ : Solve the equation:  $3x + 12 = x \rightarrow 12 = -2x \rightarrow x = -6$ . Therefore, the smallest integer is  $-6$ .
- 13. Answer choice (A) is the correct answer.** If 0 is the larger integer, then  $-1$  is the smaller integer.  $0$  divided by  $-1$  equals  $0$ .
- 14. Answer choice (A) is the correct answer.** While you can set up an equation for this problem, it’s quicker to use reasoning and the answer choices. Answer choices (C) and (D) are too big because  $50 \cdot 50 = 2500$  which is way bigger than 110. Test answer choice (A): if 10 is the smaller integer, then 11 is the greater integer, and  $10 \cdot 11 = 110$ . Therefore, answer choice (A) is correct.
- 15. Answer choice (C) is the correct answer.** Use reasoning and the answer choices. Answer choices (A) and (B) are too big because  $60 \cdot 60 \cdot 60 = 216,000$  which is way bigger than 192. Test answer choice (C): if 8 is the largest integer, then 6 and 4 are the other integers, and  $8 \cdot 6 \cdot 4 = 192$ . Therefore, answer choice (C) is correct.
- 16. Answer choice (A) is the correct answer.** Let  $x$  equal the smaller integer, so the larger integer is  $x + 1$ . The product of  $x$  and  $x + 1$  is  $x(x + 1)$ . Set this equal to 42:  $x(x + 1) = 42$ .
- 17. Answer choice (B) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of five consecutive integers is 20, then the numbers are 18, 19, 20, 21, 22. The smallest integer is 18.
- 18. Answer choice (C) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of three consecutive integers is  $-2$ , then the numbers are  $-3, -2, -1$ . The largest integer is  $-1$ .
- 19. Answer choice (A) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of five consecutive even integers is 6, then the numbers are 2, 4, 6, 8, 10. The smallest integer is 2.
- 20. Answer choice (B) is the correct answer.** The average of a set of consecutive integers is always the *median*. Since we are taking the average of four integers and four is an even number, the

*median* is the average or middle of the two middle numbers. Therefore, the numbers are 11, 13, 15, 17 because 14 is in the middle of 13 and 15. The largest integer is 17.

### Consecutive Numbers Set 2

- 1. Answer choice (D) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 1$  represent the larger integer since the larger of two consecutive integers is 1 more than the smaller. Set up the equation  $x + x + 1 = 19$  and solve:  $2x + 1 = 19 \rightarrow 2x = 18 \rightarrow x = 9$ . Therefore, the two numbers are 9 and 10, so the product is  $9 \cdot 10 = 90$ .
- 2. Answer choice (C) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 2$  represent the larger integer since the larger of two consecutive even integers is 2 more than the smaller. Set up the equation  $x + x + 2 = 70$  and solve:  $2x + 2 = 70 \rightarrow 2x = 68 \rightarrow x = 34$ . Therefore, the smaller number is 34 and the larger number is 36.
- 3. Answer choice (A) is the correct answer.** Let  $x$  equal the smaller integer and  $x + 2$  represent the larger integer since the larger of two consecutive odd integers is 2 more than the smaller. Set up the equation  $x + x + 2 = 52$  and solve:  $2x + 2 = 52 \rightarrow 2x = 50 \rightarrow x = 25$ . Therefore, the smaller number is 25.
- 4. Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer. The other three integers equal  $x + 1$ ,  $x + 2$ , and  $x + 3$ . Set up the equation  $x + x + 1 + x + 2 + x + 3 = 98$  and solve:  $4x + 6 = 98 \rightarrow 4x = 92 \rightarrow x = 23$ . Therefore, the smallest integer is 23 and the largest is  $23 + 3 = 26$ .
- 5. Answer choice (B) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 1$ ,  $x + 2$ ,  $x + 3$ , and  $x + 4$ . Set up the equation  $x + x + 1 + x + 2 + x + 3 + x + 4 = 75$  and solve:  $5x + 10 = 75 \rightarrow 5x = 65 \rightarrow x = 13$ . Therefore, the integers are 13, 14, 15, 16, 17, so 15 is the middle integer.
- 6. Answer choice (B) is the correct answer.** Let  $x$  equal the smallest integer. The other three integers equal  $x + 2$ ,  $x + 4$ , and  $x + 6$ . Set up the equation  $x + x + 2 + x + 4 + x + 6 = 40$  and solve  $4x + 12 = 40 \rightarrow 4x = 28 \rightarrow x = 7$ . Therefore, the smallest integer is 7.
- 7. Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer. The other four integers equal  $x + 2$ ,  $x + 4$ ,  $x + 6$ , and  $x + 8$ . Set up the equation  $x + x + 2 + x + 4 + x + 6 + x + 8 = 70$  and solve  $5x + 20 = 70 \rightarrow 5x = 50 \rightarrow x = 10$ . Therefore, the smallest integer is 10 and the largest integer is  $10 + 8 = 18$ .
- 8. Answer choice (C) is the correct answer.** Find 3 consecutive even integers: 2, 4, 6. Then find the difference between the smallest and the largest:  $6 - 2 = 4$ .

- 9. Answer choice (B) is the correct answer.** Let  $x$  equal the smallest integer. The other three integers equal  $x + 1$ ,  $x + 2$ , and  $x + 3$ . Set up the equation  $x + x + 1 + x + 2 + x + 3 = 6$  and solve:  $4x + 6 = 6 \rightarrow 4x = 0 \rightarrow x = 0$ . Therefore, the smallest integer is 0.
- 10. Answer choice (A) is the correct answer.** Let  $x$  equal the smallest integer. The other two integers equal  $x + 2$  and  $x + 4$ . Set up the equation  $x + x + 2 + x + 4 = -30$  and solve:  $3x + 6 = -30 \rightarrow 3x = -36 \rightarrow x = -12$ . Therefore, the smallest integer is  $-12$ .
- 11. Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer, so the middle integer is  $x + 1$ , and the largest integer is  $x + 2$ . Set up and solve an equation that represents, “six less than three times the smallest integer is equal to twice the largest”:  $3x - 6 = 2(x + 2) \rightarrow 3x - 6 = 2x + 4 \rightarrow x - 6 = 4 \rightarrow x = 10$ . Therefore, the largest integer equals  $10 + 2 = 12$ .
- 12. Answer choice (C) is the correct answer.** Let  $x$  equal the smallest integer, so the other four integers equal  $x + 2$ ,  $x + 4$ ,  $x + 6$ , and  $x + 8$ . Set up and solve an equation to represent, “the smallest integer plus the largest equals the middle integer”:  $x + x + 8 = x + 4 \rightarrow 2x + 8 = x + 4 \rightarrow x + 8 = 4 \rightarrow x = -4$ . Therefore, the smallest integer is  $-4$ .
- 13. Answer choice (D) is the correct answer.** The difference between the smallest and largest integer in a set of five consecutive even integers is *always* 8. Example: 6, 8, 10, 12, 14  $\rightarrow 14 - 6 = 8$ . Another Examples: 20, 22, 24, 26, 28  $\rightarrow 28 - 20 = 8$ .
- 14. Answer choice (B) is the correct answer.** While you can set up an equation for this problem, it’s quicker to use reasoning and the answer choices. Check the answer choices until you find one that works, starting with either (B) or (C). Let’s start with (C): assume 5 is the smallest integer, so the three integers are 5, 6, 7. Find the product:  $5 \cdot 6 \cdot 7 = 210$ . This product is *too big*, so we know the smallest integer must be *less than* 5. We can eliminate answer choice (D). Try answer choice (B): assume is the smallest integer, so the three integers are 4, 5, 6. Find the product:  $4 \cdot 5 \cdot 6 = 120$  so answer choice (B) is correct.
- 15. Answer choice (B) is the correct answer.** It’s tough to use the answer choices for this problem, so we are going to use guess and check and reasoning to find two even numbers that multiply to 80. Since consecutive even numbers are close together, think of a number that when squared that is around 80: 9 squared is around 80 because it equals 81. Therefore, let’s try two even numbers that are close to 9:  $8 \cdot 10 = 80$ , so our two numbers are 8 and 10. Find the sum of 8 and 10:  $8 + 10 = 18$ .
- 16. Answer choice (C) is the correct answer.** Let  $x$  equal the smaller integer, so the larger integer is  $x + 2$ . The product of  $x$  and  $x + 2$  is  $x(x + 2)$ . Set this equal to 48:  $x(x + 2) = 48$ .
- 17. Answer choice (C) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of five consecutive integers is 34, then the numbers are 32, 33, 34, 35, 36. The smallest integer is 32.

- 18. Answer choice (A) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of seven consecutive integers is 1, then the numbers are  $-2, -1, 0, 1, 2, 3, 4$ . The smallest integer is  $-2$ .
- 19. Answer choice (D) is the correct answer.** The average of a set of consecutive integers is always the *median*. Since we are taking the average of four integers and four is an even number, the *median* is the average or middle of the two middle numbers. Therefore, the numbers are 13, 15, 17, 19 because 16 is in the middle of 15 and 17. The largest integer is 19.
- 20. Answer choice (C) is the correct answer.** The average of a set of consecutive integers is always the median, which is the *middle integer* in this case. Therefore, if the average of three consecutive odd integers is 29, then the middle integer is 29.
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### Frequency Charts Set 1

- 1. Answer choice (C) is the correct answer.** The median of a set of data is the middle number when the numbers are lined up in order from least to greatest. If you write all of the data points in order, you will get 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1 ... etc. We also know that there are 35 total data points if we add up the values in the right column to find the total number of households. Therefore, the median will be the 19th number which is 2.
- 2. Answer choice (C) is the correct answer.** The range of a set of data is the difference between the highest and lowest numbers. Our data set represents the number of pets, so the highest number is 4 and the lowest is 0:  $4 - 0 = 4$ .
- 3. Answer choice (B) is the correct answer.** Add up the number of households that have 2, 3, or 4 pets:  $12 + 7 + 3 = 22$  households.
- 4. Answer choice (C) is the correct answer.** The mean of a data set is equal to the sum of the numbers divided by the number of terms. If you write out all of the data points from the frequency table, you will get ten 9s, thirty 10s, fifty 11s, thirty 12s, and ten 13s. Therefore, to find the sum of all of the numbers in the data set, multiply the numbers in the “age” column by the corresponding number in the “number of students” column and add the results together:  $9 \cdot 10 + 10 \cdot 30 + 11 \cdot 50 + 12 \cdot 30 + 13 \cdot 10 = 90 + 300 + 550 + 360 + 130 = 1,430$ . Find the total number of terms in the data set by adding up the numbers in the “number of students” column:  $10 + 30 + 50 + 30 + 10 = 130$ . Divide 1,430 by 130 to get a mean of 11.
- 5. Answer choice (C) is the correct answer.** The mode of a data set is the number that appears the most. Based on the table, there are more 11 year olds than any other age. Therefore, the mode is 11.

6. **Answer choice (B) is the correct answer.** Add up the number of students who are 12 or 13 years old:  $30 + 10 = 40$  students.
7. **Answer choice (B) is the correct answer.** The mean of a data set is equal to the sum of the numbers divided by the number of terms. If you write out all of the data points from the frequency chart, you will get three 1s, two 3s, one 4, six 5s, and two 7s. Therefore, to find the sum of all of the data points, multiply each “points scored” value by its frequency (number of players) and add the results:  $1 \cdot 3 + 3 \cdot 2 + 4 \cdot 1 + 5 \cdot 6 + 7 \cdot 2 = 3 + 6 + 4 + 30 + 14 = 57$ . The problem told us that there are 14 players, so divide 57 by 14 to get a mean of about 4.
8. **Answer choice (A) is the correct answer.** The median of a set of data is the middle number when the numbers are lined up in order from least to greatest. Since there are 14 data points represented by the graph, the median will be in between the 7th and 8th data points. The first three data points are 1, the next two data points are 3, the next data point is 4, and the 7th and 8th data points are 5. Therefore, the median is 5.
9. **Answer choice (B) is the correct answer.** The mode of a data set is the number that appears the most. The graph tells us that more players scored 5 points than any other number of points, so 5 is our mode. Since Jenny scored 2 fewer points than the mode, Jenny scored 3 points.
10. **Answer choice (D) is the correct answer.** Fill in the right side of the frequency chart. Since the data is symmetric around 15, then the bar at 14 should be the same height as the bar at 16: the bar at 14 should be 6 high. Now add up the number of students who completed 12, 13, 14, or 15 math problems:  $8 + 6 + 3 + 2 = 19$  students.

### Frequency Charts Set 2

1. **Answer choice (C) is the correct answer.** The mode of a set of data is the number that appears the most. Based on the table, the greatest number of students read 9 books, so 9 is the mode.
2. **Answer choice (A) is the correct answer.** The range of a set of data is the difference between the highest and lowest numbers. Our data set represents the number of books, so the highest number of books is 9 and the lowest is 5:  $9 - 5 = 4$ .
3. **Answer choice (B) is the correct answer.** The median of a data set is the middle number when the numbers are in order from least to greatest. If you write all of the data points, you will get 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6 ... etc. We also know that there are 35 total data points if we add up the values in the right column to find the total number of students. Therefore, the median will be the 19th number which is 7 books. Now find the number of students who read more than 7 books by adding up the number of students who read 8 books and the number of students who read 9 books:  $4 + 11 = 15$  students.

4. **Answer choice (B) is the correct answer.** The mean of a data set is equal to the sum of the numbers divided by the number of terms. If you write out all of the data points from the frequency table, you will get two 0s, two 1s, seven 2s, eight 3s, and five 4s. Therefore, to find the sum of all of the numbers in the data set, multiply the numbers in the “number of cars” column by the corresponding number in the “number of households” column and add the results together:  $0 \cdot 2 + 1 \cdot 2 + 2 \cdot 7 + 3 \cdot 8 + 4 \cdot 5 = 0 + 2 + 14 + 24 + 20 = 60$ . Find the total number of terms in the data set by adding up the numbers in the “number of households” column:  $2 + 2 + 7 + 8 + 5 = 24$ . Divide 60 by 24 to get a mean of 2.5
5. **Answer choice (B) is the correct answer.** The median of a data set is the middle number when the numbers are in order from least to greatest. If you write all of the data points, you will get 0, 0, 1, 1, 2, 2, 2, 2, 2, 2, 2 ... etc. We also know that there are 24 total data points if we add up the values in the right column to find the total number of students. Therefore, the median will be the average of the 12th and 13th number. The 12th and 13th numbers are both 3, so the median is 3.
6. **Answer choice (A) is the correct number.** Add up the number of households that have 0 or 1 car:  $2 + 2 = 4$  households.
7. **Answer choice (A) is the correct answer.** The mean of a data set is equal to the sum of the numbers divided by the number of terms. If you write out all of the data points from the frequency chart, you will get three 5s, two 6s, five 7s, one 8, three 9s, three 10s, and one 11. Therefore, to find the sum of all of the data points, multiply each “age” value by its frequency (number of campers) and add the results:  $5 \cdot 3 + 6 \cdot 2 + 7 \cdot 5 + 8 \cdot 1 + 9 \cdot 3 + 10 \cdot 3 + 11 \cdot 1 = 15 + 12 + 35 + 8 + 27 + 30 + 11 = 138$ . The problem tells us that there are 18 total campers, so divide 138 by 18 to get a mean of about 7.7. We want to know how many campers are *older* than the mean, so add up the number of campers that are 8, 9, 10, and 11 years old:  $1 + 3 + 3 + 1 = 8$  campers.
8. **Answer choice (B) is the correct answer.** If you write out all of the data points from the frequency chart, you will get three 5s, two 6s, five 7s, one 8, three 9s, three 10s, and one 11. The median of a data set is the middle number when the numbers are in order from least to greatest. We also know that there are 18 data points, so the median is the average of the 9th and 10th data points. The 9th data point is a 7 and the 10th data point is a 7, so the median is 7.
9. **Answer choice (D) is the correct answer.** Since the highest and lowest values don’t change, the range does not change because the range equals the difference between the highest and lowest values.
10. **Answer choice (A) is the correct answer.** Find the total number of cups of water represented by the bars on the graph by multiplying each “cups of water” value by its corresponding “number of days” value and adding the results:  $2 \cdot 1 + 3 \cdot 2 + 5 \cdot 3 + 6 \cdot 3 + 7 \cdot 5 = 2 + 6 + 15 + 18 + 35 = 76$  cups. Find the number of days that Clarissa drank 8 cups of water: Clarissa drank 3 cups of water for 2 days, so she drank 8 cups of water for 1 day (1 is half of 2). Add the 8 cups of water to the previous

total of 76:  $76 + 8 = 84$  cups. Since Clarissa drank a total of 100 cups, this means that the total amount of water she drank on the days she drank 4 cups  $= 100 - 84 = 16$ . Divide this by 4 to get that Clarissa drank 4 cups of water for 4 days.

### Circle Graphs Set 1

- 1. Answer choice (B) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore,  $90^\circ$  takes up one-fourth of a circle, because  $\frac{90}{360} = \frac{1}{4}$ . We want to find which flavor represents one-fourth of the data. First, find the total number of students by adding up the numbers in the right column of the table:  $24 + 20 + 15 + 13 + 8 = 80$ . Now find one-fourth of 80:  $\frac{1}{4} \cdot 80 = 20$ . Since 20 students chose vanilla, the portion of the graph representing vanilla has a central angle of  $90^\circ$ .
- 2. Answer choice (D) is the correct answer.** First, find the total number of students by adding up the numbers in the right column of the table:  $24 + 20 + 15 + 13 + 8 = 80$ . Now find the fraction of students that chose coffee which is  $\frac{8}{80} = \frac{1}{10}$ . Since a circle graph is divided into a total of  $360^\circ$ , find  $\frac{1}{10}$  of  $360^\circ$ :  $\frac{1}{10} \cdot 360^\circ = 36^\circ$ .
- 3. Answer choice (B) is the correct answer.** Since 100 out of 600 students chose basketball as his/her favorite sport, the fraction of students who chose basketball is  $\frac{100}{600} = \frac{1}{6}$ . Since a circle graph is divided into a total of  $360^\circ$ , find  $\frac{1}{6}$  of  $360^\circ$ :  $\frac{1}{6} \cdot 360^\circ = 60^\circ$ .
- 4. Answer choice (C) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing pepperoni has a central angle of  $45^\circ$ , then it takes up  $\frac{45}{360} = \frac{1}{8}$  of the circle. Since 28 people chose pepperoni, then 28 represents  $\frac{1}{8}$  of the total people surveyed. Find the total number of people by dividing 28 by  $\frac{1}{8}$ :  $28 \div \frac{1}{8} = 28 \cdot 8 = 224$  people.
- 5. Answer choice (A) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing A has a central angle of  $72^\circ$ , then it takes up  $\frac{72}{360} = \frac{1}{5}$  of the circle. Change  $\frac{1}{5}$  to a percent to get 20%.

6. **Answer choice (B) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing A has a central angle of  $72^\circ$ , then it takes up  $\frac{72}{360} = \frac{1}{5}$  of the circle. This means that the 15 students who received an A represent  $\frac{1}{5}$  of the total students. Find the total number of students by dividing 15 by  $\frac{1}{5}$ :  $15 \div \frac{1}{5} = 15 \cdot 5 = 75$  students.
7. **Answer choice (D) is the correct answer.** Since one-third of the students received a B, that means the portion of the graph representing those students should be one-third of the circle. A circle graph is divided into a total of  $360^\circ$ , so take one-third of  $360^\circ$  which equals  $120^\circ$ .
8. **Answer choice (B) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore,  $60^\circ$  takes up one-sixth of a circle, because  $\frac{60}{360} = \frac{1}{6}$ . Find one-sixth of the total students to find the number of students who chose pink:  $\frac{1}{6} \cdot 180 = 30$  students.
9. **Answer choice (B) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore, one-twelfth of the circle equals  $\frac{1}{12} \cdot 360^\circ = 30^\circ$ , and two-ninths of the circle equals  $\frac{2}{9} \cdot 360^\circ = 80^\circ$ . Now find the difference between  $80^\circ$  and  $30^\circ$ :  $80^\circ - 30^\circ = 50^\circ$ .
10. **Answer choice (D) is the correct answer.** The entire circle graph must add up to 100%, so find the portion representing “Lizard” by subtracting the other portions from 100%:  $100 - 40 - 30 - 18 = 12\%$ . Now find the difference between the percent of people who chose dolphin and the percent of people who chose lizard:  $18\% - 12\% = 6\%$ . Finally, find 6% of the total people:  $6\% \text{ of } 550 = 0.06 \cdot 550 = 33$ .

### Circle Graphs Set 2

1. **Answer choice (A) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore,  $36^\circ$  takes up one-tenth of a circle, because  $\frac{36}{360} = \frac{1}{10}$ . We want to find which genre represents one-tenth of the data. First, find the total number of members by adding up the numbers in the right column of the table:  $6 + 10 + 11 + 9 + 4 = 40$ . Now find one-tenth of 40:  $\frac{1}{10} \cdot 40 = 4$ . Since 4 members chose mystery, the portion of the graph representing mystery has a central angle of  $36^\circ$ .
2. **Answer choice (B) is the correct answer.** First, find the total number of members by adding up the number in the right column of the table:  $6 + 10 + 11 + 9 + 4 = 40$ . Now find the fraction of

members that chose horror which is  $\frac{6}{40} = \frac{3}{20}$ . Since a circle graph is divided into a total of  $360^\circ$ , find  $\frac{3}{20}$  of  $360^\circ$ :  $\frac{3}{20} \cdot 360^\circ = 54^\circ$ .

3. **Answer choice (D) is the correct answer.** Since Tina drank the same amount of water for each of the five days, the circle graph will be split into 5 equal parts, so the part of the graph representing Tuesday is one-fifth of the whole graph. Since a circle graph is divided into a total of  $360^\circ$ , find  $\frac{1}{5}$  of  $360^\circ$ :  $\frac{1}{5} \cdot 360^\circ = 72^\circ$ .
4. **Answer choice (C) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing rock and classical has a central angle of  $60^\circ$ , then it takes up  $\frac{60}{360} = \frac{1}{6}$  of the circle. Since 25 students chose rock or classical ( $10 + 15 = 25$ ), then 25 represents  $\frac{1}{6}$  of the total students in the band. Find the total number of students in the band by dividing 25 by  $\frac{1}{6}$ :  $25 \div \frac{1}{6} = 25 \cdot 6 = 150$  students.
5. **Answer choice (A) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing 4 pets has a central angle of  $30^\circ$ , then it takes up  $\frac{30}{360} = \frac{1}{12}$  of the circle, so one-twelfth of the people have 4 pets.
6. **Answer choice (D) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Since the portion of the graph representing no pets has a central angle of  $40^\circ$ , then the central angle of the other four sections =  $360^\circ - 40^\circ = 320^\circ$ . Therefore, the ratio of the people who have at least one pet to the people who have no pets is  $320:40 = 8:1$ , so the number of people who have no pets is one-eighth of the people who have at least 1 pet. Find one-eighth of 160:  $\frac{1}{8} \cdot 160 = 20$  people.
7. **Answer choice (D) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ , so find 40% of  $360^\circ$ :  $40\% \text{ of } 360^\circ = 0.4 \cdot 360^\circ = 144^\circ$ .
8. **Answer choice (C) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore,  $72^\circ$  takes up one-fifth of a circle, because  $\frac{72}{360} = \frac{1}{5}$ . Find one-fifth of the total students to find the number of students who chose Friday:  $\frac{1}{5} \cdot 240 = 48$  students.

9. **Answer choice (B) is the correct answer.** A circle graph is divided into a total of  $360^\circ$ . Therefore, two-fifths of the circle equals  $\frac{2}{5} \cdot 360^\circ = 144^\circ$ , and three-eighths of the circle equals  $\frac{3}{8} \cdot 360^\circ = 135^\circ$ . Now find the difference between  $144^\circ$  and  $135^\circ$ :  $144^\circ - 135^\circ = 9^\circ$ .
10. **Answer choice (D) is the correct answer.** The percentages of all of the sections on the graph should add to 100%, so find the percent of the graph representing soccer by subtracting the other portions' percentages from 100:  $100 - 37 - 29 - 14 = 20\%$ . Therefore, the percent of people who chose soccer or tennis is  $20 + 14 = 34\%$ . Find 34% of the total students:  $34\% \text{ of } 400 = 0.34 \cdot 400 = 136$  students.
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### Distance and Speed Graphs Set 1

1. **Answer choice (B) is the correct answer.** In between 1 hours and 3 hours and in between 5 hours and 6 hours, the distance from home did not change. Therefore, the car was stopped during those times. You could also use the slope. The slope of a distance vs. time graph equals speed. Since the slope of the lines in between 1 hours and 3 hours and in between 5 hours and 6 hours are both equal to zero, then the speed equals zero, so the car was stopped.
2. **Answer choice (C) is the correct answer.** The slope of a distance vs. time graph is equal to speed. Therefore, we want to look for the part of the graph with the steepest slope. The slope between 6 hours and 7 hours is the steepest, so that is when the car was driving at the fastest speed.
3. **Answer choice (B) is the correct answer.** On the graph, from 0 hours to 6 hours, the car is either stopped or driving farther away from home. At 6 hours, the graph changes directions and starts sloping downwards towards the  $x$ -axis which means the car is now driving towards home.
4. **Answer choice (B) is the correct answer.** From 0 hours to 5 hours, the car did not change direction. By the 5th hour, the car was 100 miles away from home, its starting point. Therefore, the car traveled 100 miles in the first 5 hours.
5. **Answer choice (A) is the correct answer.** The slope of a distance vs. time graph is equal to the speed. The slope of the line at 4 hours is  $\frac{60 \text{ miles}}{2 \text{ hours}} = 30 \text{ mph}$ .
6. **Answer choice (D) is the correct answer.** The graph is at its highest point, which represents the greatest speed, in between 6 and 8 minutes.
7. **Answer choice (D) is the correct answer.** Since this is a speed vs. time graph, Lydia is stopped when the speed, or  $y$  coordinate of the graph, equals 0. The speed equals 200 m/min at 10 minutes,

300 m/min at 6 minutes, and 100 m/min at 3 minutes. Therefore, Lydia was not stopped at any of those times.

8. **Answer choice (D) is the correct answer.** Lydia's speed was decreasing from 7 minutes to 8 minutes because the line is sloped downwards.
9. **Answer choice (B) is the correct answer.** In between 2 minutes and 4 minutes, Lydia rode at a constant speed of 100 meters per minute. If she rides for 2 minutes, she traveled  $2 \cdot 100 = 200$  meters.
10. **Answer choice (C) is the correct answer.** In between 6 minutes and 8 minutes, the graph is at a constant speed of 300 m/min. Therefore, the average speed is 300 m/min.
11. **Answer choice (A) is the correct answer.** In between 0 and 10 minutes, Abigail walks 0.4 miles. Then she stops, and at 15 minutes she turns around and walks 0.4 miles back to her house. She turns around again at 20 minutes and walks 0.4 more miles in between 20 minutes and 25 minutes. Therefore, her total distance =  $0.4 + 0.4 + 0.4 = 1.2$  miles.
12. **Answer choice (C) is the correct answer.** In between 0 and 10 minutes, Abigail walks 0.4 miles. Then she stops, and at 15 minutes she turns around and walks 0.4 miles back to her house. She turns around again at 20 minutes and walks 1 more mile until she ends her trip. Therefore, her total distance =  $0.4 + 0.4 + 1 = 1.8$  miles.
13. **Answer choice (D) is the correct answer.** The slope of the graph changes direction at 15 minutes and then again at 20 minutes. Therefore, Abigail turned around at 15 minutes and 20 minutes.
14. **Answer choice (A) is the correct answer.** Abigail ends her trip at the far right side of the graph which is at a distance of 1 mile from her house.
15. **Answer choice (D) is the correct answer.** The slope of a distance vs. time graph equals speed. Therefore, we want to look for the portion of the graph with the least steep slope. Out of the answer choices, the slope of the graph is the least steep at 32 minutes.

### Distance and Speed Graphs Set 2

1. **Answer choice (B) is the correct answer.** At 33 minutes, the distance from home did not change. Therefore, John was stopped at 33 minutes. You could also use the slope. The slope of a distance vs. time graph equals speed. Since the slope of the line at 33 minutes is equal to zero, then the speed equals zero, so John was stopped.
2. **Answer choice (D) is the correct answer.** The slope of a distance vs. time graph equals speed. Therefore, to find the time when John was running at the fastest speed, we want to find the portion

of the graph with the greatest, or steepest, slope. The line in between 50 and 70 minutes has the steepest slope.

3. **Answer choice (B) is the correct answer.** Looking at the graph, we can see that at both 15 minutes and 50 minutes John was 1 miles from his house.
4. **Answer choice (C) is the correct answer.** In between 0 and 40 minutes, John travels 2 miles. He then turns around and travels 1 mile in between 40 and 50 minutes. Therefore, his total distance traveled =  $2 + 1 = 3$  miles.
5. **Answer choice (A) is the correct answer.** The slope of a distance vs. time graph equals speed. The slope of the line at 20 minutes equals  $\frac{2 \text{ miles}}{30 \text{ min}} = \frac{4 \text{ miles}}{60 \text{ min}} = 4$  mph.
6. **Answer choice (A) is the correct answer.** Since this is a speed vs. time graph, the greatest speed is when the graph is at the highest point. Out of the four answer choices, the graph is at its highest point at 4 minutes.
7. **Answer choice (C) is the correct answer.** In between 6 and 8 minutes, the car's speed is 0 mph because the line is on the horizontal axis. Therefore, the car was stopped at 7 minutes.
8. **Answer choice (D) is the correct answer.** Accelerating means speeding up. In between 8 and 10 minutes, the car's speed was increasing, so the car was accelerating at 9.5 minutes.
9. **Answer choice (B) is the correct answer.** In between 2 and 4 minutes, the car was traveling at a constant speed of 40 miles per hour. 2 minutes is  $\frac{1}{30}$  of an hour, so multiply 40 by  $\frac{1}{30}$  to get  $\frac{40}{30}$  miles traveled. Simplify the fraction to get  $\frac{4}{3} = 1\frac{1}{3}$  which is about 1.3 miles.
10. **Answer choice (A) is the correct answer.** The car started at 60 mph and ended at 40 mph, so the difference equals  $60 - 40$  which equals 20 mph.
11. **Answer choice (B) is the correct answer.** The slope of the graph changes directions at 10 minutes, so Doreen turned around at 10 minutes. From 0 to 10 minutes she was going away from home, and then from 10 to 15 minutes she was going towards home. Therefore, at 10 minutes, she turned around to go home.
12. **Answer choice (C) is the correct answer.** Doreen drove 2 miles in between 0 and 10 minutes, turned around and drove 2 miles back home in between 10 and 15 minutes, and then turned around and drove 2.5 more miles. Therefore, her total distance traveled =  $2 + 2 + 2.5 = 6.5$  miles.

- 13. Answer choice (B) is the correct answer.** The slope of a distance vs. time graph equals the speed. Therefore, the speed in between 10 and 15 minutes =  $\frac{2}{10} = \frac{1}{5}$ , and the speed in between 10 and 15 minutes =  $\frac{2}{5}$  (the speed is always positive).  $\frac{2}{5}$  is twice  $\frac{1}{5}$ .
- 14. Answer choice (A) is the correct answer.** Doreen turned around to go home at 10 minutes, and she was 2 miles from home. Her friend lives 2.5 miles from her home because the graph ends at 2.5 miles. Therefore, Doreen was 0.5 miles from her friend's house when she turned around ( $2.5 - 2 = 0.5$  miles).
- 15. Answer choice (C) is the correct answer.** The slope of a distance vs. time graph equals the speed. Therefore, we are looking for the part of the graph with the greatest, or steepest, slope (positive vs. negative doesn't matter because speed is always positive). At 14 minutes, the slope of the graph is the steepest.
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### Other Charts and Graphs Set 1

- 1. Answer choice (C) is the correct answer.** The line that divides the box of a box and whisker plot into two parts represents the median, so the median is 94.
- 2. Answer choice (B) is the correct answer.** On a box and whisker plot, the right edge of the box represents the 3rd quartile. Quartiles divide the data into four quarters, so 75% of the data falls below the 3rd quartile and 25% of the data falls above the 3rd quartile. Since 96 is the 3rd quartile, and we want to find how many students scored above a 96, we need to find 25% of the total students:  $25\% \text{ of } 40 = 0.25 \cdot 40 = 10$  students
- 3. Answer choice (C) is the correct answer.** On a box and whisker plot, the left edge of the box represents the 1st quartile and the right edge of the box represents the 3rd quartile. Quartiles divide the data into four quarters, so 50% of the data falls in between the 1st and 3rd quartile. On the box and whisker plot, we can see that 90 represents the 1st quartile and 96 represents the 3rd quartile, so 50% of the students scored between a 90 and 96.
- 4. Answer choice (B) is the correct answer.** On a box and whisker plot, the far left line represents the lowest data point, and the far right line represents the highest data point. Since the highest data point on this graph is 100 and the lowest is 87, the range of the data equals  $100 - 87 = 13$ .
- 5. Answer choice (C) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first row of our stem-and-leaf plot represents the numbers 20 and 29. The mode is the number that appears the most, so since 32 appears twice, which is more than any other number, 32 is the mode.

6. **Answer choice (D) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first row of our stem-and-leaf plot represents the numbers 20 and 29. The last number in a stem-and-leaf plot represents the highest number. Therefore, the highest number of points scored by a player is 76 points.
7. **Answer choice (C) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first row of our stem-and-leaf plot represents the numbers 20 and 29. The median of a set of data is the middle number when the numbers are lined up from least to greatest. A stem-and-leaf plot arranges the data in order from least to greatest, so find the middle number from the table which is 44.
8. **Answer choice (D) is the correct answer.** Since a histogram shows the ranges of data points, but doesn't show exact data points, we cannot determine the range.
9. **Answer choice (D) is the correct answer.** Add up the number of people who make \$25,000 to \$39,000 and the number of people who make \$40,000 to 54,000:  $1 + 7 = 8$  people.
10. **Answer choice (B) is the correct answer.** Since a histogram shows the ranges of data points, but doesn't show exact data points, we cannot determine the exact value of the median. However, we can find the range of values for the median. The median is the middle number of a data set when the numbers are in order from least to greatest. Therefore, the median of this data set falls in between \$55,000 and \$69,000, so \$57,000 could be the median.

### Other Charts and Graphs Set 2

1. **Answer choice (B) is the correct answer.** The line that divides the box of a box and whisker plot into two parts represents the median, so the median is 50.
2. **Answer choice (A) is the correct answer.** On a box and whisker plot, the far left line represents the lowest data point, so the youngest teacher is 35 years old.
3. **Answer choice (D) is the correct answer.** On a box and whisker plot, the right edge of the box represents the 3rd quartile. Quartiles divide the data into four quarters, so 75% of the data falls below the 3rd quartile and 25% of the data falls above the 3rd quartile. Since 60 is the 3rd quartile, 75% of the teachers are younger than 60.
4. **Answer choice (B) is the correct answer.** On a box and whisker plot, the left edge of the box represents the 1st quartile. Quartiles divide the data into four quarters, so 25% of the data falls below the 1st quartile and 75% of the data falls above the 1st quartile. Since 40 is the 1st quartile,

25% of the teachers are younger than 40. Find 25% of the total teachers:  $25\% \text{ of } 36 = 0.25 \cdot 36 = 9$  teachers

5. **Answer choice (B) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first and second rows of our stem-and-leaf plot represent the numbers 67, 73, 74, 77, and 77. The median of a set of data is the middle number when the numbers are lined up from least to greatest. A stem-and-leaf plot arranges the data in order from least to greatest, so find the middle number from the table which is 86.
6. **Answer choice (C) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first and second rows of our stem-and-leaf plot represent the numbers 67, 73, 74, 77, and 77. The mode of a data set is the number that appears the most. Therefore, the mode of this data set is 85. Since Juliet scored 3 more points than the mode, she scored 88 points.
7. **Answer choice (C) is the correct answer.** On a stem-and-leaf plot, the stem column represents the tens digit of the number, and the leaf column represents the ones digit. Therefore, the first and second rows of our stem-and-leaf plot represent the numbers 67, 73, 74, 77, and 77. The range is the difference between the highest and lowest numbers, so the range is  $97 - 67 = 30$ .
8. **Answer choice (B) is the correct answer.** Since a histogram shows the ranges of data points, but doesn't show exact data points, we cannot determine the exact value of the range. However, we can find the range of values for the range. The range is the difference between the highest and lowest number. In the leftmost bar, we see that the smallest height is between 50 and 59. If we look at the rightmost bar, we see that the largest height is between 80 and 89. Therefore, the range is between 21 and 39 feet ( $89 - 50 = 39$  and  $80 - 59 = 21$ ). Since 35 feet is in between 21 and 39 feet, 35 feet could be the range.
9. **Answer choice (A) is the correct answer.** Add the two bars that represent trees that are 70-79 feet tall and trees that are 80-89 feet tall:  $4 + 6 = 10$  trees.
10. **Answer choice (D) is the correct answer.** Since a histogram shows the ranges of data points, but doesn't show exact data points, we cannot determine the exact value of the median.
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### Quantitative Comparisons Set 1

1. **Answer choice (B) is the correct answer.** Find the value of Column A first. The three consecutive integers that have a product of 720 are 8, 9, and 10 because  $8 \cdot 9 \cdot 10 = 720$ . Therefore, Column A equals 8. Column B is greater than Column A.

2. **Answer choice (C) is the correct answer.** The probability of Column A is  $\frac{3}{6} \cdot \frac{1}{2}$ . The probability of Column B is also  $\frac{3}{6} \cdot \frac{1}{2}$ . Columns A and B are equal.
3. **Answer choice (C) is the correct answer.** When you add or subtract the same number from every number in a data set, the mean, median, and mode all change by that number. Therefore, the change in the mean and mode are both  $-5$ . Columns A and B are equal.
4. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of the girls' heights:  $4 \cdot 60 = 240$ . Find the sum of the boys' heights:  $3 \cdot 70 = 210$ . Add the sums to get a total sum of  $210 + 240 = 450$ . Column B is greater than Column A.
5. **Answer choice (A) is the correct answer.** The average of a set of consecutive integers is always the *median*, or in this case the middle, integer. Therefore, the middle integer is 15. Column A is greater than Column B.
6. **Answer choice (A) is the correct answer.** To find the expected number of heads, multiply the probability of flipping a heads by the number of flips:  $\frac{1}{2} \cdot 37 = 17.5$ . Therefore, Column A equals 17.5 which is greater than Column B.
7. **Answer choice (A) is the correct answer.** Column A equals the mode which is 31. Column B equals the median which is 19. Column A is greater than Column B.
8. **Answer choice (C) is the correct answer.** Find Column A by multiplying the number of pairs of shoes, the number of pairs of pants, and the number of shirts:  $2 \cdot 5 \cdot 3 = 30$  outfits. Columns A and B are equal.
9. **Answer choice (B) is the correct answer.** Since Column B is the probability of only one event, and Column A is the probability of the event from Column A *and* another event, Column A must have a greater probability. The probability of doing something once is always less than the probability of doing that same thing twice.
10. **Answer choice (B) is the correct answer.** The probability of choosing a white ball is three times the probability of choosing a red, so the probability of choosing a white ball is  $\frac{6}{9}$ . The sum of the probabilities of choosing each ball have to add up to 1, so find the probability of choosing a blue

ball by subtracting the other two probabilities from 1:  $1 - \frac{6}{9} - \frac{2}{9} = \frac{1}{9}$ . Therefore, Column A equals  $\frac{1}{9}$ , so Column B is greater than Column A.

- 11. Answer choice (C) is the correct answer.** In both columns, the number that the number cube lands on does not affect the probability of the coin landing on tails. In both columns, we are just finding the probability that the coin lands on tails, so the two columns are equal.
- 12. Answer choice (B) is the correct answer.** Find the average number of slices by multiplying the numbers in each row and finding the sum of all of the results:  $0 \cdot 5 + 1 \cdot 5 + 2 \cdot 10 + 3 \cdot 5 = 0 + 5 + 20 + 15 = 40$ . Now divide this by the total number of children (add up the number in the right column to find the total number of children is 25):  $40 \div 25 = 1.6$ , so Column B is greater than Column A.
- 13. Answer choice (B) is the correct answer.** Since 100 out of 500 people chose romance, the portion of the graph representing romance equals  $\frac{100}{500} = \frac{1}{5}$ . Find the central angle of the portion of the graph representing romance by multiplying  $\frac{1}{5}$  by  $360^\circ$ :  $\frac{1}{5} \cdot 360^\circ = 72^\circ$ . Column B is greater than Column A.
- 14. Answer choice (A) is the correct answer.** The median of the data is the middle number which is 4.5. You don't need to find the exact mean: since the data set has 50 as the highest number, which is significantly higher than the other numbers, 3 and 5, we can tell that it will bring the mean up to be higher than 4.5. If you actually want to find the mean, add up all of the numbers and divide by 10 to get 8.5. Column A is greater than Column B.
- 15. Answer choice (D) is the correct answer.** Since a histogram shows the ranges of data points, but doesn't show exact data points, we cannot determine the exact value of the median. However, we can find the range of values for the median. The median is the middle number of a data set when the numbers are in order from least to greatest. Therefore, the median of this data set falls in between 20 and 24 miles. Therefore, if the median is 20, then Column B is greater, but if the median is 24, Column A is greater. Therefore, we cannot determine the relationship.

## Quantitative Comparisons Set 2

- 1. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Find the sum of Scarlett's four tests by multiplying  $92 \cdot 4$  to get 368. Therefore, Column B is greater than Column A.

2. **Answer choice (C) is the correct answer.** To find the expected number of ones, multiply the probability of rolling a 1 by the number of rolls:  $\frac{1}{6} \cdot 72 = 12$ . To find the expected number of fours, multiply the probability of rolling a 4 by the number of rolls:  $\frac{1}{6} \cdot 72 = 12$ . Therefore, Column A and Column B are equal.
3. **Answer choice (A) is the correct answer.** Since Star can choose from the number 0 through 9 inclusive, she can choose from 10 numbers. Since she can repeat numbers, for each digit in her code, she has 10 options. Therefore, the total number of codes she can make is  $10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 10^5$ . Therefore, Column A is greater than Column B.
4. **Answer choice (A) is the correct answer.** Let  $x$  equal the smallest of the three integers, so  $x + 2$  represents the middle integer, and  $x + 4$  represents the largest integer. Set up the equation  $x + x + 2 + x + 4 = 36$  and solve:  $3x + 6 = 36 \rightarrow 3x = 30 \rightarrow x = 10$ . Therefore, 10 is the smallest integer, 12 is the middle integer, and 14 is the largest integer. Column A is greater than Column B.
5. **Answer choice (D) is the correct answer.** We do not know what the starting median of the numbers is, so we cannot compare the new median to the new mean.
6. **Answer choice (C) is the correct answer.** For Column A, the probability of choosing a green and then purple marble  $= \frac{3}{21} \cdot \frac{8}{21} = \frac{24}{21 \cdot 21}$ . (Don't multiply out the denominators because it wastes time and you won't need to when comparing the probabilities.) For Column B, the probability of choosing a blue and then red marble  $= \frac{4}{21} \cdot \frac{6}{21} = \frac{24}{21 \cdot 21}$ . Therefore, the two probabilities are equal.
7. **Answer choice (B) is the correct answer.** The range is the highest number minus the lowest number:  $60 - 30 = 30$ . Therefore, the range is equal to the lowest number in the data set. The mean of this set has to be greater than 30 because all of the numbers except 30 are greater than 30. Therefore, the mean is greater than the range, so Column B is greater than Column A.
8. **Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up and solve an equation to find the value of  $x$ :  $150 = \frac{10x + 20x}{2} \rightarrow 300 = 10x + 20x \rightarrow 300 = 30x \rightarrow x = 10$ . Therefore, Column A is greater than Column B.

- 9. Answer choice (A) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of Khalil's first three tests =  $95 \cdot 3 = 285$ . Now set up and solve an average equation to find his fourth test using 96 as his new average and  $x$  as his fourth test score:  $96 = \frac{285 + x}{4} \rightarrow 384 = 285 + x \rightarrow x = 99$ . Therefore, Khalil scored a 99 on his fourth test, which is greater than 98, so Column A is greater than Column B.
- 10. Answer choice (C) is the correct answer.** If the probability of landing on a black space is  $\frac{3}{5}$ , then  $\frac{3}{5}$  of the spaces are black. Therefore, to find the total number of spaces on the spinner, divide 6 by  $\frac{3}{5}$  to get 10 spaces. Since there are 10 spaces and 6 are black, find the number of white spaces by subtracting 10 minus 6 to get 4 white spaces. Therefore, Column A and Column B are equal.
- 11. Answer choice (B) is the correct answer.** For both columns, we only want to find the probability of the event that comes after the word "probability." Therefore, for Column A, we want the probability of rolling a 2 on the second roll, and for Column B, we want the probability of rolling an even number on the second roll. The first roll in each scenario does not affect our probability. Since there are 3 even numbers on a six-sided number cube and there is only one 2, the probability of rolling an even number is higher. Column B is greater than Column A.
- 12. Answer choice (B) is the correct answer.** The mode of a data set is the number that appears the most. This data set represents the number of slices, so the mode is the number of slices that shows up the most. The greatest number of children ate 2 slices of pizza, so 2 is the mode. Column B is greater than Column A.
- 13. Answer choice (A) is the correct answer.** Find the original median. The median of a data set is the middle number when the numbers are in order from least to greatest: 1, 1, 3, 4, 5, 6, 7, 8, 9, 9. We have two middle numbers, 5 and 6, so the median is the average of those two numbers which is 5.5. After we add a number, the median becomes 6. If we add another number, we will have 11 data points, so the median will be the sixth data point. We need to add a number that is 6 or greater for 6 to be the sixth data point. Therefore, Column A is greater than Column B.
- 14. Answer choice (A) is the correct answer.** Find the fraction of the graph that represents people who chose math by dividing  $120^\circ$  by  $360^\circ$ :  $\frac{120}{360} = \frac{1}{3}$ . Therefore, one-third of the total students chose math and two-thirds did not choose math. Find the number of students who did not choose math by finding two-thirds of 450:  $\frac{2}{3} \cdot 450 = 300$ . Therefore, Column A is greater than Column B.
- 15. Answer choice (B) is the correct answer.** While we cannot determine the exact range from a histogram, we can determine the range of values that include the range. The lowest possible data

point is 10 and the highest possible data point is 34. Therefore, the greatest possible range is  $34 - 10 = 24$ . Since 25 is greater than 24, Column B is greater than Column A.

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## Math Course 5

### Angles Set 1

- Answer choice (B) is the correct answer.** Since all three angles make a straight line, they need to add up to  $180^\circ$ :  $a + 32^\circ + 90^\circ = 180$ . Solve this equation to get that  $a = 58^\circ$ .
- Answer choice (C) is the correct answer.** Find the sum of the angles in the pentagon using the following formula, where  $n$  equals the number of sides:  $180(n - 2) = 180(5 - 2) = 540^\circ$ . Set up an equation that says the sum of all five angles equals  $540^\circ$ :  $x + y + 92^\circ + 68^\circ + 129^\circ = 540^\circ$ . Solve the equation:  $x + y + 289^\circ = 540^\circ \rightarrow x + y = 251^\circ$ .
- Answer choice (D) is the correct answer.** In the diagram, angles  $a$ ,  $c$ ,  $e$  and  $g$  are all equal and angles  $b$ ,  $d$ ,  $f$ , and  $h$  are all equal. Each angle from the first group is supplementary (adds up to  $180^\circ$ ) to each angle from the second group. Therefore, angles  $h$  and  $c$  are supplementary, or add up to  $180^\circ$ .
- Answer choice (B) is the correct answer.** Angle  $y$  and  $113^\circ$  have to add up to  $180^\circ$  because they form a straight line. Therefore, angle  $y$  equals  $180^\circ - 113^\circ = 67^\circ$ . The sum of the angles in a triangle is  $180^\circ$ , so  $x + y + y = 180^\circ \rightarrow x + 67^\circ + 67^\circ = 180^\circ \rightarrow x = 46^\circ$ .
- Answer choice (A) is the correct answer.** Find the sum of the angles in the octagon using the following formula, where  $n$  equals the number of sides:  $180(n - 2) = 180(8 - 2) = 1080^\circ$ .
- Answer choice (D) is the correct answer.** The sum of the angles in a quadrilateral is  $360^\circ$ , so set up the equation:  $90^\circ + 3x + 23^\circ + 4x - 6^\circ + x - 3^\circ = 360$ . Solve the equation:  $104^\circ + 8x = 360 \rightarrow 8x = 256 \rightarrow x = 32^\circ$ . Plug  $x$  back into each angle expression to find the greatest angle.  $3x + 23^\circ = 3(32^\circ) + 23^\circ = 119^\circ$ .  $4x - 6^\circ = 4(32^\circ) - 6^\circ = 122^\circ$ .  $x - 3 = 32^\circ - 3^\circ = 29^\circ$ . Therefore,  $122^\circ$  is the greatest angle.
- Answer choice (B) is the correct answer.** Let  $x$  equal the measure of angle LKM, so the measure of angle JKM equals  $x - 18^\circ$ . The two angles form a right angle, so set the sum equal to  $90^\circ$ :  $x + x - 18^\circ = 90^\circ$ . Solve the equation:  $2x - 18^\circ = 90^\circ \rightarrow 2x = 108 \rightarrow x = 54^\circ$ . Therefore, angle LKM has a measure of  $54^\circ$ .
- Answer choice (A) is the correct answer.** Angle  $a$  and the angle measuring  $110^\circ$  are supplementary which means they add up to  $180^\circ$ . Therefore, angle  $a = 180^\circ - 110^\circ = 70^\circ$ .

9. **Answer choice (C) is the correct answer.** Find the sum of the angles in the hexagon using the following formula, where  $n$  equals the number of sides:  $180(n - 2) = 180(6 - 2) = 720^\circ$ . Since each angle is the same in a regular hexagon, divide the sum by 6 to find the measure of each angle:  $720^\circ \div 6 = 120^\circ$ .
10. **Answer choice (A) is the correct answer.** Because lines  $j$  and  $k$  are parallel, the angle measuring  $6x + 29^\circ$  and the angle measuring  $5x + 41^\circ$  are supplementary which means they add up to  $180^\circ$ . Therefore,  $6x + 29 + 5x + 41 = 180^\circ$ . Solve the equation:  $11x + 70 = 180 \rightarrow 11x = 110 \rightarrow x = 10$ .
11. **Answer choice (B) is the correct answer.** The sum of the exterior angles of any polygon is  $360^\circ$ . Find the measure of each exterior angle of a 12-gon by dividing  $360^\circ$  by 12 to get  $30^\circ$ .
12. **Answer choice (C) is the correct answer.** The angle measuring  $97^\circ$  is a vertical angle to the large angle consisting of the angles measuring  $2x - 13^\circ$  and  $4x - 18^\circ$ . Therefore, the two angles are equal, so  $2x - 13^\circ + 4x + 8^\circ = 97^\circ$ . Solve the equation:  $6x - 5 = 97 \rightarrow 6x = 102 \rightarrow x = 17$ .
13. **Answer choice (A) is the correct answer.** Since the three angles form a straight line, they add up to  $180^\circ$ . Therefore,  $x - 3 + 100 + 2y + 6 = 180$ . Solve the equation to get  $x + 2y$  by itself:  $x + 2y + 103 = 180 \rightarrow x + 2y = 77$ .
14. **Answer choice (D) is the correct answer.** The angles in a quadrilateral add up to  $360^\circ$ , so set up the equation  $x + 2x + 3x + 4x = 360^\circ$ , where  $x$ ,  $2x$ ,  $3x$ , and  $4x$  represent the measures of the four angles. Solve the equation:  $10x = 360^\circ \rightarrow x = 36^\circ$ . Since  $x$  represents the measure of the smallest angle, the smallest angle is  $36^\circ$ . Since  $4x$  represents the measure of the largest angle, the largest angle equals  $4(36^\circ) = 144^\circ$ . The sum of the smallest angle and largest angle =  $36^\circ + 144^\circ = 180^\circ$ .
15. **Answer choice (B) is the correct answer.** Since the angle measuring  $78^\circ$  and the angle measuring  $d^\circ$  make a straight line, they add up to  $180^\circ$ :  $d + 78^\circ = 180^\circ \rightarrow d = 102^\circ$ . Since the angle measuring  $78^\circ$  and the angle measuring  $c + d^\circ$  are vertical angles, they are equal:  $78^\circ = c + d$ . Plug in the measure of angle  $d$  and solve the equation for  $c$ :  $78^\circ = c + 102^\circ \rightarrow c = -24$ .

## Angles Set 2

1. **Answer choice (B) is the correct answer.** First, find the sum of the angles in a hexagon by using the formula  $180(n - 2)$  where  $n$  represents the number of sides. Therefore, the sum of the angles in a hexagon =  $180(6 - 2) = 180(4) = 720^\circ$ . Since the hexagon is regular, all of the angles have the same measure, so each angle =  $720^\circ \div 6 = 120^\circ$ . Finally, set  $6x = 120^\circ$  and divide each side by 6 to get  $x = 20$ .
2. **Answer choice (B) is the correct answer.** Since the three angles make a straight line, they must add up to  $180^\circ$ . Set up an equal for the sum of the three angles and solve:  $x + 90 + 44 = 180 \rightarrow x + 134 = 180 \rightarrow x = 46$ .

3. **Answer choice (C) is the correct answer.** The angle measuring  $a^\circ$  and the angle measuring  $72^\circ$  are supplementary (add up to  $180^\circ$ ) because they are *same side exterior angles*. Therefore  $a + 72 = 180$ , so  $a = 108$ .
4. **Answer choice (C) is the correct answer.** The sum of exterior angles of any polygon is  $360^\circ$ . Since an equilateral triangle has three congruent exterior angles, divide  $360^\circ$  by 3 to get  $120^\circ$  for each exterior angle.
5. **Answer choice (D) is the correct answer.** Since the triangle is isosceles, the two base angles are congruent. Let each base angle equal  $x$ . The sum of the angles in a triangle is  $180^\circ$ , so  $x + x + 80 = 180$ . Solve this equation:  $2x + 80 = 180 \rightarrow 2x = 100 \rightarrow x = 50^\circ$ . Since the angle measuring  $k^\circ$  and the right base angle form a straight line, they add up to  $180^\circ$ . Therefore,  $50 + k = 180$ , so  $k = 130^\circ$ .
6. **Answer choice (C) is the correct angle.** Since the shape is a trapezoid, Angle A and D are supplementary (add up to  $180^\circ$ ). Set up an equation for the sum of angles A and D and solve:  $6x + 3x = 180 \rightarrow 9x = 180 \rightarrow x = 20$ . Because the shape is an *isosceles trapezoid*, angle C is congruent to angle D, so angle C =  $3x = 3(20) = 60^\circ$ .
7. **Answer choice (B) is the correct answer.** Find the sum of the angles in a pentagon by using the formula  $180(n - 2)$  where  $n$  represents the number of sides. Therefore, the sum of the angles in a pentagon =  $180(5 - 2) = 180(3) = 540^\circ$ .
8. **Answer choice (B) is the correct answer.** Supplementary angles add up to  $180^\circ$ , so set up the equation  $7x + 5x = 180$  where  $7x$  represents the larger angles and  $5x$  represents the smaller angle. Solve the equation:  $12x = 180 \rightarrow x = 15$ . Therefore, the larger angles =  $7(15) = 105^\circ$ , and the smaller angle =  $5(15) = 75^\circ$ . The difference equals  $105 - 75 = 30^\circ$ .
9. **Answer choice (A) is the correct answer.** Angles K and L are consecutive angles (next to each other). In a parallelogram, consecutive angles are supplementary (add up to  $180^\circ$ ). Since angle K and L are both  $130^\circ$ , they do NOT add up to  $180^\circ$ , so quadrilateral JKLM is NOT a parallelogram.
10. **Answer (A) choice is the correct answer.** The angles in a quadrilateral add up to 360, so set up and solve an equation for the sum of the angles using  $x$  as the missing angle in the quadrilateral:  $90 + 115 + 100 + x = 360 \rightarrow 305 + x = 360 \rightarrow x = 55^\circ$ . Since the angle we labeled as  $x$  and the angle labeled as  $b$  create a straight line, they add up to  $180^\circ$ . Therefore  $55 + b = 180 \rightarrow b = 125^\circ$ .
11. **Answer choice (C) is the correct answer.** Since the three angles form a straight line, they add up to  $180^\circ$ . Set up and solve an equation setting the sum of the three angles equal to 180:  $x + 32 + 4x - 21 + 2x + 15 = 180 \rightarrow 7x + 26 = 180 \rightarrow 7x = 154 \rightarrow x = 22$ .

- 12. Answer choice (C) is the correct answer.** First, find the sum of the angles in a pentagon by using the formula  $180(n - 2)$  where  $n$  represents the number of sides. Therefore, the sum of the angles in a pentagon  $= 180(5 - 2) = 180(3) = 540^\circ$ . Now set up and solve an equation setting the sum of the angles equal to  $540^\circ$ :  $90 + x + 230 + 80 + x + 60 = 540 \rightarrow 2x + 460 = 540 \rightarrow 2x = 80 \rightarrow x = 40^\circ$ .
- 13. Answer choice (C) is the correct answer.** The angle measuring  $4x - 12^\circ$  and the angle measuring  $2y + 8^\circ$  are congruent because they are *alternate exterior angles*. Therefore, set the two equations equal to each other and rearrange them to isolate  $2x - y$ :  $4x - 12 = 2y + 8 \rightarrow 4x = 2y + 20 \rightarrow 4x - 2y = 20 \rightarrow 2x - y = 10$ .
- 14. Answer choice (B) is the correct answer.** The sum of the angles in a triangle is 180, so set up the equation  $2x + 3x + 5x = 180$  where  $2x$ ,  $3x$ , and  $5x$  represent the smallest angle, middle angle, and largest angle respectively. Solve the equation:  $10x = 180 \rightarrow x = 18$ . Therefore, the smallest angle is  $2(18) = 36^\circ$ , and the largest angle is  $5(18) = 90^\circ$ . Find the average of  $36^\circ$  and  $90^\circ$ :  $(36^\circ + 90^\circ) \div 2 = 126^\circ \div 2 = 63^\circ$ .
- 15. Answer choice (B) is the correct answer.** The angle measuring  $120^\circ$  and the angle measuring  $a + 10^\circ$  make a straight line, so they add up to  $180^\circ$ . Therefore,  $120 + a + 10 = 180 \rightarrow 130 + a = 180 \rightarrow a = 50$ . The angle measuring  $a + 10^\circ$  and the angle measuring  $2b - a^\circ$  are vertical angles, so they are congruent. Therefore,  $a + 10 = 2b - a$ . Plug in 50 for  $a$  and solve for  $b$ :  $50 + 10 = 2b - 50 \rightarrow 60 = 2b - 50 \rightarrow 110 = 2b \rightarrow b = 55$
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### Circles Set 1

- 1. Answer choice (C) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, the area of a circle with a radius of 8 inches  $= \pi 8^2 = 64\pi \text{ in}^2$ .
- 2. Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, since the radius of this circle is 9 ft, the area  $= \pi 9^2 = 81\pi \text{ ft}^2$ .
- 3. Answer choice (A) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a diameter of 7 mm  $= 7\pi \text{ mm}$ .
- 4. Answer choice (B) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a radius of 16 mm  $= 2 \cdot 16\pi \text{ mm} = 32\pi \text{ mm}$ .
- 5. Answer choice (A) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, to find the radius of a circle that has an area of  $36\pi \text{ yd}^2$ , set up the

equation  $36\pi = \pi r^2$ . Solve the equation by dividing both sides by  $\pi$  and then taking the square root of both sides:  $36\pi = \pi r^2 \rightarrow 36 = r^2 \rightarrow r = 6$  yd.

6. **Answer choice (D) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, to find the diameter of a circle with a circumference of  $9\pi$  cm, set up the equation  $9\pi = \pi d$ . Divide both sides of the equation by  $\pi$  to get  $d = 9$  cm.
7. **Answer choice (D) is the correct answer.** First find the radius of the circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, to find the radius of a circle that has an area of  $49\pi$  mm<sup>2</sup>, set up the equation  $49\pi = \pi r^2$ . Solve the equation by dividing both sides by  $\pi$  and then taking the square root of both sides:  $49\pi = \pi r^2 \rightarrow 49 = r^2 \rightarrow r = 7$  mm. Now find the circumference. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a radius of 7 mm =  $7 \cdot 2\pi$  mm =  $14\pi$  mm.
8. **Answer choice (C) is the correct answer.** First, find the radius of the circle. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, to find the radius of a circle with a circumference of  $26\pi$  mm, set up the equation  $26\pi = 2\pi r$ . Divide both sides of the equation by  $2\pi$  to get  $r = 13$  mm. Now find the area of the circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, since the radius of this circle is 13 mm, the area =  $\pi 13^2 = 169\pi$  mm<sup>2</sup>.
9. **Answer choice (B) is the correct answer.** The sum of the central angles in a circle is  $360^\circ$ , so set up and solve the equation  $28^\circ + 97^\circ + 34^\circ + 78^\circ + 111^\circ + b = 360^\circ \rightarrow 348^\circ + b = 360^\circ \rightarrow b = 12^\circ$ .
10. **Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. First, find the area of a circle with a the radius of 6 m:  $A = \pi 6^2 = 36\pi$  m<sup>2</sup>. Now divide this by 4 to find the area of a *quarter* circle with a radius of 6 m to get an area of  $9\pi$  m<sup>2</sup>.
11. **Answer choice (B) is the correct answer.** A circle has a total of  $360^\circ$ , so  $20^\circ$  makes up  $\frac{20^\circ}{360^\circ} = \frac{1}{18}$  of the circle.
12. **Answer choice (B) is the correct answer.** Find the length of the arc of the semicircle by finding half of the circumference of a circle with a diameter of 24. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a diameter of 24 in =  $24\pi$  in. Cut this in half to get that the length of the arc equals  $12\pi$  in. Since we want the perimeter of the entire figure, add the length of the diameter to the length of the arc:  $12\pi + 24$  in.

**13. Answer choice (B) is the correct answer.** First, find the circumference of the circle. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a diameter of 15 cm =  $15\pi$  cm. Now find the fraction of the circle that minor arc BC makes up by dividing  $120^\circ$  by  $360^\circ$  because there are  $360^\circ$  in a circle:  $\frac{120^\circ}{360^\circ} = \frac{1}{3}$  of the circle. Therefore, minor arc BC makes up  $\frac{1}{3}$  of the entire circumference, so the length of minor arc BC =  $\frac{1}{3} \cdot 15\pi = 5\pi$  cm.

**14. Answer choice (C) is the correct answer.** A circle has a total of  $360^\circ$ , so  $30^\circ$  makes up  $\frac{30^\circ}{360^\circ} = \frac{1}{12}$  of the circle. Therefore,  $\frac{1}{12}$  of the circle is shaded.

**15. Answer choice (A) is the correct answer.** First, find the area of the entire circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, the area of a circle with a radius of 6 in =  $\pi 6^2 = 36\pi$  in<sup>2</sup>. Now find the fraction of the circle that the shaded slice takes up by dividing  $40^\circ$  by  $360^\circ$  because there are  $360^\circ$  in a circle:  $\frac{40^\circ}{360^\circ} = \frac{1}{9}$  of the circle. Therefore, the shaded area makes up  $\frac{1}{9}$  of the entire area, so the area of the shaded region equals  $\frac{1}{9} \cdot 36\pi = 4\pi$  in<sup>2</sup>.

### Circles Set 2

- 1. Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. If the diameter of the circle is 10 ft, then the radius is 5 ft, and the area =  $\pi 5^2 = 25\pi$  ft<sup>2</sup>.
- 2. Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, if the radius of the circle is 3 m, then the area =  $\pi 3^2 = 9\pi$  m<sup>2</sup>.
- 3. Answer choice (C) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a radius of 11 m =  $2(11)\pi$  m =  $22\pi$  m.
- 4. Answer choice (A) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a diameter of 15 in =  $15\pi$  in.

5. **Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, to find the radius of a circle that has an area of  $100\pi$  ft<sup>2</sup>, set up the equation  $100\pi = \pi r^2$ . Solve the equation by dividing both sides by  $\pi$  and then taking the square root of both sides:  $100\pi = \pi r^2 \rightarrow 100 = r^2 \rightarrow r = 10$  ft. Find the diameter by multiplying the radius by two to get 20 ft.
6. **Answer choice (C) is the correct answer.** The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, to find the radius of a circle with a circumference of  $25\pi$  m, set up the equation  $25\pi = 2\pi r$ . Divide both sides of the equation by  $2\pi$  to get  $r = 12.5\pi$  m.
7. **Answer choice (B) is the correct answer.** First find the radius of the circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, to find the radius of a circle that has an area of  $64\pi$  in<sup>2</sup>, set up the equation  $64\pi = \pi r^2$ . Solve the equation by dividing both sides by  $\pi$  and then taking the square root of both sides:  $64\pi = \pi r^2 \rightarrow 64 = r^2 \rightarrow r = 8$  in. Now find the circumference. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a radius of 8 in =  $8 \cdot 2\pi$  in =  $16\pi$  in.
8. **Answer choice (C) is the correct answer.** First, find the radius of the circle. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, to find the radius of a circle with a circumference of  $50\pi$  mm, set up the equation  $50\pi = 2\pi r$ . Divide both sides of the equation by  $2\pi$  to get  $r = 25$  mm. Now find the area of the circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, since the radius of this circle is 25 mm, the area =  $\pi 25^2 = 625\pi$  mm<sup>2</sup>.
9. **Answer choice (B) is the correct answer.** The sum of the central angles in a circle is  $360^\circ$ . Set the sum of the angles equal to  $360^\circ$  using  $x$  to represent the central angle of the fourth slice:  $x + 182^\circ + 37^\circ + 50^\circ = 360^\circ$ . Solve the equation:  $269^\circ + x = 360^\circ \rightarrow x = 91^\circ$ .
10. **Answer choice (B) is the correct answer.** Find the area of a full circle with a diameter of 18 yd. Since the diameter is 18 yd, the radius is 9 yd. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, the area of a full circle with a radius of 9 yd =  $\pi 9^2 = 81\pi$  yd<sup>2</sup>. Divide  $81\pi$  yd<sup>2</sup> by 2 to find the area of the semicircle to get  $40.5\pi$  yd<sup>2</sup>.
11. **Answer choice (A) is the correct answer.** If the area of a quarter circle is  $36\pi$  yd<sup>2</sup>, then the area of a full circle with the same radius is  $4 \cdot 36\pi$  yd<sup>2</sup> =  $144\pi$  yd<sup>2</sup>. First find the radius of the circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. Therefore, to find the radius of a circle that has an area of  $144\pi$  yd<sup>2</sup>, set up the equation  $144\pi = \pi r^2$ . Solve the equation by dividing both sides by  $\pi$  and then taking the square root of both sides:  $144\pi = \pi r^2 \rightarrow 144 = r^2 \rightarrow r = 12$  yd.

- 12. Answer choice (B) is the correct answer.** A circle has a total of  $360^\circ$ , so  $50^\circ$  makes up  $\frac{50^\circ}{360^\circ} = \frac{5}{36}$  of the circle. Therefore, Arc AB takes up  $\frac{5}{36}$  of the circumference of the circle.
- 13. Answer choice (D) is the correct answer.** A circle has a total of  $360^\circ$ , so  $60^\circ$  makes up  $\frac{60^\circ}{360^\circ} = \frac{1}{6}$  of the circle. Therefore,  $\frac{1}{6}$  of the circle is shaded.
- 14. Answer choice (A) is the correct answer.** First, find the circumference of the circle. The formula for the circumference of a circle is  $C = 2\pi r$  or  $C = \pi d$  where  $r$  represents the radius and  $d$  represents the diameter. Therefore, the circumference of a circle with a radius of 9 in  $= 9 \cdot 2\pi$  in  $= 18\pi$  in. Now find the fraction of the circle that minor arc AB makes up by dividing  $40^\circ$  by  $360^\circ$  because there are  $360^\circ$  in a circle:  $\frac{40^\circ}{360^\circ} = \frac{1}{9}$  of the circle. Therefore, minor arc AB makes up  $\frac{1}{9}$  of the entire circumference, so the length of minor arc AB  $= \frac{1}{9} \cdot 18\pi = 2\pi$  in.
- 15. Answer choice (A) is the correct answer.** First, find the area of the entire circle. The formula for the area of a circle is  $A = \pi r^2$ , where  $r$  represents the radius. If the diameter is 6 m, then the radius is 3 m, so the area  $= \pi 3^2 = 9\pi$  m<sup>2</sup>. Now find the fraction of the circle that the shaded slice takes up by dividing  $150^\circ$  by  $360^\circ$  because there are  $360^\circ$  in a circle:  $\frac{150^\circ}{360^\circ} = \frac{5}{12}$  of the circle. Therefore, the shaded area makes up  $\frac{5}{12}$  of the entire area, so the area of the shaded region equals  $\frac{5}{12} \cdot 9\pi = 3.75\pi$  m<sup>2</sup>.
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### Triangles Set 1

- 1. Answer choice (B) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so  $x^\circ + 83^\circ + 34^\circ = 180^\circ$ . Solve the equation to get  $x = 63^\circ$ .
- 2. Answer choice (D) is the correct answer.** All we know about the triangle is that the angles add up to  $180^\circ$ . However, we cannot determine the difference between  $a$  and  $b$  with this information.
- 3. Answer choice (B) is the correct answer.** Since the triangle is isosceles, the bottom two angles are equal. The sum of the angles in a triangle is  $180^\circ$ , so  $x^\circ + 43^\circ + 43^\circ = 180^\circ$ . Solve the equation to get  $x = 94^\circ$ .
- 4. Answer choice (C) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so

$$2a^\circ + 50^\circ + a^\circ + 28^\circ = 180^\circ. \text{ Solve the equation: } 3a^\circ + 78^\circ = 180^\circ \rightarrow 3a^\circ \rightarrow 102^\circ \rightarrow a = 34.$$

5. **Answer choice (C) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so  $x^\circ + y^\circ + 38^\circ = 180^\circ$ . Isolate  $x$ :  $x^\circ + y^\circ = 142^\circ \rightarrow x = 142 - y$ .
6. **Answer choice (D) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so  $b - 11 + 2b + 16 + 3b - 29 = 180$ . Solve the equation:  $6b - 24 = 180 \rightarrow 6b = 204 \rightarrow b = 34$ . Plug  $b$  back into each angle expression to find the measures of each angle,  $b - 11 = 23^\circ$ ,  $2b + 16 = 84^\circ$ , and  $3b - 29 = 73^\circ$ . Therefore, the largest angle measures  $84^\circ$ .
7. **Answer choice (B) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. In answer choice (B)  $15 + 10 = 25$ , so the sum of the two smaller sides is equal to the third side, NOT greater than. Therefore, answer choice (B) cannot be a triangle.
8. **Answer choice (B) is the correct answer.** Since all of the sides of the triangle are equal, then all of the angles are equal. Since the angles in a triangle add up to  $180^\circ$ , the measure of each angle is  $60^\circ$ . Set  $53 - 2k$  equal to 60 and solve for  $k$ :  $53 - 2k = 60 \rightarrow -2k = 7 \rightarrow k = -3.5$ .
9. **Answer choice (A) is the correct answer.** Since the angles in a triangle add up to  $180^\circ$ , angle C has a measure of  $39^\circ$ . Since angles A and C are equal, sides AB and CB are also equal. Set  $12 - x$  equal to  $3x - 24$  and solve for  $x$ :  $12 - x = 3x - 24 \rightarrow 36 = 4x \rightarrow x = 9$ . Plug  $x$  back into the expression that represents side BC:  $3(9) - 24 = 27 - 24 = 3$ .
10. **Answer choice (D) is the correct answer.** Since the triangle is equilateral, then all of the sides are equal. Set  $2y + 15$  equal to  $60 - 7y$  and solve:  $2y + 15 = 60 - 7y \rightarrow 9y = 45 \rightarrow y = 5$ . Plug  $y$  back into either expression to find the length of each side:  $2(5) + 15 = 10 + 15 = 25$  ft. If the length of each side of the triangle is 25 ft, then the perimeter is  $25 + 25 + 25 = 75$  ft.
11. **Answer choice (B) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. If the perimeter of the triangle is 37 feet, then the three side lengths are 18, 7, and 12. Since  $7 + 12 > 18$ , this triangle works.
12. **Answer choice (D) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. Therefore, if  $b$  is the smallest side, then  $b + 3 > 4$ , which means  $b > 1$ .
13. **Answer choice (D) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. If the sides lengths measure 4 in, 16 in, and 12 in, then  $4 + 12 = 16$ . Since the sum of the two smallest sides is equal to the third side, NOT greater than, this triangle doesn't work.

- 14. Answer choice (A) is the correct answer.** Since the left triangle is isosceles, the two base angles are congruent. The angles in a triangle add up to  $180^\circ$ , so each base angle equals  $70^\circ$  ( $40^\circ + 70^\circ + 70^\circ = 180^\circ$ ). The third angle in the right triangle that is not labeled forms a straight line with the right base angle of the left triangle. Therefore, the two angles add to  $180^\circ$ . Therefore, the third angle of the right triangle equals  $110^\circ$  ( $70^\circ + 110^\circ = 180^\circ$ ). Finally, the angles in the right triangle must add to  $180^\circ$ , so  $y + z + 110 = 180$ . Subtract 110 from both sides to get  $y + z = 70$ .
- 15. Answer choice (B) is the correct answer.** The angles in a triangle add up to  $180^\circ$ , and angle DAC is  $30^\circ$  fewer than angle ADC. Let  $x$  represent the measure of angle ADC, so  $x - 30$  represents the measure of angle DAC. Therefore,  $30 + x + x - 30 = 180 \rightarrow 2x = 180 \rightarrow x = 90$ . So angle ADC equals  $90^\circ$  and angle DAC equals  $60^\circ$ . We know that angle BAD equals  $140^\circ$ , and BAD equals DAC + CAB. So  $140^\circ = 60^\circ + CAB$ . Therefore, angle CAB equals  $80^\circ$ . Finally, the three angles in the right triangle must add to  $180^\circ$ , so  $70^\circ + 80^\circ + b = 180$ . Solve the equation to get that angle  $b = 30^\circ$ .

### Triangles Set 2

- 1. Answer choice (B) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so  $y^\circ + 79^\circ + 84^\circ = 180^\circ$ . Solve the equation to get  $y = 17^\circ$ .
- 2. Answer choice (B) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so  $a^\circ + b^\circ + 57^\circ = 180^\circ$ . Subtract 57 from both sides to get  $a + b = 123^\circ$ .
- 3. Answer choice (C) is the correct answer.** Since the left and right side of the triangle are congruent, the two angles across from them (the bottom two angles) are congruent. Therefore,  $x = 67^\circ$ .
- 4. Answer choice (B) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so set up and solve the equation  $48 + 72 + 38 - q = 180 \rightarrow 158 - q = 180 \rightarrow -q = 22 \rightarrow q = -22$ .
- 5. Answer choice (D) is the correct answer.** All we know about the triangle is that the angles add up to  $180^\circ$ . However, we cannot determine the difference between  $x$  and  $y$  with this information.
- 6. Answer choice (B) is the correct angle.** The sum of the angles in a triangle is  $180^\circ$ , so set up and solve the equation  $x - 25 + 3x + 6 + x + 9 = 180 \rightarrow 5x - 10 = 180 \rightarrow 5x = 190 \rightarrow x = 38$ . The smallest angle is  $x - 25$ , so the smallest angle =  $38 - 25 = 13^\circ$ .
- 7. Answer choice (A) is the correct answer.** Since the triangle has three congruent sides, it is equilateral. The measure of each angle in an equilateral triangle is  $60^\circ$ . Set  $5a - 75$  equal to 60 and solve:  $5a - 75 = 60 \rightarrow 5a = 135 \rightarrow a = 27$ .

- 8. Answer choice (D) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. Therefore, answer choice (D) works because  $9 + 2 > 10$ .
- 9. Answer choice (C) is the correct answer.** Since angles A and C are congruent, sides AB and BC are also congruent. So set up the equation  $2a - 1 = a + 1$  and solve:  $2a - 1 = a + 1 \rightarrow a - 1 = 1 \rightarrow a = 2$ . Now plug  $a$  into either expression to find the length of AC and BC:  $2a - 1 = 2(2) - 1 = 4 - 1 = 3$ . Therefore, sides AB and BC equal 3. Angle B is  $90^\circ$  because the angles in a triangle add up to  $180^\circ$ . Therefore, use the pythagorean theorem to find side AC:  $3^2 + 3^2 = (AC)^2 \rightarrow 9 + 9 = (AC)^2 \rightarrow 18 = (AC)^2 \rightarrow AC = \sqrt{18} \rightarrow AC = 3\sqrt{2}$ .
- 10. Answer choice (C) is the correct answer.** Since the triangle is equilateral, all of the sides are equal. Set  $2x - 10$  equal to 40 and solve for  $x$ :  $2x - 10 = 40 \rightarrow 2x = 50 \rightarrow x = 25$ . Set  $60 + 4y = 40$  and solve for  $y$ :  $60 + 4y = 40 \rightarrow 4y = -20 \rightarrow y = -5$ . Find  $x - y$ :  $25 - (-5) = 30$ .
- 11. Answer choice (D) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. If the perimeter of the triangle is 54 feet, then the three side lengths are 12, 15, and 27. Since  $12 + 15 = 27$ , this triangle does NOT work.
- 12. Answer choice (D) is the correct answer.** In any triangle, the sum of any two sides has to be greater than the third side. Therefore,  $8 + 12$  must be greater than  $a$ , so  $20 > a$  or  $a < 20$ .
- 13. Answer choice (B) is the correct answer.** In any triangle, the sum of the two smallest sides has to be greater than the third side. If the three sides are 3, 5, and 6, then  $3 + 5 > 6$ , so this triangle works.
- 14. Answer choice (A) is the correct answer.** Angle D is right, so it measures  $90^\circ$ . Since the sum of the angles in any triangle is  $180^\circ$ , angle D plus angle DCB plus angle DBC equals  $180^\circ$ :  $90 + 30 + \text{DBC} = 180^\circ \rightarrow \text{DBC} = 60^\circ$ . The measure of  $\text{ABD} = 130^\circ$ , so  $\text{ABC} + \text{DBC} = 130^\circ$ :  $\text{ABC} + 60^\circ = 130^\circ \rightarrow \text{ABC} = 70^\circ$ . Now we know angle A =  $85^\circ$  and angle ABC =  $70^\circ$ . Find angle ACB by setting the sum of the angles in triangle ABC equal to  $180^\circ$ :  $85^\circ + 70^\circ + \text{ACB} = 180^\circ \rightarrow \text{ACB} = 25^\circ$ .
- 15. Answer choice (C) is the correct answer.** The sum of the angles in any triangle equals  $180^\circ$ , so set up an equation for the sum of the angles in triangle LMN:  $56^\circ + 28^\circ + \text{MNL} = 180 \rightarrow \text{MNL} = 96^\circ$ . Since angle MNO measures  $169^\circ$ , then  $\text{MNL} + \text{ONL} = 169^\circ$ . Plug in  $96^\circ$  for MNL and solve for the measure of angle ONL:  $96^\circ + \text{ONL} = 169^\circ \rightarrow \text{ONL} = 73^\circ$ . Finally, set up an equation for the sum of the angles in triangle LNO and isolate  $x + y$ :  $x + y + 73 = 180 \rightarrow x + y = 107$ .
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### Pythagorean Theorem Set 1

- 1. Answer choice (B) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow 6^2 + 8^2 = c^2 \rightarrow 36 + 64 = c^2 \rightarrow 100 = c^2 \rightarrow c = 10$  in.

2. **Answer choice (B) is the correct answer.** Use the pythagorean theorem to find the missing side:  
 $a^2 + b^2 = c^2 \rightarrow 5^2 + 7^2 = c^2 \rightarrow 25 + 49 = c^2 \rightarrow 74 = c^2 \rightarrow c = \sqrt{74}$  cm.
3. **Answer choice (B) is the correct answer.** Use the pythagorean theorem to find the missing side:  
 $a^2 + b^2 = c^2 \rightarrow 10^2 + 4^2 = c^2 \rightarrow 100 + 16 = c^2 \rightarrow 116 = c^2 \rightarrow c = \sqrt{116}$  m =  $2\sqrt{29}$  m.
4. **Answer choice (C) is the correct answer.** Use the pythagorean theorem to find the missing side:  
 $a^2 + b^2 = c^2 \rightarrow a^2 + 5^2 = 13^2 \rightarrow a^2 + 25 = 169 \rightarrow 144 = a^2 \rightarrow a = 12$  in.
5. **Answer choice (A) is the correct answer.** Use the pythagorean theorem to find the missing side:  
 $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = 7^2 \rightarrow a^2 + 9 = 49 \rightarrow 40 = a^2 \rightarrow a = \sqrt{40}$  mm =  $2\sqrt{10}$  mm.
6. **Answer choice (C) is the correct answer.** Use the pythagorean theorem to find the missing side:  
 $a^2 + b^2 = c^2 \rightarrow a^2 + 8^2 = 17^2 \rightarrow a^2 + 64 = 289 \rightarrow 225 = a^2 \rightarrow a = 15$  ft.
7. **Answer choice (A) is the correct answer.** First, find the missing leg using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = \sqrt{58}^2 \rightarrow a^2 + 9 = 58 \rightarrow 49 = a^2 \rightarrow a = 7$  km. Now find the area of the triangle using the formula for the area of a triangle:  $A = \frac{1}{2}bh$ .  $A = \frac{1}{2}(3)(7) = 10.5$  m<sup>2</sup>.
8. **Answer choice (A) is the correct answer.** If you draw a diagonal in a square, it divides the square into two congruent right triangles with the diagonal as the hypotenuse. Use the pythagorean theorem to find the diagonal:  $a^2 + b^2 = c^2 \rightarrow 5^2 + 5^2 = c^2 \rightarrow 25 + 25 = c^2 \rightarrow 50 = c^2 \rightarrow c = \sqrt{50}$  ft =  $5\sqrt{2}$  ft.
9. **Answer choice (B) is the correct answer.** First, find the height of the large triangle by using the pythagorean theorem on the smaller triangle on the right:  $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = 5^2 \rightarrow a^2 + 9 = 25 \rightarrow 16 = a^2 \rightarrow a = 4$  m. Now find the area of the larger triangle using 4 m as the height, 7 m as the base, and the formula for the area of a triangle:  $A = \frac{1}{2}bh$ .  $A = \frac{1}{2}(4)(7) = 14$  m<sup>2</sup>.
10. **Answer choice (B) is the correct answer.** First, find the bottom side of the smaller left triangle using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = \sqrt{34}^2 \rightarrow a^2 + 9 = 34 \rightarrow 25 = a^2 \rightarrow a = 5$  in. Now find the bottom side of the smaller right triangle using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = \sqrt{58}^2 \rightarrow a^2 + 9 = 58 \rightarrow 49 = a^2 \rightarrow a = 7$  in. Therefore, the base of the large triangle =  $5 + 7 = 12$  in. Find the area of the large triangle using 12 in as the base, 3 in as the height, and the formula for the area of a triangle:  $A = \frac{1}{2}bh$ .  $A = \frac{1}{2}(3)(12) = 18$  in<sup>2</sup>.

- 11. Answer choice (B) is the correct answer.** The shortest distance between A and B is the straight line distance between A and B. Draw a line from A to B to form a right triangle. Then use the pythagorean theorem to find the length of AB:  $a^2 + b^2 = c^2 \rightarrow 9^2 + 12^2 = c^2 \rightarrow 81 + 144 = c^2 \rightarrow 225 = c^2 \rightarrow c = 15$  yd.
- 12. Answer choice (A) is the correct answer.** Draw the diagonal of the rectangle and you will divide the rectangle into two congruent right triangles. Find the length of the rectangle by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 2^2 = \sqrt{53}^2 \rightarrow a^2 + 4 = 53 \rightarrow 49 = a^2 \rightarrow a = 7$  mm. Now find the area of the rectangle by multiplying length times width:  $2 \cdot 7 = 14$  mm<sup>2</sup>.
- 13. Answer choice (B) is the correct answer.** If you draw a diagonal in a square, it divides the square into two congruent right triangles with the diagonal as the hypotenuse. Since a square has all equal sides, the two legs of each right triangle are equal. Use the pythagorean theorem to find the diagonal using  $a$  for both legs of the right triangle:  $a^2 + a^2 = (3\sqrt{2})^2 \rightarrow 2a^2 = 18 \rightarrow a^2 = 9 \rightarrow a = 3$  cm.
- 14. Answer choice (D) is the correct answer.** If you draw Gerad's bike path, and then draw a line from his home to school, you will create a right triangle with legs measuring 3 miles and 4 miles. Use the pythagorean theorem to find the straight-line distance between Gerald's school and home:  $a^2 + b^2 = c^2 \rightarrow 3^2 + 4^2 = c^2 \rightarrow 9 + 16 = c^2 \rightarrow 25 = c^2 \rightarrow c = 5$  miles.
- 15. Answer choice (D) is the correct answer.** If you draw a diagram for the scenario, you will have a right triangle with a hypotenuse of 10 ft and one leg measuring 8 ft. Solve for the other leg of the triangle using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 8^2 = 10^2 \rightarrow a^2 + 64 = 100 \rightarrow 36 = a^2 \rightarrow a = 6$  ft.

### Pythagorean Theorem Set 2

- 1. Answer choice (B) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow 10^2 + 24^2 = c^2 \rightarrow 100 + 576 = c^2 \rightarrow 676 = c^2 \rightarrow c = 26$  cm.
- 2. Answer choice (A) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow 8^2 + 12^2 = c^2 \rightarrow 64 + 144 = c^2 \rightarrow 208 = c^2 \rightarrow c = \sqrt{208} \rightarrow c = 4\sqrt{13}$  in.
- 3. Answer choice (C) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow 8^2 + 7^2 = c^2 \rightarrow 64 + 49 = c^2 \rightarrow 113 = c^2 \rightarrow c = \sqrt{113}$  cm.
- 4. Answer choice (C) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow a^2 + 5^2 = 10^2 \rightarrow a^2 + 25 = 100 \rightarrow 75 = a^2 \rightarrow a = \sqrt{75}$  mm  $\rightarrow a = 5\sqrt{3}$  mm.

5. **Answer choice (B) is the correct answer.** Use the pythagorean theorem to find the missing side:  $a^2 + b^2 = c^2 \rightarrow a^2 + 4^2 = 5^2 \rightarrow a^2 + 16 = 25 \rightarrow 9 = a^2 \rightarrow a = 3$  ft.
6. **Answer choice (B) is the correct answer.** First, find the other leg of the triangle by using the equation for the area of a triangle (assume 6 is the base of the triangle):  $A = \frac{1}{2}bh$ . Plug in 24 for the area, and 6 for the base, and solve for the height:  $24 = \frac{1}{2}(6)h \rightarrow 24 = 3h \rightarrow h = 8$  cm. Now we have a right triangle with legs measuring 6 cm and 8 cm, so use the pythagorean theorem to find the hypotenuse:  $a^2 + b^2 = c^2 \rightarrow 6^2 + 8^2 = c^2 \rightarrow 36 + 64 = c^2 \rightarrow 100 = c^2 \rightarrow c = 10$  cm.
7. **Answer choice (A) is the correct answer.** Find the missing leg using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 2^2 = (4\sqrt{5})^2 \rightarrow a^2 + 4 = 80 \rightarrow 76 = a^2 \rightarrow a = \sqrt{76} \rightarrow a = 2\sqrt{19}$  in. Find the area of the triangle by using the equation for the area of a triangle:  $A = \frac{1}{2}bh$ . Plug in  $2\sqrt{19}$  for the base and 2 for the height:  $A = \frac{1}{2}(2)2\sqrt{19} \rightarrow A = 2\sqrt{19}$  in<sup>2</sup>.
8. **Answer choice (B) is the correct answer.** First find the missing leg of the smaller triangle on the left using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 6^2 = 10^2 \rightarrow a^2 + 36 = 100 \rightarrow 64 = a^2 \rightarrow a = 8$  m. Therefore, the height of the large triangle is 8 m. Find the area by using the equation for the area of a triangle:  $A = \frac{1}{2}bh$ . Plug in 11 for the base ( $6 + 5 = 11$ ) and 8 for the height:  $A = \frac{1}{2} \cdot 11 \cdot 8 \rightarrow A = 44$  m<sup>2</sup>.
9. **Answer choice (A) is the correct answer.** Find the missing leg of the smaller triangle on the right by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 7^2 = (\sqrt{65})^2 \rightarrow a^2 + 49 = 65 \rightarrow 16 = a^2 \rightarrow a = 4$  in. Therefore, the height of the large triangle is 4 in. Find the missing leg of the smaller triangle on the left using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 4^2 = 5^2 \rightarrow a^2 + 16 = 25 \rightarrow a^2 = 9 \rightarrow a = 3$  in. Therefore, the base of the large triangle is  $3 + 7 = 10$  in. Find the area by using the equation for the area of a triangle:  $A = \frac{1}{2}bh$ . Plug in 10 for the base and 4 for the height:  $A = \frac{1}{2} \cdot 10 \cdot 4 \rightarrow A = 20$  in<sup>2</sup>.
10. **Answer choice (A) is the correct answer.** The shortest distance between L and N is the straight line distance between L and N. Draw a line from L and N to form a right triangle. Then use the pythagorean theorem to find the length of LN:  $a^2 + b^2 = c^2 \rightarrow (\sqrt{7})^2 + 3^2 = c^2 \rightarrow 7 + 9 = c^2 \rightarrow 16 = c^2 \rightarrow c = 4$  yd.
11. **Answer choice (B) is the correct answer.** If you draw a diagonal in a square, it divides the square into two congruent right triangles with the diagonal as the hypotenuse. Since a square has all equal

sides, the two legs are each 4 km. Find the length of the diagonal using the pythagorean theorem:  
 $4^2 + 4^2 = c^2 \rightarrow 16 + 16 = c^2 \rightarrow 32 = c^2 \rightarrow c = \sqrt{32} \rightarrow c = 4\sqrt{2}$  km.

- 12. Answer choice (A) is the correct answer.** Draw the diagonal of the rectangle and you will have two congruent right triangles with one leg measuring 4 mm and the hypotenuse measuring 6 mm. Find the missing side of the triangle, which is the width of the rectangle, by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 4^2 = 6^2 \rightarrow a^2 + 16 = 36 \rightarrow 20 = a^2 \rightarrow a = \sqrt{20}$  mm  $\rightarrow a = 2\sqrt{5}$  mm. Find the perimeter of the rectangle by adding up the sides:  $4 + 4 + 2\sqrt{5} + 2\sqrt{5} = 8 + 4\sqrt{5}$  mm.
- 13. Answer choice (C) is the correct answer.** If you draw a diagonal in a square, it divides the square into two congruent right triangles with the diagonal as the hypotenuse. Since a square has all equal sides, the two legs of each right triangle are equal. Use the pythagorean theorem to find the diagonal using  $a$  for both legs of the right triangle:  $a^2 + a^2 = (10\sqrt{2})^2 \rightarrow 2a^2 = 200 \rightarrow a^2 = 100 \rightarrow a = 10$  in. Now find the area of the square by squaring the side length:  $10^2 = 100$  in<sup>2</sup>.
- 14. Answer choice (D) is the correct answer.** If you draw the situation, you will have a right triangle with a base of 9 ft, a hypotenuse of 15 ft, and a missing leg that represents the height of the tree. Find the height of the tree using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 9^2 = 15^2 \rightarrow a^2 + 81 = 225 \rightarrow 144 = a^2 \rightarrow a = 12$  ft.
- 15. Answer choice (B) is the correct answer.** Find the distance traveled by each boat after 2 hours by multiplying the speed by 2. The boat traveling east has traveled  $2 \cdot 20 = 40$  miles. The boat traveling south has traveled  $2 \cdot 15 = 30$  miles. Now start at a point and draw a line east (left) and label it 40 miles. From the starting point, draw a line south (down) and measure it 30 miles. Now draw the distance between the endpoints of the two lines and that will represent the distance between the two boats. Find the distance using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow 30^2 + 40^2 = c^2 \rightarrow 900 + 1600 = c^2 \rightarrow 2500 = c^2 \rightarrow c = 50$  mi.

### Distance and Midpoint Set 1

- 1. Answer choice (B) is the correct answer.** Since the  $x$  coordinates of the two points are both 5, the distance between the two points is equal to the distance, or difference, between the  $y$  coordinates:  $8 - 2 = 6$  units.
- 2. Answer choice (A) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left( \frac{6 + (-4)}{2}, \frac{9 + 5}{2} \right) \rightarrow \left( \frac{2}{2}, \frac{14}{2} \right) \rightarrow (1, 7)$ .

3. **Answer choice (C) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(4 - (-3))^2 + (7 - 2)^2 = d^2 \rightarrow 7^2 + 5^2 = d^2 \rightarrow 49 + 25 = d^2 \rightarrow 74 = d^2 \rightarrow d = \sqrt{74}$  units.
4. **Answer choice (B) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points,  $(-3, 2)$  and  $(2, -2)$ , into the formula and simplify:  $(2 - (-3))^2 + (-2 - 2)^2 = d^2 \rightarrow 5^2 + (-4)^2 = d^2 \rightarrow 25 + 16 = d^2 \rightarrow 41 = d^2 \rightarrow d = \sqrt{41}$  units.
5. **Answer choice (D) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left( \frac{(-5) + 2}{2}, \frac{10 + (-3)}{2} \right) \rightarrow \left( \frac{-3}{2}, \frac{7}{2} \right) \rightarrow (-1.5, 3.5)$ .
6. **Answer choice (B) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(-1 - 7)^2 + (0 - 6)^2 = d^2 \rightarrow (-8)^2 + (-6)^2 = d^2 \rightarrow 64 + 36 = d^2 \rightarrow 100 = d^2 \rightarrow d = 10$  units.
7. **Answer choice (A) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points,  $(-3, -2)$  and  $(2, 2)$ , into the formula and simplify:  $\left( \frac{(-3) + 2}{2}, \frac{(-2) + 2}{2} \right) \rightarrow \left( \frac{-1}{2}, \frac{0}{2} \right) \rightarrow (-0.5, 0)$ .
8. **Answer choice (B) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point

and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint and one endpoint. Set up an equation for the  $x$ -coordinate of the midpoint which equals  $-10$ , using  $x_2$  to represent the  $x$  coordinate of the second point:  $-10 = \frac{5 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and subtracting 5:  $-20 = 5 + x_2 \rightarrow x_2 = -25$ . Therefore, the  $x$ -coordinate of the other endpoint is  $-25$ . Do the same for the  $y$ -coordinate:  $-2 = \frac{2 + y_2}{2} \rightarrow -4 = 2 + y_2 \rightarrow y_2 = -6$ . Therefore, the other endpoint is  $(-25, -6)$ .

- 9. Answer choice (C) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint and one endpoint. Set up an equation for the  $x$ -coordinate of the midpoint which equals  $-10$ , using  $x_2$  to represent the  $x$  coordinate of the second point:  $-10 = \frac{-15 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and adding 15:  $-20 = -15 + x_2 \rightarrow x_2 = -5$ . Therefore, the  $x$ -coordinate of the other endpoint is  $-5$ . Do the same for the  $y$ -coordinate:  $-5 = \frac{0 + y_2}{2} \rightarrow -10 = 0 + y_2 \rightarrow y_2 = -10$ . Therefore, the other endpoint is  $(-5, -10)$ .

- 10. Answer choice (A) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse. We know that the distance between the points is 13 and the difference between the  $x$  coordinates is 12 ( $19 - 7 = 12$ ). Therefore, using  $\Delta y$  to represent the difference in the  $y$  coordinates, we can set up the following equation: simplify:  $12^2 + (\Delta y)^2 = 13^2$ . Solve the equation for  $\Delta y$ :  $144 + (\Delta y)^2 = 169 \rightarrow (\Delta y)^2 = 25 \rightarrow \Delta y = 5$ . This means the difference in the  $y$  coordinates equals 5. The difference between  $-3$  and  $-8$  equals 5, so answer choice (A) is correct.

- 11. Answer choice (C) is the correct answer.** The diagonal of the square can be drawn from point A to point C or point B to point D. Let's use point A and point C and find the distance between the two points using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(1 - 5)^2 + (10 - 6)^2 = d^2 \rightarrow (-4)^2 + (4)^2 = d^2 \rightarrow 16 + 16 = d^2 \rightarrow 32 = d^2 \rightarrow d = \sqrt{32} = 4\sqrt{2}$  units.

- 12. Answer choice (D) is the correct answer.** Find the distance between the two given points using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(-6 - (-4))^2 + (0 - 3)^2 = d^2 \rightarrow$

$(-2)^2 + (3)^2 = d^2 \rightarrow 4 + 9 = d^2 \rightarrow 13 = d^2 \rightarrow d = \sqrt{13}$  units. This distance represents the radius of the circle, so multiply it by 2 to find the diameter: diameter =  $2\sqrt{13}$  units.

**13. Answer choice (A) is the correct answer.** The center of the circle is the midpoint of the endpoints of the diameter. Use the midpoint formula:  $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left(\frac{6 + 2}{2}, \frac{8 + (-2)}{2}\right) \rightarrow \left(\frac{8}{2}, \frac{6}{2}\right) \rightarrow (4, 3)$ .

**14. Answer choice (D) is the correct answer.** Find the distance between the two points to find the diameter using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(-7 - (-2))^2 + (0 - 5)^2 = d^2 \rightarrow (-5)^2 + (-5)^2 = d^2 \rightarrow 25 + 25 = d^2 \rightarrow 50 = d^2 \rightarrow d = \sqrt{50} = 5\sqrt{2}$  units. Divide this by 2 to find the radius: radius =  $\frac{5\sqrt{2}}{2}$  units.

**15. Answer choice (B) is the correct answer.** The center of the circle is the midpoint of segment KJ.

To find the midpoint of two points, use the following formula:  $midpoint = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ ,

where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint of KJ and one endpoint, endpoint K. Set up an equation for the  $x$ -coordinate of the midpoint which equals  $-7$ , using  $x_2$  to represent the  $x$

coordinate of point J:  $7 = \frac{5 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and

subtracting 5:  $14 = 5 + x_2 \rightarrow x_2 = 9$ . Therefore, the  $x$ -coordinate of the other endpoint is 9. Do the

same for the  $y$ -coordinate:  $9 = \frac{4 + y_2}{2} \rightarrow 18 = 4 + y_2 \rightarrow y_2 = 14$ . Therefore, the other endpoint is  $(9, 14)$ .

## Distance and Midpoint Set 2

- 1. Answer choice (A) is the correct answer.** Since the  $y$  coordinates of the two points are both 5, the distance between the two points is equal to the distance, or difference, between the  $x$  coordinates:  $-1 - (-7) = 6$  units.
- 2. Answer choice (B) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the

two points. Plug the given points into the formula and simplify:  $(1 - 4)^2 + (-2 - 2)^2 = d^2 \rightarrow (-3)^2 + (-4)^2 = d^2 \rightarrow 9 + 16 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$  units.

3. **Answer choice (D) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left( \frac{0 + (-8)}{2}, \frac{-7 + 7}{2} \right) \rightarrow \left( \frac{-8}{2}, \frac{0}{2} \right) \rightarrow (-4, 0)$ .
4. **Answer choice (C) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points,  $(3, 4)$  and  $(1, -3)$ , into the formula and simplify:  $(1 - 3)^2 + (-3 - 4)^2 = d^2 \rightarrow (-2)^2 + (-7)^2 = d^2 \rightarrow 4 + 49 = d^2 \rightarrow 53 = d^2 \rightarrow d = \sqrt{53}$  units.
5. **Answer choice (C) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(14 - (-1))^2 + (3 - 11)^2 = d^2 \rightarrow (15)^2 + (-8)^2 = d^2 \rightarrow 225 + 64 = d^2 \rightarrow 289 = d^2 \rightarrow d = 17$  units.
6. **Answer choice (A) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left( \frac{12 + (-10)}{2}, \frac{-4 + (-9)}{2} \right) \rightarrow \left( \frac{2}{2}, \frac{-13}{2} \right) \rightarrow (1, -6.5)$ .
7. **Answer choice (A) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points,  $(4, 1)$  and  $(-3, 3)$ , into the formula and simplify:  $\left( \frac{4 + (-3)}{2}, \frac{1 + 3}{2} \right) \rightarrow \left( \frac{1}{2}, \frac{4}{2} \right) \rightarrow (0.5, 2)$ .

- 8. Answer choice (D) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint and one endpoint. Set up an equation for the  $x$ -coordinate of the midpoint which equals 5, using  $x_2$  to represent the  $x$  coordinate of the second point:  $5 = \frac{8 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and subtracting 8:  $10 = 8 + x_2 \rightarrow x_2 = 2$ . Therefore, the  $x$ -coordinate of the other endpoint is 2. Do the same for the  $y$ -coordinate:  $-1 = \frac{3 + y_2}{2} \rightarrow -2 = 3 + y_2 \rightarrow y_2 = -5$ . Therefore, the other endpoint is  $(2, -5)$ .
- 9. Answer choice (C) is the correct answer.** To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint and one endpoint. Set up an equation for the  $x$ -coordinate of the midpoint which equals  $-2$ , using  $x_2$  to represent the  $x$  coordinate of the second point:  $-2 = \frac{-1 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and adding 1:  $-4 = -1 + x_2 \rightarrow x_2 = -3$ . Therefore, the  $x$ -coordinate of the other endpoint is  $-3$ . Do the same for the  $y$ -coordinate:  $7 = \frac{5 + y_2}{2} \rightarrow 14 = 5 + y_2 \rightarrow y_2 = 9$ . Therefore, the other endpoint is  $(-3, 9)$ .
- 10. Answer choice (C) is the correct answer.** To find the distance between two points, use the pythagorean theorem using the difference between the  $x$  coordinates as one leg of the triangle, the difference between the  $y$  coordinates as the other leg, and the distance between the two points as the hypotenuse. We know that the distance between the points is  $\sqrt{13}$  and the difference between the  $y$  coordinates is 2 ( $1 - (-1) = 2$ ). Therefore, using  $\Delta x$  to represent the different in the  $x$  coordinates, we can set up the following equation: simplify:  $(\Delta x)^2 + 2^2 = (\sqrt{13})^2$ . Solve the equation for  $\Delta x$ :  $(\Delta x)^2 + 4 = 13 \rightarrow (\Delta x)^2 = 9 \rightarrow \Delta x = 3$ . This means the difference in the  $x$  coordinates equals 3. The difference between  $-13$  and  $-10$  equals 3, so answer choice (C) is correct.
- 11. Answer choice (A) is the correct answer.** The diagonal of the square can be drawn from point J to point L or point K to point M. Let's use point J and point L and find the distance between the two points:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(4 - (-2))^2 + (-3 - 3)^2 = d^2 \rightarrow (6)^2 + (-6)^2 = d^2 \rightarrow 36 + 36 = d^2 \rightarrow 72 = d^2 \rightarrow d = \sqrt{72} = 6\sqrt{2}$  units.

- 12. Answer choice (A) is the correct answer.** The distance between the center of the circle and point K equals the radius. Find the distance between the two given points using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(5 - 2)^2 + (5 - 1)^2 = d^2 \rightarrow (3)^2 + (4)^2 = d^2 \rightarrow 9 + 16 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$  units.
- 13. Answer choice (B) is the correct answer.** The center of the circle is the midpoint of the endpoints of the diameter. To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the endpoints of the diameter into the formula and simplify:  $\left( \frac{-4 + (-10)}{2}, \frac{1 + (-5)}{2} \right) \rightarrow \left( \frac{-14}{2}, \frac{-4}{2} \right) \rightarrow (-7, -2)$ .
- 14. Answer choice (D) is the correct answer.** Find the diameter of the circle by finding the distance between the endpoints of the diameter using the distance formula. The distance between the center of the circle and point K equals the radius. Find the distance between the two given points using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ , where  $(x_1, y_1)$  represents the coordinates of the first point,  $(x_2, y_2)$  represents the coordinates of the second point, and  $d$  represents the distance between the two points. Plug the given points into the formula and simplify:  $(0 - 12)^2 + (7 - 2)^2 = d^2 \rightarrow (-12)^2 + (5)^2 = d^2 \rightarrow 144 + 25 = d^2 \rightarrow 169 = d^2 \rightarrow d = 13$  units. Divide the diameter by 2 to get a radius of 6.5 units.
- 15. Answer choice (B) is the correct answer.** The center of the circle is the midpoint of segment AB. To find the midpoint of two points, use the following formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. For this problem, we are given the midpoint of AB and one endpoint, endpoint A. Set up an equation for the  $x$ -coordinate of the midpoint which equals 3, using  $x_2$  to represent the  $x$  coordinate of point B:  $3 = \frac{-5 + x_2}{2}$ . Solve the equation by multiplying both sides by 2 and adding 5:  $6 = -5 + x_2 \rightarrow x_2 = 11$ . Therefore, the  $x$ -coordinate of the other endpoint is 11. Do the same for the  $y$ -coordinate:  $-3 = \frac{1 + y_2}{2} \rightarrow -6 = 1 + y_2 \rightarrow y_2 = -7$ . Therefore, the other endpoint is  $(11, -7)$ .
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### Similar Figures Set 1

- 1. Answer choice (D) is the correct answer.** Since the rectangles are similar, their corresponding sides are proportional, so we can set up the following proportion:  $\frac{12}{18} = \frac{x}{15}$ . Cross multiply and solve:  $12(15) = 18x \rightarrow 180 = 18x \rightarrow x = 10$ .
- 2. Answer choice (B) is the correct answer.** Since the triangles are similar, their corresponding sides are proportional, so we can set up the following proportion:  $\frac{x}{1.3x} = \frac{y}{26}$ . Cross multiply and solve:  $26x = 1.3xy \rightarrow 26 = 1.3y \rightarrow y = 20$ .
- 3. Answer choice (C) is the correct answer.** Since the triangles are similar, their corresponding angles are congruent. Therefore, the sum of the measures of angles E and F equals the sum of the measure of angles B and C. Find the sum of the measures of angles B and C (the sum of the angles in any triangle is  $180^\circ$ ):  $54^\circ + B + C = 180^\circ \rightarrow B + C = 126^\circ$ . Therefore, the sum of E and F also equals  $126^\circ$ .
- 4. Answer choice (A) is the correct answer.** Since the quadrilaterals are similar, their corresponding sides are proportional. Find  $x$  by setting up the following proportion:  $\frac{6}{12} = \frac{x}{10}$ . Cross multiply and solve:  $60 = 12x \rightarrow x = 5$ . Since the quadrilaterals are similar, angle D is equal to angle M. Find angle M by using the fact that the sum of the angles in a quadrilateral equals  $360^\circ$ :  $M + 140^\circ + 80^\circ + 90^\circ = 360^\circ \rightarrow M = 50^\circ$ . Therefore, angle D, or  $y$ , also equals  $50^\circ$ . Add  $x$  and  $y$  to get 55.
- 5. Answer choice (B) is the correct answer.** Find the value of  $x$  by setting up an equation for the area of rectangle ABCD:  $128 = x(2x) \rightarrow 128 = 2x^2 \rightarrow 64 = x^2 \rightarrow x = 8$ . Therefore, segment AD = 8, segment AB = 16, and segment JK = 24. Since the rectangles are similar, their corresponding sides are proportional. Set up and solve the following proportion to find side JM:  $\frac{16}{24} = \frac{8}{JK} \rightarrow 16(JK) = 192 \rightarrow JK = 12$  inches.
- 6. Answer choice (B) is the correct answer.** Since the triangles are similar, their corresponding sides are proportional. Find the height of triangle B,  $h$ , solving the following proportion:  $\frac{10}{5} = \frac{8}{h} \rightarrow 10h = 40 \rightarrow h = 4$  inches. Find the area of triangle B using the formula  $A = \frac{1}{2}bh$ :  $A = \frac{1}{2}(8)(4) = 16$  in<sup>2</sup>.
- 7. Answer choice (D) is the correct answer.** The ratio of the width of two similar rectangles is equal to the ratio of the perimeters of two similar rectangles.
- 8. Answer choice (A) is the correct answer.** The smaller triangle is similar to the larger triangle, so their corresponding sides are proportional. Set up and solve the following proportion:  $\frac{6}{18} = \frac{3}{x+3} \rightarrow 6(x+3) = 54 \rightarrow x+3 = 9 \rightarrow x = 6$ .

9. **Answer choice (A) is the correct answer.** If the radius of Circle A is one-third of the ratio of Circle B, then the area of Circle A is one-ninth of Circle B:  $\left(\frac{1}{3}\right)^2 = \frac{1}{9}$ . Find one-ninth of the area of Circle B to find the area of Circle A:  $\frac{1}{9} \cdot 9\pi = \pi \text{ in}^2$ .
10. **Answer choice (A) is the correct answer.** The smaller rectangle is similar to the larger rectangle, so their corresponding sides are proportional. Set up and simplify the following proportion:  $\frac{4x}{6x} =$
- $$\frac{a}{b} \rightarrow \frac{4}{6} = \frac{a}{b} \rightarrow \frac{2}{3} = \frac{a}{b}.$$

### Similar Figures Set 2

1. **Answer choice (B) is the correct answer.** Since the rectangles are similar, their corresponding sides are proportional, so we can set up the following proportion:  $\frac{6}{YZ} = \frac{10}{12}$ . Cross multiply and solve:  $6(12) = 10(YZ) \rightarrow 72 = 10(YZ) \rightarrow YZ = 7.2 \text{ in}$ .
2. **Answer choice (A) is the correct answer.** Since the quadrilaterals are similar, their corresponding angles are congruent. Therefore, the angle measuring  $a^\circ$  is congruent to the bottom left angle in the left quadrilateral. The sum of the angles in a quadrilateral is  $360^\circ$ , so we can set up and solve the equation  $128^\circ + 74^\circ + 90^\circ + a^\circ = 360^\circ \rightarrow 292^\circ + a^\circ = 360^\circ \rightarrow a = 68$ .
3. **Answer choice (A) is the correct answer.** Since the triangles are similar, their corresponding angles are congruent. Therefore, angle J = angle F, so angle J equals  $137^\circ$ . The sum of the angles in a triangle is  $180^\circ$ , so set up and solve the equation  $x + y + 137 = 180 \rightarrow x + y = 43$ .
4. **Answer choice (D) is the correct answer.** The two triangles are similar because they both have a right angle and angle ACB is congruent to angle DCE because they are vertical angles. Since the triangles are similar, their corresponding angles are congruent, so angle BAC is congruent to angle DEC. Since the triangles are similar, their corresponding sides are proportional. Therefore,  $\frac{AB}{BC} = \frac{DE}{CD}$ . Therefore, answer choices (A), (B), and (C) are true, so we are left with answer choice (D) as the false statement.
5. **Answer choice (C) is the correct answer.** Since the rectangles are similar, their corresponding sides are proportional. Therefore, we can set up and solve the following proportion, using  $x$  to represent the width of the smaller rectangle:  $\frac{10}{x} = \frac{26}{13} \rightarrow 130 = 26x \rightarrow x = 5 \text{ m}$ . Find the height of the smaller rectangle by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 5^2 = 13^2 \rightarrow a^2 + 25 =$

$169 \rightarrow a^2 = 144 \rightarrow a = 12$ . So the smaller rectangle measures 5 m by 12 m. Find the area by multiplying the dimensions:  $5 \cdot 12 = 60 \text{ m}^2$ .

6. **Answer choice (B) is the correct answer.** Since the triangles are similar, their corresponding sides are proportional. Therefore, if side HI is 75% of side HK, then side LM is 75% of side LO. Find side LM by finding 75% of side LO:  $75\% \text{ of } 12 = 0.75 \cdot 12 = 9 \text{ cm}$ .
7. **Answer choice (C) is the correct answer.** The smaller triangle is similar to the larger triangle, so their corresponding side lengths are proportional. Therefore, we can set up and solve the following proportion:  $\frac{4}{12} = \frac{6}{BC} \rightarrow 72 = 4(BC) \rightarrow BC = 18 \text{ in}$
8. **Answer choice (B) is the correct answer.** The ratio of the area of two similar rectangles is equal to the ratio of any dimension squared. Therefore, the ratio of the areas equals  $(4:3)^2 = 16:9$ .
9. **Answer choice (A) is the correct answer.** If Circle X has a circumference that is 150% of the circumference of Circle Y, then the ratio of the circumference of Circle X to the circumference of Circle Y is  $1.5 : 1 = 3:2$ . The ratio of the circumference of two circles is equal to the ratio of their radii because all circles are similar, therefore, the ratio of the radius of Circle X to the radius of Circle Y is also 3:2.
10. **Answer choice (C) is the correct answer.** The smaller rectangle is similar to the larger rectangle, so their corresponding sides are proportional. Set up and simplify the following proportion:  $\frac{8}{b} = \frac{a}{5} \rightarrow ab = 8(5) \rightarrow ab = 40$ .
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### Area and Perimeter Word Problems Set 1

1. **Answer choice (B) is the correct answer.** Start with a square that has a side length of 2, so the area is 4. Now double the side lengths to get a side length of 4 and an area of 16. The new area of 16 is four times the old area of 4.
2. **Answer choice (D) is the correct answer.** If the length is three less than twice the width, then the length equals  $2w - 3$ . Find the perimeter by adding all of the sides:  $w + w + 2w - 3 + 2w - 3 = 6w - 6$ .
3. **Answer choice (C) is the correct answer.** Find the original area:  $A = 16 \cdot 20 = 320 \text{ in}^2$ . Decrease the height by 4 in to get a new height of 16 in. Find the new area:  $A = 16 \cdot 16 = 256 \text{ in}^2$ . Find the difference in the areas:  $320 - 256 = 64 \text{ in}^2$ .
4. **Answer choice (B) is the correct answer.** Start with a rectangle that measures 10 by 10, so the area is 100. Now decrease one side by 50%, so the dimensions are 5 by 10. The new area is 50 which is a 50% decrease from the original area of 100.

5. **Answer choice (B) is the correct answer.** Start with a rectangle that measures 10 by 10, so the area is 100. Now decrease both sides by 30%, so the dimensions are 7 by 7. The new area is 49 which is a 51% decrease from the original area of 100.
6. **Answer choice (D) is the correct answer.** Start with a triangle that measures 10 by 10, so the area is 50 ( $A = \frac{1}{2}bh$ ). Now increase one side by 10% to get 11, and decrease the other side by 10% to get 9. The new area is 49.5 Find the percent change from 50 to 49.5 by dividing the difference by 50 and multiplying by 100 to get a 1% decrease.
7. **Answer choice (A) is the correct answer.** Change the dimensions of the rug to feet: 36 inches = 3 feet and 60 inches = 5 feet. Now find the area of the rug:  $5 \text{ ft} \cdot 3 \text{ ft} = 15$  square feet. Since the rug costs \$2.40 per square foot, multiply the area of the rug by the cost per square foot:  $\$2.40 \cdot 15 = \$36$ .
8. **Answer choice (A) is the correct answer.** First, find the length of the left and right side of the parallelogram by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow 5^2 + 12^2 = c^2 \rightarrow 25 + 144 = c^2 \rightarrow 169 = c^2 \rightarrow c = 13$  in. Now find the perimeter of the parallelogram by adding up all of the sides:  $15 + 15 + 13 + 13 = 56$  in. Find the area of the parallelogram by multiplying the base by the height:  $15 \cdot 12 = 180 \text{ in}^2$ . Find the difference between the values of the area and perimeter:  $180 - 56 = 124$ .
9. **Answer choice (C) is the correct answer.** Find the small leg of the right triangle using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 8^2 = (4\sqrt{5})^2 \rightarrow a^2 + 64 = 80 \rightarrow a^2 = 16 \rightarrow a = 4$  m. Therefore, the top base of the trapezoid =  $4 + 7 + 4 = 15$  m. Find the area of the trapezoid by using the following formula:  $A = \frac{1}{2}(b_1 + b_2) \cdot h$ . Plug in the values and solve:  $A = \frac{1}{2}(15 + 7) \cdot 8 = 88 \text{ m}^2$
10. **Answer choice (D) is the correct answer.** Find the area of a 20 m by 20 m square:  $20 \cdot 20 = 400 \text{ m}^2$ . Change 1 km to meters to get 1000 m. Now find the area of 1000 m by 1000 m square:  $1000 \cdot 1000 = 1,000,000$ . Divide 1,000,000 by 400 to get 2500.
11. **Answer choice (B) is the correct answer.** Find the perimeter of the rectangular field by adding up the sides:  $70 + 70 + 80 + 80 = 300$  m. Multiply this by 5 to find how far Suzan ran:  $300 \cdot 5 = 1500$  m. Since she ran at a speed of 2 m/s, divide 1500 m by 2 m/s to get 750 seconds.
12. **Answer choice (A) is the correct answer.** The rectangle that gives the largest perimeter measures 48 in by 1 in. Therefore, the perimeter equals  $48 + 48 + 1 + 1 = 98$  in.
13. **Answer choice (C) is the correct answer.** The rectangle that gives the smallest perimeter measures 4 ft by 6 ft. Therefore, the perimeter equals  $4 + 4 + 6 + 6 = 20$  ft.

- 14. Answer choice (A) is the correct answer.** The rectangle that gives the smallest area measures 9 m by 1 m. Therefore, the area equals  $9 \cdot 1 = 9 \text{ m}^2$ .
- 15. Answer choice (D) is the correct answer.** The rectangle that gives the largest area measures 9 m by 9 m. Therefore, the area equals  $9 \cdot 9 = 81 \text{ m}^2$ .
- 16. Answer choice (B) is the correct answer.** The area of Square A =  $8 \cdot 8 = 64 \text{ in}^2$ . Since the area of Square B is one-fourth of the area of Square A, the area of Square B =  $64 \div 4 = 16 \text{ in}^2$ . Therefore, the side length of Square B is 4 in because 4 in  $\cdot$  4 in equals an area of  $16 \text{ in}^2$ .
- 17. Answer choice (B) is the correct answer.** Find the radius of Circle B by using the formula for the area of a circle:  $64\pi = \pi r^2 \rightarrow r = 8 \text{ in}$ . Since the radius of Circle A is one-fourth of the radius of Circle B, the radius of Circle A equals  $8 \div 4 = 2 \text{ in}$ . Find the area of Circle A:  $A = \pi 2^2 = 4\pi \text{ in}^2$ .
- 18. Answer choice (D) is the correct answer.** If Circle A's diameter is one-third of Circle B's diameter, then Circle B's diameter is three times Circle A's diameter. The ratio of the area of similar shapes (all circles are similar) is equal to the ratio of any dimensions squared. The ratio of the diameter of Circle B to the diameter of Circle A is 3:1, so the ratio of the area of Circle B to Circle A is 9:1.
- 19. Answer choice (A) is the correct answer.** Using  $h$  as the height of Triangle A and  $b$  as the base of Triangle B, the area of Triangle A =  $\frac{1}{2}(2b)h$ . The area of Triangle B =  $\frac{1}{2}b(2h)$ . Because the order of multiplication doesn't matter, the two areas are the same, so the ratio of the areas is 1:1.
- 20. Answer choice (D) is the correct answer.** Find the radius of the circle by using the formula for the area of a circle:  $16\pi = \pi r^2 \rightarrow r = 4 \text{ cm}$ . This means the diameter of the circle is 8 cm which also equals the side length of the square. Therefore, the area of the square =  $8 \cdot 8 = 64 \text{ cm}^2$ .

### Area and Perimeter Word Problems Set 2

- 1. Answer choice (B) is the correct answer.** Start with a square that has a side length of 2, so the perimeter is 8. Now cut the side lengths in half to get a side length of 1 and a perimeter of 4. The ratio of the original perimeter to the new perimeter is 2:1.
- 2. Answer choice (C) is the correct answer.** If the length is three times the width, then the length equals  $3w$ . Find the area by multiplying the length by the width:  $3w \cdot w = 3w^2$ .
- 3. Answer choice (C) is the correct answer.** Find the original area:  $A = 24 \cdot 10 = 240 \text{ cm}^2$ . Increase the width by 3 cm to get a new width of 27 cm. Find the new area:  $A = 27 \cdot 10 = 270 \text{ cm}^2$ . Find the difference in the areas:  $270 - 240 = 30 \text{ cm}^2$ .

4. **Answer choice (B) is the correct answer.** Start with a rectangle that measures 10 by 10, so the area is 100. Now decrease one side by 25%, so the dimensions are 7.5 by 10. The new area is 75 which is a 25% decrease from the original area of 100.
5. **Answer choice (B) is the correct answer.** Start with a rectangle that measures 10 by 10, so the area is 100. Now increase one side by 40% and decrease the other side by 20% to get dimensions of 14 and 8. The new area is 112 which is a 12% increase from the original area of 100.
6. **Answer choice (D) is the correct answer.** Start with a triangle that measures 10 by 10, so the area is 50 ( $A = \frac{1}{2}bh$ ). Now increase both sides by 60% to get a base and height of 16. The new area is 128. Find the percent change from 50 to 128 by dividing the difference by 50 and multiplying the result by 100 to get a percent change of 156%.
7. **Answer choice (C) is the correct answer.** First, change the dimensions to feet because the cost is \$3.30 per square foot: the dimensions in feet are 4 ft by 6 ft. The area of the rug =  $4 \cdot 6 = 24$  square feet. Multiply the area by the cost per square foot to find the total cost:  $24 \cdot 3.30 = \$79.20$ .
8. **Answer choice (D) is the correct answer.** Find the height of the parallelogram by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 3^2 = 5^2 \rightarrow a^2 + 9 = 25 \rightarrow a^2 = 16 \rightarrow a = 4$ . Find the area by multiplying the base times the height:  $10 \cdot 4 = 40 \text{ ft}^2$ .
9. **Answer choice (D) is the correct answer.** Find the height of the trapezoid by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow a^2 + 2^2 = (\sqrt{29})^2 \rightarrow a^2 + 4 = 29 \rightarrow a^2 = 25 \rightarrow a = 5$ . Since the trapezoid is *isosceles*, the left and right sides are congruent. If you draw a straight line down from the top right corner of the trapezoid, you will create a right triangle that is congruent to the right triangle on the left. Therefore, the bottom base of the trapezoid equals  $2 + 6 + 2 = 10$  m. Find the area using the formula for the area of a trapezoid:  $A = \frac{1}{2}(b_1 + b_2)h \rightarrow A = \frac{1}{2}(6 + 10)(5) \rightarrow A = \frac{1}{2}(16)(5) \rightarrow A = 40$
10. **Answer choice (D) is the correct answer.** Find the area of a 3 in by 3 in square:  $3 \cdot 3 = 9 \text{ in}^2$ . Change 3 ft to inches by multiplying by 12 to get 36 in. Now find the area of 36 in by 36 in square:  $36 \cdot 36 = 1296 \text{ in}^2$ . Divide 1296 by 9 to get 144.
11. **Answer choice (C) is the correct answer.** Find the perimeter of the field by adding the sides:  $50 + 50 + 70 + 70 = 240$  m. Multiply that by 3 to find the total distance Archie ran:  $240 \cdot 3 = 720$  m. We want his speed in meters per second, so change 4 minutes into seconds by multiplying by 60 to get 240 seconds. Finally, divide 720 meters by 240 seconds to get a speed of 3 m/s.

- 12. Answer choice (D) is the correct answer.** The rectangle that gives the largest perimeter measures 72 in by 1 in. Therefore, the perimeter equals  $72 + 72 + 1 + 1 = 146$  in.
- 13. Answer choice (C) is the correct answer.** The rectangle that gives the smallest perimeter measures 6 ft by 6 ft. Therefore, the perimeter equals  $6 + 6 + 6 + 6 = 24$  ft.
- 14. Answer choice (A) is the correct answer.** The rectangle that gives the smallest area measures 24 m by 1 m. Therefore, the area equals  $24 \cdot 1 = 24$  m<sup>2</sup>.
- 15. Answer choice (C) is the correct answer.** The rectangle that gives the largest area measures 8 m by 7 m. Therefore, the area equals  $8 \cdot 7 = 56$  m<sup>2</sup>.
- 16. Answer choice (B) is the correct answer.** Since Square B has a side length of 3 in, it has an area of 9 in<sup>2</sup>. The area of Square A is 9 times the area of Square B, so multiply 9 by 9 to get that Square A has an area of 81 in<sup>2</sup>. The area of a square equals the side length squared, so take the square root of 81 to get that Square A has a side length of 9 in.
- 17. Answer choice (C) is the correct answer.** Find the radius of Circle A by using the formula for the area of a circle:  $36\pi = \pi r^2 \rightarrow r = 6$  m. Since the radius of Circle A is half of the radius of Circle B, the radius of Circle B is twice the radius of Circle A, so the radius of Circle B is 12 m. Find the area of Circle B:  $A = \pi r^2 \rightarrow A = (12^2)\pi \rightarrow A = 144\pi$  m<sup>2</sup>.
- 18. Answer choice (A) is the correct answer.** The ratio of the perimeters of similar shapes (all circles are similar) is equal to the ratio of any dimensions. The ratio of the diameter of Circle B to the diameter of Circle A =  $x$ :  $1.5x = 1:1.5 = 2:3$ , so the ratio of the circumference of Circle B to Circle A is also 2:3.
- 19. Answer choice (D) is the correct answer.** Using  $h$  as the height of Triangle B and  $b$  as the base of Triangle B, the area of Triangle A =  $\frac{1}{2}\left(\frac{1}{2}b\right)\left(\frac{1}{2}h\right) = \frac{1}{8}bh$ . The area of Triangle B =  $\frac{1}{2}bh$ . Since both areas have  $bh$  in them, those don't matter in our ratio. Therefore, the ratio of the area of Triangle A to the area of Triangle B =  $\frac{1}{8} : \frac{1}{2} = 1:4$ .
- 20. Answer choice (C) is the correct answer.** Since the area of a square is 36 ft<sup>2</sup>, the side length is 6 ft because  $6^2 = 36$ . If you draw a circle inscribed in a square, the side length of the square equals the diameter of the circle. Therefore, the diameter of the circle is 6 ft, so the radius is 3 ft. Find the area of the circle:  $A = \pi r^2 \rightarrow A = (3^2)\pi \rightarrow A = 9\pi$  ft<sup>2</sup>.
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**Shaded and Composite Area Set 1**

- 1. Answer choice (D) is the correct answer.** Count up the fully-shaded squares to get 11 fully-shaded squares. There are two half-shaded squares, so together they equal 1 fully-shaded square. Therefore, there are a total of 12 fully-shaded squares. Multiply this by 2 units<sup>2</sup> per square to get  $12 \cdot 2 = 24$  units<sup>2</sup>.
- 2. Answer choice (C) is the correct answer.** Since the perimeter of each small square is 8 units, the side length of each small square is 2 units. This means the area of each small square is 4 units<sup>2</sup>. There are a total of 12 shaded squares, so multiply 12 by 4 to get a shaded area of 48 units<sup>2</sup>.
- 3. Answer choice (C) is the correct answer.** To find the shaded area, subtract the area of the white triangle from the area of the outer rectangle:  $80 \text{ m}^2 - 40 \text{ m}^2 = 40 \text{ m}^2$ .
- 4. Answer choice (D) is the correct answer.** The side length of the square is the diameter of the circle which equals 8 in. To find the shaded area, subtract the area of the circle from the area of the outer square:  $64 - 16\pi \text{ in}^2$ .
- 5. Answer choice (A) is the correct answer.** The area of the inner square equals the area of the outer square minus the area of the shaded region. The area of the outer square equals 64 in<sup>2</sup>. Therefore, the area of the inner square =  $64 - 39 = 25 \text{ in}^2$  which means the side length of the inner square is 5 in. The side length of the inner square equals the side length of the outer square minus the two widths of the shaded region which both equal  $x$ , so  $5 = 8 - 2x$ . Solve the equation to get that  $x = 1.5$  in.
- 6. Answer choice (B) is the correct answer.** The area of the figure is equal to the area of the large square that measures  $y$  by  $y$  minus the area of the cut out square that measures  $x$  by  $x$ : shaded area =  $y^2 - x^2$ .
- 7. Answer choice (C) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ . To find the shaded area, subtract the area of the inner circle from the area of the outer circle:  $144\pi - 100\pi = 44\pi \text{ m}^2$ .
- 8. Answer choice (A) is the correct answer.** To find the shaded area, subtract the area of the triangle from the area of the quarter circle. The area of the quarter circle equals one-fourth the area of the entire circle:  $16\pi \div 4 = 4\pi \text{ cm}^2$ , and the area of the triangle equals  $8 \text{ cm}^2$ . Therefore, the shaded area equals  $4\pi - 8 \text{ cm}^2$ .
- 9. Answer choice (A) is the correct answer.** To find the area of the shaded region, subtract the white triangle from the outer semicircle. The height of the triangle equals the radius of the circle which is 5 cm, so the area of the triangle equals  $25 \text{ cm}^2$ . The formula for the area of a circle is  $A = \pi r^2$ . The

area of the semicircle equals half of the area of the entire circle, so it equals  $25\pi \div 2 = 12.5\pi \text{ cm}^2$ . Therefore, the shaded area equals  $12.5\pi - 25 \text{ cm}^2$ .

- 10. Answer choice (C) is the correct answer.** To find the area of the shaded region, subtract the area of the four quarter circles from the area of the outer square. The sum of the areas of the four quarter circles are equal to the area of a full circle with the same radius. Since the side length of the square is 8 mm, the radius of the circle is 4 mm, so the sum area of the four quarter circles =  $16\pi \text{ mm}^2$ . (The formula for the area of a circle is  $A = \pi r^2$ .) The area of the square is  $64 \text{ mm}^2$ , so the shaded area is  $64 - 16\pi \text{ mm}^2$ .

### Shaded and Composite Area Set 2

- 1. Answer choice (B) is the correct answer.** To find the area of the shaded region, we need to find the area of each small square. To find the area of each small square, we need to find the side length of each small square. Count up the number of side lengths that make up the perimeter of the shaded region to get 18. Divide the perimeter of the shaded region by the number of side lengths to get the side length of each small square:  $36 \div 18 = 2$  units. Now find the area of each small square by squaring the side length:  $2^2 = 4 \text{ units}^2$ . Finally, find the area of the shaded region by multiplying the number of shaded squares, 8, by the area of each square:  $4 \cdot 8 = 32 \text{ units}^2$ .
- 2. Answer choice (A) is the correct answer.** If you count up the number of shaded squares, you get 9 shaded squares. Each square has an area of  $\frac{1}{3} \text{ units}^2$ , so multiplying 9 by  $\frac{1}{3}$  to find the shaded area:  $9 \cdot \frac{1}{3} = 3 \text{ units}^2$ .
- 3. Answer choice (B) c is the correct answer.** To find the shaded area, subtract the area of the white triangle from the area of the outer rectangle. The area of the outer rectangle is length times width, so it is  $16x$ . The area of the white triangle is length times width divided by 2, so it is  $8x$ . Therefore, the shaded area =  $16x - 8x = 8x$ . Set the expression for the shaded area equal to 80 and solve for  $x$ :  $8x = 80 \rightarrow x = 10$ .
- 4. Answer choice (C) is the correct answer.** To find the shaded area, subtract the area of the white square from the area of the outer square. The area of the outer square is  $10^2 = 100 \text{ in}^2$ . The side length of the inner square is  $10 - 4 = 6$  in (subtract the 2 in border on each side), so the area is  $6^2 = 36 \text{ in}^2$ . Therefore, the shaded area =  $100 - 36 = 64 \text{ in}^2$ .
- 5. Answer choice (C) is the correct answer.** To find the shaded area, subtract the area of the white square from the area of the outer circle. Since the diameter of the circle is 4 ft, the radius is 2 ft. The formula for the area of a circle is  $A = \pi r^2$ . Therefore, the area is  $4\pi \text{ ft}^2$ . Find the side length of the square by drawing a diameter of the circle that is also the diagonal of the square. Now use the pythagorean theorem to find the side length, using  $a$  to represent each side of the square:  $a^2 + a^2 =$

$4^2 \rightarrow 2a^2 = 16 \rightarrow a^2 = 8 \rightarrow a = \sqrt{8} \rightarrow a = 2\sqrt{2}$ . Therefore, the area of the square is  $(2\sqrt{2})^2 = 8 \text{ ft}^2$ . Subtract the area of the square from the circle to get a shaded area of  $4\pi - 8 \text{ ft}^2$ .

6. **Answer choice (A) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , so the area of the inner circle is  $16\pi \text{ m}^2$ . The shaded area equals the area of the outer circle minus the area of the inner circle. Set up and solve an equation for the shaded area using  $A$  to represent the area of the outer circle:  $20\pi = A - 16\pi \rightarrow A = 36\pi$ . Since the area of the outer circle is  $36\pi \text{ m}^2$ , the radius of the outer circle is 6 m. The width of the shaded ring equals the radius of the outer circle minus the radius of the inner circle:  $6 - 4 = 2 \text{ m}$ .
7. **Answer choice (D) is the correct answer.** The area of the figure is equal to the area of the large square that measures  $2y$  by  $2y$  minus the area of the cut out square that measures  $x^2$  by  $x^2$ : shaded area =  $(2y)^2 - (x^2)^2 = 4y^2 - x^4$ .
8. **Answer choice (A) is the correct answer.** To find the shaded area, subtract the area of the white circles from the area of the outer rectangle. The area of the outer region =  $12 \cdot 4 = 48 \text{ in}^2$ . The formula for the area of a circle is  $A = \pi r^2$ . The radius of each circle is 2 in, and there are three full white circles, so the total area of the three white circles equals  $3 \cdot 4\pi = 12\pi \text{ in}^2$ . Therefore, the shaded area equals  $48 - 12\pi \text{ in}^2$ .
9. **Answer choice (C) is the correct answer.** To find the value of  $x$ , we need to find what fraction of the circle the white slice takes up. First, find the area of the entire circle using the equation  $A = \pi r^2$ :  $A = 36\pi$ . Now subtract the shaded area from the total area to find the area of the white slice:  $36\pi - 30\pi = 6\pi$ . Therefore, the white slice takes up  $\frac{1}{6}$  of the circle (because  $\frac{6\pi}{36\pi} = \frac{1}{6}$ ) Finally, since a circle has  $360^\circ$ , find  $\frac{1}{6}$  of  $360^\circ$  to find  $x$ :  $\frac{1}{6} \cdot 360^\circ = 60^\circ$ .
10. **Answer choice (C) is the correct answer.** The shaded area equals that area of the quarter circle minus the area of the white triangle. To find the area of a quarter circle, find one-fourth of the area of the whole circle. The formula for the area of a circle is  $A = \pi r^2$ . So the area of the quarter circle is  $\frac{1}{4} \cdot 81\pi = \frac{81\pi}{4} \text{ in}^2$ . The base and height of the triangle are both equal to the radius of the circle, so they equal 9 in. Therefore, the area of the triangle is  $\frac{81}{2} \text{ in}^2$ . Subtract the area to get a shaded area of  $\frac{81\pi}{4} - \frac{81}{2} \text{ in}^2$ .
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**Volume and Surface Area Set 1**

- 1. Answer choice (C) is the correct answer.** To find the volume of a cube, cube the side length:  $5^3 = 5 \cdot 5 \cdot 5 = 125 \text{ cm}^3$ .
- 2. Answer choice (B) is the correct answer.** The surface area of a cube is equal to the sum of the areas of each side. Since a cube has 6 equal sides, divide  $24 \text{ in}^2$  by 6 to get that the area of each side is  $4 \text{ in}^2$ . Since the area of each side is  $4 \text{ in}^2$ , and each side is a square, the side length is 2 in.
- 3. Answer choice (A) is the correct answer.** To find the surface area of the open box, add up the area of the five sides. The left and right sides each have an area of  $3 \cdot 5 = 15 \text{ cm}^2$ . The front and back sides each have an area of  $3 \cdot 10 = 30 \text{ cm}^2$ . The bottom side has an area of  $10 \cdot 5 = 50 \text{ cm}^2$ . Therefore, the surface area =  $15 + 15 + 30 + 30 + 50 = 140 \text{ cm}^2$ .
- 4. Answer choice (D) is the correct answer.** Multiply the dimensions of the rectangular prism to find the total number of cubes:  $2 \cdot 6 \cdot 3 = 36$  cubes. Since each cube has a volume of  $3 \text{ cm}^3$ , multiply 36 by 3 to get the volume of the rectangular prism:  $36 \cdot 3 = 108 \text{ cm}^3$ .
- 5. Answer choice (D) is the correct answer.** To find the volume of a cube, cube the side length. Therefore, to find the side length of a cube given the volume, find the cube root of the volume. The cube root of 27 is 3 because  $3^3 = 27$ , so the side length of the cube is 3 cm. This means the area of each side of the cube is  $3 \cdot 3 = 9 \text{ cm}^2$ . Since two sides are shaded, the shaded area =  $2 \cdot 9 = 18 \text{ cm}^2$ .
- 6. Answer choice (B) is the correct answer.** After you cut out the 2 in by 2 in squares from all four corners, the length and width of the box each decrease by 4 inches. Therefore, the new width is 4 in, and the new length is 11 in. Once the box is folded, the height is 2 in. Find the volume by multiplying the three dimensions together:  $2 \cdot 4 \cdot 11 = 88 \text{ in}^3$ .
- 7. Answer choice (C) is the correct answer.** To find the surface area of a cube, multiply the area of one side by 6. The surface area of Cube A =  $2 \cdot 2 \cdot 6 = 24 \text{ in}^2$ . The surface area of Cube B =  $4 \cdot 4 \cdot 6 = 96 \text{ in}^2$ . The ratio of the surface area of Cube B to the surface area of Cube A is 96:24 which equals 4:1.
- 8. Answer choice (A) is the correct answer.** The ratio of the volumes of 3d figures is equal to the ratio of any dimension of the 3d figures cubed. Therefore, the ratio of the volumes of the cubes =  
$$\left(\frac{2}{3}\right)^3 = \frac{8}{27}$$
- 9. Answer choice (D) is the correct answer.** Find the volume of the pool by multiplying all three dimensions:  $20 \cdot 12 \cdot 10 = 2400 \text{ ft}^3$ . Divide the volume of the pool by the rate the two pumps can fill the pool:  $2400 \div 4 = 600 \text{ ft}^3/\text{hr}$ . This means that together,  $600 \text{ ft}^3$  of water flows out of both pumps per hour, so  $300 \text{ ft}^3$  flows out of each pump per hour. Change this to ft per minute by dividing by 60:  $300 \div 60 = 5 \text{ ft}^3$ .

10. **Answer choice (A) is the correct answer.** The volume of a rectangular prism is equal to the product of all three dimensions. Therefore,  $11 \cdot 2x \cdot x = 88 \text{ ft}^3$ . Solve the equation to find  $x$ :  $22x^2 = 88 \rightarrow x^2 = 4 \rightarrow x = 2$ .

### Volume and Surface Area Set 2

1. **Answer choice (C) is the correct answer.** The surface area of a cube is equal to the sum of the areas of each side. Find the area of one side by squaring the side length because each side of a cube is a square:  $10^2 = 100 \text{ in}^2$ . Multiply the area of one side by six because there are six sides:  $100 \cdot 6 = 600 \text{ in}^2$ .
2. **Answer choice (B) is the correct answer.** To find the volume of a cube, cube the side length. Therefore,  $V = s^3$ . If the volume of a cube is  $64 \text{ m}^3$ , then  $64 = s^3$ . Take the cube root of both sides to get  $s = 4 \text{ m}$ .
3. **Answer choice (B) is the correct answer.** First find the side length of the cube. Since a cube has 6 equal sides, divide  $96 \text{ in}^2$  by 6 to get that the area of each side is  $16 \text{ in}^2$ . Since the area of each side is  $16 \text{ in}^2$ , and each side is a square, the side length is 4 in. Now find the volume. To find the volume of a cube, cube the side length:  $4^3 = 4 \cdot 4 \cdot 4 = 64 \text{ m}^3$ .
4. **Answer choice (A) is the correct answer.** The surface area of a 3D figure is the sum of the areas of each side. Find the area of the two triangular sides using the formula  $A = \frac{1}{2}bh$ :  $A = \frac{1}{2}8 \cdot 6 \rightarrow A = 24 \text{ cm}^2$ . To find the areas of the rectangles that connect the two triangular bases, we need to find the hypotenuse of the right triangles using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow 6^2 + 8^2 = c^2 \rightarrow 36 + 64 = c^2 \rightarrow 100 = c^2 \rightarrow c = 10$ . Now find the area of each rectangular side by multiplying the length by the width:  $6 \cdot 11 = 66 \text{ cm}^2$ ,  $8 \cdot 11 = 88 \text{ cm}^2$ ,  $10 \cdot 11 = 110 \text{ cm}^2$ . Add up the area of all five sides to get the total surface area:  $24 + 24 + 66 + 88 + 110 = 312 \text{ cm}^2$ .
5. **Answer choice (C) is the correct answer.** The ratio of the surface areas of 3D figures is equal to the ratio of any dimension of the 3D figures squared. Therefore, the ratio of the surface areas of the cubes  $= \left(\frac{1}{4}\right)^2 = \frac{1}{16}$ .
6. **Answer choice (B) is the correct answer.** Multiply the dimensions of the rectangular prism to find the total number of cubes:  $3 \cdot 3 \cdot 4 = 36$  cubes. Since each the total volume of the rectangular prism is  $108 \text{ units}^3$ , divide 108 by 36 to get that each small cube has a volume of  $3 \text{ units}^3$ .
7. **Answer choice (B) is the correct answer.** Find the area of one of the sides by dividing  $128 \text{ in}^2$  by 2 to get  $64 \text{ in}^2$ . Since each side is a square with an area of  $64 \text{ in}^2$ , the side length is 8 in ( $8 \cdot 8 = 64$ ).

- 8. Answer choice (D) is the correct answer.** To find the volume of a cube, cube the side length. Therefore,  $V = s^3$ . Therefore, the volume of Cube A =  $1^3 = 1$ , and the volume of Cube B =  $3^3 = 27$ , so the ratio of the volume of Cube A to Cube B is 1:27.
- 9. Answer choice (A) is the correct answer.** To find the surface area of the rectangular prism, find the sum of the area of each side. The area of the front and back sides =  $4x \cdot x = 4x^2$ . The area of the top and bottom sides =  $4x \cdot 3x = 12x^2$ . The area of the left and right side =  $3x \cdot x = 3x^2$ . Add up the areas of all six sides:  $4x^2 + 4x^2 + 12x^2 + 12x^2 + 3x^2 + 3x^2 = 38x^2$ .
- 10. Answer choice (C) is the correct answer.** Since water flows out of each pump at a rate of 5 ft<sup>3</sup>/min, a total of 10 ft<sup>3</sup>/min flows out of the two pumps. It takes 2 hours, or 120 minutes, to fill the pool. So find the volume of water in the pool by multiplying 10 ft<sup>3</sup>/min by 120 minutes to get a volume of 1200 ft<sup>3</sup>. The volume of a rectangular pool is  $V = lwh$ , where  $l$  is the length of the base,  $w$  is the width of the base, and  $h$  is the height or depth. Since the area of the base of the pool is 120 ft<sup>2</sup>,  $l \cdot w = 120$ . Plug in 1200 for  $V$  and 120 for  $lw$  into the volume equation and solve for  $h$ :  $V = lwh \rightarrow 1200 = 120h \rightarrow h = 10$  ft.
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### Geometry Formulas Set 1

- 1. Answer choice (C) is the correct answer.** Isolate  $h$  in the formula by multiplying both sides by 2 and dividing both sides by  $b$ :  $A = \frac{1}{2}bh \rightarrow h = \frac{2A}{b}$ . Plug in 30 for the area and 15 for the base:  $h = \frac{2(30)}{15} = 4$  m.
- 2. Answer choice (B) is the correct answer.** Isolate  $h$  in the formula by dividing both sides by  $lw$ :  $V = lwh \rightarrow h = \frac{V}{lw}$ . Plug in 84 for the volume:  $h = \frac{84}{lw}$ .
- 3. Answer choice (A) is the correct answer.** Find the radius of Sphere A by setting the surface area of  $64\pi$  ft<sup>2</sup> equal to SA in the given formula:  $64\pi = 4\pi r^2$ . Solve for  $r$  by first dividing both sides by  $4\pi$  and then taking the square root of both sides:  $16 = r^2 \rightarrow r = 4$  ft. Now find the radius of Sphere B using the same method:  $16\pi = 4\pi r^2 \rightarrow 4 = r^2 \rightarrow r = 2$  ft. Therefore, the radius of Sphere A is 2 times greater than the radius of Sphere B.
- 4. Answer choice (A) is the correct answer.** Find the radius by plugging in  $72\pi$  for the volume and 8 for the height in the given formula:  $72\pi = 8\pi r^2$ . Solve for  $r$  by first dividing both sides by  $8\pi$  and then taking the square root of both sides:  $9 = r^2 \rightarrow r = 3$  yd.

5. **Answer choice (B) is the correct answer.** The area of the base of the pyramid is equal to  $lw$ , so  $lw = 16$  inches. Find the height of the pyramid by plugging in 32 for the volume and 16 for  $lw$ :  $32 = \frac{1}{3}16h$ . Solve for  $h$ :  $96 = 16h \rightarrow h = 6$  in.
6. **Answer choice (D) is the correct answer.** Isolate the  $r$  in the given equation by first multiplying both sides by 3:  $3V = \pi r^2 h$ . Next, divide both sides by  $\pi h$ :  $\frac{3V}{\pi h} = r^2$ . Finally, Take the square root of both sides:  $r = \sqrt{\frac{3V}{\pi h}}$ . Now plug in 125 for  $V$  to get  $r = \sqrt{\frac{3 \cdot 125}{\pi h}}$ .
7. **Answer choice (B) is the correct answer.** Plug in  $48\pi$  for the  $SA$  and 4 for  $r$  into the given equation:  $48\pi = 2\pi(4)h + 2\pi(4)^2$ . Simplify the right side of the equation:  $48\pi = 8\pi h + 32\pi$ . Subtract  $32\pi$  from both sides:  $16\pi = 8\pi h$ . Divide both sides by  $8\pi$ :  $h = 2$  cm.
8. **Answer choice (C) is the correct answer.** Since the height is equal to the radius, then  $r = h$ . Replace  $r$  with  $h$  and plug in  $9\pi$  for  $V$  in the original equation:  $9\pi = \frac{1}{3}\pi h \cdot h^2$ . Simplify the right side of the equation and solve for  $h$ :  $9\pi = \frac{1}{3}\pi h^3 \rightarrow 27 = h^3 \rightarrow h = 3$  cm.
9. **Answer choice (B) is the correct answer.** To find the average of the bases, add the bases and divide by two or cut the sum in half. Therefore, the average of the bases equals  $\frac{1}{2}(b_1 + b_2)$ . Plug in 14 for  $\frac{1}{2}(b_1 + b_2)$  and 56 for  $A$  in the given equation and solve:  $56 = 14h \rightarrow h = 4$  mm.
10. **Answer choice (A) is the correct answer.** Let  $l$  equal the length. Since the width is twice the length, the width is  $2l$ . Since the height is one-fourth of the width, the height is  $0.5l$ . Set up an equation for the volume of the prism, where 1000 equals the volume:  $1000 = l(2l)(0.5l)$ . Solve the equation for  $l$ :  $1000 = l^3 \rightarrow l = 10$  ft. Since the height equals  $0.5l$ , the height equals  $0.5 \cdot 10 = 5$  ft.

### Geometry Formulas Set 2

1. **Answer choice (B) is the correct answer.** Isolate  $h$  in the formula by dividing both sides by  $lw$ :  $V = lwh \rightarrow h = \frac{V}{lw}$ . Plug in 216 for the volume, 12 for the width, and 9 for the length:  $h = \frac{216}{9 \cdot 12} = \frac{216}{108} = 2$  ft.

2. **Answer choice (B) is the correct answer.** Find the height by plugging in  $400\pi$  for the volume and 10 for the radius in the given formula:  $400\pi = \pi(10)^2 \cdot h$ . Solve for  $h$  by first squaring 10 to get  $400\pi = 100\pi \cdot h$ . Now divide both sides by  $100\pi$  to get  $h = 4$  in.
3. **Answer choice (B) is the correct answer.** First, find the radius of the sphere by plugging in  $36\pi$  for the  $V$  in the given equation:  $36\pi = \frac{4}{3}\pi r^3$ . Now solve the equation by dividing both sides by  $\frac{4}{3}\pi$  to get  $27 = r^3$ . Take the cube root of both sides to get  $r = 3$  cm. Therefore, the diameter is  $2 \cdot 3 = 6$  cm.
4. **Answer choice (D) is the correct answer.** Isolate  $b$  in the formula by multiplying both sides by 2 and then dividing both sides by  $h$ :  $A = \frac{1}{2}bh \rightarrow b = \frac{2A}{h}$ . Plug in 96 for  $A$  to get  $b = \frac{2 \cdot 96}{h} \rightarrow b = \frac{192}{h}$ .
5. **Answer choice (C) is the correct answer.** Plug in  $96\pi$  for  $V$  and 2 for  $h$  in the original equation to get  $96\pi = \frac{1}{3}\pi r^2 \cdot 2$ . Multiply both sides of the equation by 3, and then divide both sides by  $2\pi$ :  $288\pi = \pi r^2 \cdot 2 \rightarrow 144 = r^2$ . Take the square root of both sides to get  $r = 12$  in.
6. **Answer choice (C) is the correct answer.** Since the radius is half of the height, the height is twice the radius. Therefore,  $h = 2r$ . Replace  $h$  with  $2r$  in the original equation and  $V$  with  $250\pi$ :  $250\pi = \pi r^2 \cdot 2r$ . Simplify the right side of the equation to get  $250\pi = 2\pi r^3$ . Divide both sides by  $2\pi$  to get  $125 = r^3$ . Take the cube root of both sides to get  $r = 5$  in. Since the height is twice the radius, the height equals  $5 \cdot 2 = 10$  in.
7. **Answer choice (A) is the correct answer.** Isolate the  $h$  by first multiplying both sides of the equation by 2 to get  $2A = (b_1 + b_2)h$ . Now divide both sides by  $(b_1 + b_2)$  to get  $\frac{2A}{b_1 + b_2} = h$ .
8. **Answer choice (B) is the correct answer.** Since the height is 50% longer than the base, the height  $= 1.5b$ . Plug in 150 for  $A$  in the original equation and  $1.5b$  for  $h$  to get  $150 = b(1.5b)$ . Solve the equation:  $150 = 1.5b^2 \rightarrow 100 = b^2 \rightarrow b = 10$  ft. Now find the height by multiplying the base by 1.5:  $h = 1.5(10) = 15$  ft.
9. **Answer choice (B) is the correct answer.** Since the base of the pyramid is a square, the length and width of the base are equal. Therefore,  $l = w$ . Plug  $l$  in for  $w$ , 15 in for  $V$ , and 5 in for  $h$  in the original equation to get  $15 = \frac{1}{3} \cdot 5 \cdot l \cdot l$ . Simplify and solve the equation:  $15 = \frac{5}{3}l^2 \rightarrow 9 = l^2 \rightarrow l = 3$  in.

- 10. Answer choice (B) is the correct answer.** Since the product of the radius and the height is 14, then  $rh = 14$ . Plug in  $60\pi$  for the  $SA$  and 14 for  $rh$  into the given equation:  $60\pi = 2\pi(14) + 2\pi r^2$ . Simplify the right side of the equation:  $60\pi = 28\pi + 2\pi r^2$ . Subtract  $28\pi$  from both sides:  $32\pi = 2\pi r^2$ . Divide both sides by  $2\pi$ :  $r^2 = 16$ . Take the square root of both sides to get  $r = 4$  cm.
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### Coordinate Geometry Set 1

- 1. Answer choice (A) is the correct answer.** A parallelogram is a four sided shape with two pairs of opposite sides that are both congruent and parallel. If you plot the point  $(1, -2)$ , neither pair of opposite sides have the same slope, so neither pair is parallel. Therefore, the shape formed is NOT a parallelogram.
- 2. Answer choice (B) is the correct answer.** To translate a point 3 units to the left, subtract 3 from the  $x$ -coordinate, so  $(a, b)$  becomes  $(a - 3, b)$ . To reflect a point across the  $x$ -axis, change the sign of the  $y$ -coordinate, so  $(a - 3, b)$  becomes  $(a - 3, -b)$ .
- 3. Answer choice (D) is the correct answer.** When a point is reflected over the  $y$ -axis, the  $x$ -coordinate changes signs and the  $y$ -coordinate stays the same. Therefore, when  $(3, 6)$  is reflected over the  $y$ -axis it becomes  $(-3, 6)$ .
- 4. Answer choice (B) is the correct answer.** A square has four equal sides and opposite sides have the same slope. If you plot the point  $(2, -4)$  on the graph, the four side lengths are equal and opposite sides have the same slope (steepness).
- 5. Answer choice (D) is the correct answer.** First, translate the point  $(-3, -2)$  up 4 units by adding 4 to the  $y$ -coordinate: the new point is  $(-3, 2)$ . Now reflect the point  $(-3, 2)$  over the  $x$ -axis. When a point is reflected over the  $x$ -axis, the  $y$ -coordinate changes signs and the  $x$ -coordinate stays the same. Therefore,  $(-3, 2)$  becomes  $(-3, -2)$ .
- 6. Answer choice (D) is the correct answer.** A parallelogram has two pairs of opposite sides that are congruent and parallel (have the same slope or steepness). If you plot the point  $(2, 5)$ , opposite sides will be congruent and parallel.
- 7. Answer choice (A) is the correct answer.** Draw the triangle and use the segment connecting the points  $(-7, -2)$  and  $(-1, -2)$  as the base of the triangle. The length of this base is 6 units. Find the height by finding the distance from the base to the point  $(-4, 4)$  which is 6 units. Find the area of the triangle by multiplying one-half times the base times the height to get 18 units<sup>2</sup>.
- 8. Answer choice (B) is the correct answer.** A rectangle has opposite sides that are congruent and parallel and consecutive sides that are perpendicular, or form right angles. If you plot the original points,  $(-2, 6)$  and  $(1, -1)$ , and the points from answer choice (B),  $(-2, 6)$  and  $(1, -1)$ , you will form

a rectangle: opposite sides will be congruent and parallel (same slope) and consecutive sides will be perpendicular (form a right angle and have opposite reciprocal slopes).

9. **Answer choice (B) is the correct answer.** Find the distance between the points (5, 3) and (3, 5) using the distance formula:  $(5 - 3)^2 + (3 - 5)^2 = d^2$ . Solve the equation:  $2^2 + (-2)^2 = d^2 \rightarrow 4 + 4 = d^2 \rightarrow 8 = d^2 \rightarrow d = \sqrt{8} \rightarrow d = 2\sqrt{2}$ . Since the shape is a rectangle, the distance between the points (2, 0) and (0, 2) (the opposite side) is also  $2\sqrt{2}$ . Find the distance between the points (5, 3) and (2, 0) using the distance formula:  $(5 - 2)^2 + (3 - 0)^2 = d^2$ . Solve the equation:  $3^2 + 3^2 = d^2 \rightarrow 9 + 9 = d^2 \rightarrow 18 = d^2 \rightarrow d = \sqrt{18} \rightarrow d = 3\sqrt{2}$ . Since the shape is a rectangle, the distance between (0, 2) and (3, 5) (the opposite side) is also  $3\sqrt{2}$ . Find the perimeter by adding all four sides:  $2\sqrt{2} + 2\sqrt{2} + 3\sqrt{2} + 3\sqrt{2} = 10\sqrt{2}$ .
10. **Answer choice (C) is the correct answer.** To rotate a point  $90^\circ$  clockwise, first flip the  $x$  and  $y$  coordinates: (5, 7) becomes (7, 5). Then change the sign of the new  $y$ -coordinate: (7, 5) becomes (7, -5).

## Coordinate Geometry Set 2

1. **Answer choice (B) is the correct answer.** Since the  $x$ -coordinate of the point is  $x$  after shifting it 4 units right, find the original  $x$ -coordinate by subtracting 4 from  $x$  to get  $x - 4$ . Since the  $y$ -coordinate of the point is  $y$  after shifting it 2 units up, find the original  $y$ -coordinate by subtracting 2 from  $y$  to get  $y - 2$ . Therefore, the coordinates of the original point are  $(x - 4, y - 2)$ .
2. **Answer choice (A) is the correct answer.** Use the distance formula to find the distance from the origin to point Q:  $(-4 - 0)^2 + (3 - 0)^2 = d^2 \rightarrow 16 + 9 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$ . Use the distance formula to find the distance from the origin to point T:  $(-3 - 0)^2 + (-4 - 0)^2 = d^2 \rightarrow 9 + 16 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$ . Therefore, the distance from point Q to the origin is the same as the distance from point T to the origin, so points Q and T are equidistant from the origin.
3. **Answer choice (B) is the correct answer.** When a point is reflected over the  $x$ -axis, the  $y$ -coordinate changes signs and the  $x$ -coordinate stays the same. Therefore, when (4, 2) is reflected over the  $x$ -axis it becomes (4, -2).
4. **Answer choice (C) is the correct answer.** A right triangle must have one right angle. To create a right angle with two line segments, the two segments must be *perpendicular*, and *perpendicular* lines have *opposite reciprocal* slopes. If we plot the point (5, 1), there is a right angle created at the point (2, 3). We can verify this by finding the slope of the line through the points (5, 1) and (2, 3), and finding the slope of the line through the points (2, 3) and (-2, -3).  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second

point. Therefore, the slope of the line through  $(5, 1)$  and  $(2, 3) = \frac{3-1}{2-5} = -\frac{2}{3}$ . The slope of the line through the points  $(2, 3)$  and  $(-2, -3) = \frac{-3-3}{-2-2} = \frac{-6}{-4} = \frac{3}{2}$ . Since  $-\frac{2}{3}$  and  $\frac{3}{2}$  are *opposite reciprocals*, the two lines are *perpendicular* and form a right angle.

5. **Answer choice (A) is the correct answer.** First, rotate the point  $180^\circ$ . To rotate a point  $180^\circ$ , change the sign of the  $x$  and  $y$  coordinates:  $(5, 6)$  becomes  $(-5, -6)$ . Now translate the new point 2 units left by subtracting 2 from the  $x$  coordinate to get  $(-7, -6)$ .
6. **Answer choice (C) is the correct answer.** Plot the points on a coordinate grid, labeling point  $(-1, -3)$  as A, point  $(-1, 1)$  as B, point  $(2, 4)$  as C, and point  $(2, 0)$  as D. Connect the points to form a parallelogram. Use AB as the base which has a length of 4 units. The height is the distance between segments AB and CD which is 3. Find the area by multiplying the base by the height:  $4 \cdot 3 = 12$  units<sup>2</sup>.
7. **Answer choice (A) is the correct answer.** Since we want to plot an *isosceles trapezoid*, the two non-parallel sides must be congruent. If we plot the point  $(5, 2)$ , the two non-parallel sides of the trapezoid are congruent.
8. **Answer choice (D) is the correct answer.** A rectangle has opposite sides that are congruent and parallel and consecutive sides that are perpendicular, or form right angles. If you plot the original points,  $(-4, 1)$  and  $(3, 1)$ , and the points from answer choice (D),  $(-4, 5)$  and  $(3, 5)$ , you will form a rectangle: opposite sides will be congruent and parallel (same slope) and consecutive sides will be perpendicular (form a right angle and have opposite reciprocal slopes).
9. **Answer choice (B) is the correct answer.** Since we have a square, all four sides are equal. Therefore, to find the perimeter, find the distance between two consecutive sides of the square and multiply that by 4. Find the distance between the points  $(7, 4)$  and  $(4, 0)$  using the distance formula:  $(7-4)^2 + (4-0)^2 = d^2$ . Solve the equation:  $3^2 + 4^2 = d^2 \rightarrow 9 + 16 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$ . Multiply the sides length of 5 by 4 to get a perimeter of 20.
10. **Answer choice (B) is the correct answer.** To rotate a point  $90^\circ$  counterclockwise, first flip the  $x$  and  $y$  coordinates:  $(-2, -4)$  becomes  $(-4, -2)$ . Then change the sign of the new  $x$ -coordinate:  $(-4, -2)$  becomes  $(4, -2)$ .
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### Slope Set 1

1. **Answer choice (C) is the correct answer.** To find the slope between two points, use the equation

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} \text{ where } (x_1, y_1) \text{ represents the coordinates of the first point, and}$$

$(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $slope = \frac{11-8}{7-1} = \frac{3}{6} = \frac{1}{2}$ .

2. **Answer choice (C) is the correct answer.** When finding the slope between two points on a coordinate grid, you can use the slope formula,  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point, or count using the grid. Let's use the formula: find two points on the graph:  $(-4, -1)$  and  $(1, 1)$ . Now plug the points into the slope formula and simplify:  $slope = \frac{1 - (-1)}{1 - (-4)} = \frac{2}{5}$ .
3. **Answer choice (B) is the correct answer.** This linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is  $-6$ .
4. **Answer choice (C) is the correct answer.** Isolate the  $y$  in the given equation by first subtracting  $6x$  from both sides and then dividing both sides by  $-2$ :  $6x - 2y = 8 \rightarrow -2y = -6x + 8 \rightarrow y = 3x - 4$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is  $3$ .
5. **Answer choice (A) is the correct answer.** When finding the slope between two points on a coordinate grid, you can use the slope formula,  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point, or count using the grid. Let's use the formula: find two points on the graph:  $(2, -4)$  and  $(1, -1)$ . Now plug the points into the slope formula and simplify:  $slope = \frac{(-1) - (-4)}{1 - 2} = \frac{3}{-1} = -3$ .
6. **Answer choice (A) is the correct answer.** To find the slope between two points, use the equation  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $slope = \frac{(-2) - 2}{-3 - (-5)} = \frac{-4}{2} = -2$ .
7. **Answer choice (C) is the correct answer.** First, find the slope of the given line by isolating  $y$  in the equation to get  $y = -\frac{4}{5}x - \frac{1}{5}$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the

slope of this line is  $-\frac{4}{5}$ . The slopes of perpendicular lines are *opposite reciprocals* (flip the fraction and change the sign), so the slope of line  $m$  is  $\frac{5}{4}$ .

- 8. Answer choice (C) is the correct answer.** Find the slope between the given two points by using the slope formula,  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $slope = \frac{3 - 8}{-1 - 4} = \frac{-5}{-5} = 1$ . Parallel lines have the *same slope*, so the slope of line  $k$  is also 1.
- 9. Answer choice (D) is the correct answer.** First, isolate  $y$  in the equation:  $-\frac{1}{2}x - \frac{3}{4}y = 2 \rightarrow -\frac{3}{4}y = \frac{1}{2}x + 2 \rightarrow y = -\frac{2}{3}x - \frac{8}{3}$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is  $-\frac{2}{3}$ .
- 10. Answer choice (B) is the correct answer.** We are looking for the equation where  $y$  decreases at the greatest rate as  $x$  increases. Therefore, we are looking for the equation with the steepest negative slope. The slope of the equation in answer choice (B) is  $-\frac{5}{4}$ , which is the steepest negative slope.
- 11. Answer choice (C) is the correct answer.** Use the slope formula to find the value of  $x$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in 4 for the slope and plug in the given coordinates:  $4 = \frac{9 - 1}{x - 2}$ . Solve the equation for  $x$ :  $4 = \frac{8}{x - 2} \rightarrow 4x - 8 = 8 \rightarrow 4x = 16 \rightarrow x = 4$ .
- 12. Answer choice (B) is the correct answer.** Use the slope formula to find the value of  $y$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in  $\frac{3}{2}$  for the slope and plug in the given coordinates:  $\frac{3}{2} = \frac{y - (-9)}{2 - (-1)}$ . Solve the equation for  $y$ :  $\frac{3}{2} = \frac{y + 9}{3} \rightarrow 2y + 18 = 9 \rightarrow 2y = -9 \rightarrow y = -4.5$ .
- 13. Answer choice (C) is the correct answer.** The given equation is in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is 2. Since the two lines are parallel, the slope of the other line is also 2. Use the slope

formula to find the value of  $a$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in 2 for the slope and plug in the given coordinates:  $2 = \frac{6 - 4}{a - 3}$ . Solve the equation for  $a$ :  $2 = \frac{2}{a - 3} \rightarrow 2a - 6 = 2 \rightarrow 2a = 8 \rightarrow a = 4$ .

**14. Answer choice (B) is the correct answer.** Since we are looking for the graph where  $y$  increases at the greatest rate as  $x$  increases, we are looking for the graph with the steepest positive slope. Graph (B) has the steepest positive slope.

**15. Answer choice (D) is the correct answer.** First, find the slope of the line that passes through

$(0, 2)$  and  $(3, -2)$  by using the slope formula:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 2}{3 - 0} = -\frac{4}{3}$ . Since the line passing through the points  $(-4, 5)$  and  $(0, y)$  is perpendicular to the other line, the slope is the *opposite reciprocal* of  $-\frac{4}{3}$  which is  $\frac{3}{4}$ . Now use the slope formula again to find the value of  $y$ :  $\frac{3}{4} = \frac{y - 5}{0 - (-4)} \rightarrow \frac{3}{4} = \frac{y - 5}{4} \rightarrow 4y - 20 = 12 \rightarrow 4y = 32 \rightarrow y = 8$ .

**16. Answer choice (A) is the correct answer.** Perpendicular lines have *opposite reciprocal* slopes. For example, if a line has a slope of  $\frac{3}{4}$ , then a line that is perpendicular to that line will have a slope of  $-\frac{4}{3}$ . When you multiply any opposite reciprocals together, the product is  $-1$ :  $-\frac{4}{3} \cdot \frac{3}{4} = -\frac{12}{12} = -1$

**17. Answer choice (B) is the correct answer.** If three points are on the same line, then the slope between any two of the three points will be constant. The slope between the two given points is  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 6}{-2 - 4} = \frac{3}{-6} = -\frac{1}{2}$ . The slope between  $(4, 6)$  and  $(2, 7)$  is also  $-\frac{1}{2}$ :  $\frac{7 - 6}{2 - 4} = -\frac{1}{2}$

**18. Answer choice (A) is the correct answer.** Find the slope of the given line using the points  $(1, 1)$  and  $(3, 2)$ :  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 1}{3 - 1} = \frac{1}{2}$ . Since the line graphed represents the line  $y = 2mx + b$ , the slope of the line is  $2m$ . Set  $2m$  equal to the slope of  $\frac{1}{2}$  to find  $m$ :  $\frac{1}{2} = 2m \rightarrow m = \frac{1}{4}$ . Therefore, the slope of the line  $y = mx + b$  equals  $m$  which equals  $\frac{1}{4}$ .

**19. Answer choice (C) is the correct answer.** If three points are on the same line, then the slope between any two of the three points will be constant. The slope between the two given points is

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - (-4)}{4 - 0} = \frac{4}{4} = 1. \text{ The slope between } (4, 0) \text{ and } (2, -3) \text{ does NOT equal } 1: \frac{-3 - 0}{2 - 4} = \frac{3}{2} \neq 1.$$

Therefore, the point  $(2, -3)$  is NOT on the line passing through the two given points.

- 20. Answer choice (B) is the correct answer.** Since we want a line that passes through  $(0, 0)$  and intersects segment AB, we are looking for a line with a negative slope that is less steep than the given line  $m$ . The slope of line  $m$  is  $-1$ , so we are looking for a negative number that is larger (less negative) than  $-1$ :  $-\frac{1}{2}$  is larger than  $-1$ , so a slope of  $-\frac{1}{2}$  is less steep than a slope of  $-1$ .

### Slope Set 2

- 1. Answer choice (A) is the correct answer.** To find the slope between two points, use the equation  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\text{slope} = \frac{3 - 1}{5 - 6} = \frac{2}{-1} = -2$ .
- 2. Answer choice (C) is the correct answer.** This linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is 4.
- 3. Answer choice (D) is the correct answer.** When finding the slope between two points on a coordinate grid, you can use the slope formula,  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point, or count using the grid. Let's use the formula: find two points on the graph:  $(-1, 0)$  and  $(0, 2)$ . Now plug the points into the slope formula and simplify:  $\text{slope} = \frac{2 - 0}{0 - (-1)} = \frac{2}{1} = 2$ .
- 4. Answer choice (A) is the correct answer.** To find the slope between two points, use the equation  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\text{slope} = \frac{9 - 3}{-6 - (-4)} = \frac{6}{-2} = -3$ .
- 5. Answer choice (B) is the correct answer.** When finding the slope between two points on a coordinate grid, you can use the slope formula,  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point, or count

using the grid. Let's use the formula: find two points on the graph:  $(2, -2)$  and  $(-3, 0)$ . Now plug the points into the slope formula and simplify:  $slope = \frac{0 - (-2)}{-3 - 2} = \frac{2}{-5} = -\frac{2}{5}$ .

- 6. Answer choice (D) is the correct answer.** Isolate the  $y$  in the given equation by first subtracting  $\frac{5}{3}x$  from both sides to get  $-\frac{1}{3}y = -\frac{5}{3}x - 3$ . Now multiply both sides by  $-3$  to get  $y = 5x + 9$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is 5.
- 7. Answer choice (B) is the correct answer.** Isolate the  $y$  in the given equation by first subtracting  $8x$  from both sides and then dividing both sides by 4:  $4y = -8x + 12 \rightarrow y = -2x + 3$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is  $-2$ .
- 8. Answer choice (A) is the correct answer.** First, find the slope of the given line by isolating  $y$  in the equation to get  $y = \frac{1}{3}x - \frac{4}{3}$ . Now this linear equation is written in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is  $\frac{1}{3}$ . The slopes of perpendicular lines are *opposite reciprocals* (flip the fraction and change the sign), so the slope of line  $m$  is  $-3$ .
- 9. Answer choice (D) is the correct answer.** Find the slope between the given two points by using the slope formula,  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $slope = \frac{0 - 5}{-4 - (-1)} = \frac{-5}{-3} = \frac{5}{3}$ . Parallel lines have the *same slope*, so the slope of line  $k$  is also  $\frac{5}{3}$ .
- 10. Answer choice (A) is the correct answer.** We are looking for the equation where  $y$  decreases at the greatest rate as  $x$  decreases. Therefore, we are looking for the equation with the steepest positive slope. The slope of the equation in answer choice (A) is 2, which is the steepest positive slope.
- 11. Answer choice (B) is the correct answer.** Use the slope formula to find the value of  $x$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in 2 for the slope and plug in the given coordinates:  $2 = \frac{0 - 6}{x - 8}$ . Solve the equation for  $x$ :  $2 = \frac{-6}{x - 8} \rightarrow 2x - 16 = -6 \rightarrow 2x = 10 \rightarrow x = 5$ .

- 12. Answer choice (B) is the correct answer.** Use the slope formula to find the value of  $y$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in  $-\frac{1}{4}$  for the slope and plug in the given coordinates:  $-\frac{1}{4} = \frac{y - 3}{-1 - (-2)}$ . Solve the equation for  $y$ :  $-\frac{1}{4} = \frac{y - 3}{1} \rightarrow 4y - 12 = -1 \rightarrow 4y = 11 \rightarrow y = \frac{11}{4}$ .
- 13. Answer choice (C) is the correct answer.** The given equation is in slope-intercept form:  $y = mx + b$ , where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of this line is 3. Since the two lines are parallel, the slope of the other line is also 3. Use the slope formula to find the value of  $a$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$  where  $(x_1, y_1)$  represents the coordinates of the first point, and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in 3 for the slope and plug in the given coordinates:  $3 = \frac{5 - (-1)}{a - 1}$ . Solve the equation for  $a$ :  $3 = \frac{6}{a - 1} \rightarrow 3a - 3 = 6 \rightarrow 3a = 9 \rightarrow a = 3$ .
- 14. Answer choice (A) is the correct answer.** Since we are looking for the graph where  $y$  increases at the greatest rate as  $x$  decreases, we are looking for the graph with the steepest negative slope. Graph (A) has the steepest positive slope.
- 15. Answer choice (D) is the correct answer.** First, find the slope of the line that passes through  $(-2, -1)$  and  $(-5, 6)$  by using the slope formula:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-1)}{-5 - (-2)} = -\frac{7}{3}$ . Since the line passing through the points  $(-2, 2)$  and  $(5, y)$  is perpendicular to the other line, the slope is the *opposite reciprocal* of  $-\frac{7}{3}$  which is  $\frac{3}{7}$ . Now use the slope formula again to find the value of  $y$ :  $\frac{3}{7} = \frac{y - 2}{5 - (-2)} \rightarrow \frac{3}{7} = \frac{y - 2}{7} \rightarrow 7y - 14 = 21 \rightarrow 7y = 35 \rightarrow y = 85$ .
- 16. Answer choice (C) is the correct answer.** Parallel lines have *the same slope*, therefore, the quotient of the slopes of two parallel lines is 1 because any number divided by itself equals 1.
- 17. Answer choice (D) is the correct answer.** If three points are on the same line, then the slope between any two of the three points will be constant. The slope between the two given points is  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 2}{0 - (-3)} = \frac{6}{3} = 2$ . The slope between  $(-2, 4)$  and  $(0, 8)$  is also 2:  $\frac{8 - 4}{0 - (-2)} = \frac{4}{2} = 2$ .
- 18. Answer choice (D) is the correct answer.** If three points are on the same line, then the slope between any two of the three points will be constant. The slope between the two given points is

$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 6}{4 - 2} = \frac{-2}{2} = -1$ . The slope between (5, 2) and (2, 6) does NOT equal  $-1$ :  $\frac{6 - 2}{2 - 5} = -\frac{4}{3} \neq -1$ . Therefore, the point (5, 2) is NOT on the line passing through the two given points.

- 19. Answer choice (C) is the correct answer.** Find the slope of the given line using the points (0, 0) and (-1, 3):  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 0}{-1 - 0} = -3$ . Since the line graphed represents the line  $y = mx + b$ , the slope of the line is  $m$ , so  $m = -3$ . The slope of the line  $y = -\frac{1}{3}mx + b$  equals  $-\frac{1}{3}m$  which equals  $-\frac{1}{3}(-3) = 1$ .
- 20. Answer choice (A) is the correct answer.** Any line that passes through (0, 0) and intersects segment AB has a positive slope that is less steep than line  $k$ . The slope of line  $k$  is 2, so slopes of 0.25, 1, and 1.5 are all less steep than this, so answer choice (B), (C), and (D) could be the slopes of line  $j$ . Since 2.5 is greater than 2, a slope of 2.5 is steeper than a slope of 2. Therefore, answer choice (A) could NOT be the slope of line  $j$ .

### Writing Equations of Lines Set 1

- 1. Answer choice (B) is the correct answer.** All of the answer choices are linear equations written in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, if a line has a slope of 3 and a  $y$ -intercept of 6, plug in 3 for  $m$  and 6 for  $b$  to get  $y = 3x + 6$ .
- 2. Answer choice (B) is the correct answer.** All of the answer choices are linear equations written in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, if a line has a slope of  $\frac{3}{4}$  and a  $y$ -intercept of  $-7$ , plug in  $\frac{3}{4}$  for  $m$  and  $-7$  for  $b$  to get  $y = \frac{3}{4}x - 7$ .
- 3. Answer choice (C) is the correct answer.** To write a linear equation given the slope and a point, use *point-slope form*:  $y - y_1 = m(x - x_1)$ , where  $m$  represents the slope and  $(x_1, y_1)$  represents a point on the line. Plug in 2 for  $m$  and the point (4, 1) for  $(x_1, y_1)$ :  $y - 1 = 2(x - 4)$ . Now simplify the equation and isolate  $y$ :  $y - 1 = 2x - 8 \rightarrow y = 2x - 7$ .
- 4. Answer choice (A) is the correct answer.** To write a linear equation given the slope and a point, use *point-slope form*:  $y - y_1 = m(x - x_1)$ , where  $m$  represents the slope and  $(x_1, y_1)$  represents a point on the line. Plug in  $\frac{5}{6}$  for  $m$  and the point  $(-12, -4)$  for  $(x_1, y_1)$ :  $y - (-4) = \frac{5}{6}(x - (-12))$ . Now simplify the equation and isolate  $y$ :  $y + 4 = \frac{5}{6}x + 10 \rightarrow y = \frac{5}{6}x + 6$ .

5. **Answer choice (A) is the correct answer.** To write a linear equation given two points, first find the slope:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 8}{0 - 6} = \frac{-3}{-6} = \frac{1}{2}$ . The problem told us that the line passes through (0, 5) which is the  $y$ -intercept of the line. Since we have the slope and the  $y$ -intercept, we can write the equation in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Plug in  $\frac{1}{2}$  for  $m$  and 5 for  $b$ :  $y = \frac{1}{2}x + 5$ .
6. **Answer choice (A) is the correct answer.** To write a linear equation given two points, first find the slope:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-6 - (-3)}{-2 - (-8)} = \frac{-3}{6} = -\frac{1}{2}$ . Use *point-slope form*:  $y - y_1 = m(x - x_1)$ , where  $m$  represents the slope and  $(x_1, y_1)$  represents a point on the line. Plug in  $-\frac{1}{2}$  for  $m$  and either point for  $(x_1, y_1)$ ; we will plug in the first point:  $y - (-3) = -\frac{1}{2}(x - (-8))$ . Simplify the equation and isolate  $y$ :  $y + 3 = -\frac{1}{2}x - 4 \rightarrow y = -\frac{1}{2}x - 7$ .
7. **Answer choice (B) is the correct answer.** Parallel lines have the *same slope*. The given linear equation and the linear equations in the answer choices are written in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, the slope of the given line is  $-2$  and the slope of the line in answer choice (B) is also  $-2$ , so they are parallel.
8. **Answer choice (D) is the correct answer.** The slope of the given line is  $-\frac{1}{2}$ . Perpendicular lines have *opposite reciprocal* slopes. Therefore, the slope of a line perpendicular to the given line is 2. Now write the equation of a line with a slope of 2 that passes through the point (7, 0) using *point-slope form*:  $y - y_1 = m(x - x_1)$ . Plug in 2 for  $m$  and (7, 0) for  $(x_1, y_1)$  and isolate  $y$ :  $y - 0 = 2(x - 7) \rightarrow y = 2x - 14$ .
9. **Answer choice (A) is the correct answer.** The slope of the given line is  $-3$ . Parallel lines have the *same slope*, so the slope of a line parallel to the given line is also  $-3$ . If the line crosses the  $x$ -axis at 4, then it passes through the points (4, 0). Now write the equation of a line with a slope of  $-3$  that passes through the point (4, 0) using *point-slope form*:  $y - y_1 = m(x - x_1)$ . Plug in  $-3$  for  $m$  and (4, 0) for  $(x_1, y_1)$  and isolate  $y$ :  $y - 0 = -3(x - 4) \rightarrow y = -3x + 12$ .
10. **Answer choice (D) is the correct answer.** Using the points (0, 1) and (1, 3), find the slope of the line:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 1}{1 - 0} = \frac{2}{1} = 2$ . The  $y$ -intercept is where the line crosses the  $y$ -axis, so the  $y$ -intercept of this line is 1. Write the equation in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Plug in 2 for  $m$  and 1 for  $b$ :  $y = 2x + 1$ .

## Writing Equations of Lines Set 2

- Answer choice (B) is the correct answer.** All of the answer choices are linear equations written in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, if a line has a slope of  $-2$  and a  $y$ -intercept of  $5$ , plug in  $-2$  for  $m$  and  $5$  for  $b$  to get  $y = -2x + 5$ .
- Answer choice (C) is the correct answer.** All of the answer choices are linear equations written in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, if a line has a slope of  $-\frac{1}{3}$  and a  $y$ -intercept of  $\frac{2}{3}$ , plug in  $-\frac{1}{3}$  for  $m$  and  $\frac{2}{3}$  for  $b$  to get  $y = -\frac{1}{3}x + \frac{2}{3}$ .
- Answer choice (B) is the correct answer.** If a line has a slope of  $0$ , it is a horizontal line. Horizontal lines are written in the form  $y = b$ , where  $b$  is the  $y$ -intercept and the  $y$ -coordinate of every point on the line. Since the  $y$  coordinate of the given point is  $4$ , the equation of the line is  $y = 4$ .
- Answer choice (D) is the correct answer.** To write a linear equation given the slope and a point, use *point-slope form*:  $y - y_1 = m(x - x_1)$ , where  $m$  represents the slope and  $(x_1, y_1)$  represents a point on the line. Plug in  $-\frac{2}{5}$  for  $m$  and the point  $(9, -3)$  for  $(x_1, y_1)$ :  $y - (-3) = -\frac{2}{5}(x - 9)$ . Now simplify the equation and isolate  $y$ :  $y + 3 = -\frac{2}{5}x + \frac{18}{5} \rightarrow y = -\frac{2}{5}x + \frac{3}{5}$ .
- Answer choice (D) is the correct answer.** To write a linear equation given two points, first find the slope:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-4)}{2 - 0} = \frac{10}{2} = 5$ . The problem told us that the line passes through  $(0, -4)$  which is the  $y$ -intercept of the line. Since we have the slope and the  $y$ -intercept, we can write the equation in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Plug in  $5$  for  $m$  and  $-4$  for  $b$ :  $y = 5x - 4$ .
- Answer choice (A) is the correct answer.** To write a linear equation given two points, first find the slope:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-2)}{3 - 9} = \frac{4}{-6} = -\frac{2}{3}$ . Use *point-slope form*:  $y - y_1 = m(x - x_1)$ , where  $m$  represents the slope and  $(x_1, y_1)$  represents a point on the line. Plug in  $-\frac{2}{3}$  for  $m$  and either point for  $(x_1, y_1)$ ; we will plug in the first point:  $y - (-2) = -\frac{2}{3}(x - 9)$ . Simplify the equation and isolate  $y$ :  $y + 2 = -\frac{2}{3}x + 6 \rightarrow y = -\frac{2}{3}x + 4$ .

7. **Answer choice (C) is the correct answer.** The slope of the given line is 4. Perpendicular lines have *opposite reciprocal* slopes. Therefore, the slope of a line perpendicular to the given line is  $-\frac{1}{4}$ . Answer choice (C) has a line with a slope of  $-\frac{1}{4}$ .
8. **Answer choice (A) is the correct answer.** The slope of the given line is  $-3$ . Perpendicular lines have *opposite reciprocal* slopes. Therefore, the slope of a line perpendicular to the given line is  $\frac{1}{3}$ . Since the lines intersect at the point  $(9, 8)$ , then they both pass through the point  $(9, 8)$ . Therefore, write the equation of a line with a slope of  $\frac{1}{3}$  that passes through the point  $(9, 8)$  using *point-slope form*:  $y - y_1 = m(x - x_1)$ . Plug in  $\frac{1}{3}$  for  $m$  and  $(9, 8)$  for  $(x_1, y_1)$  and isolate  $y$ :  $y - 8 = \frac{1}{3}(x - 9) \rightarrow y - 8 = \frac{1}{3}x - 3 \rightarrow y = \frac{1}{3}x + 5$ .
9. **Answer choice (D) is the correct answer.** The slope of the given line is  $-\frac{2}{5}$ . The slopes of parallel lines are *the same*. Therefore, the slope of the line parallel to the given line is  $-\frac{2}{5}$ . Since the line crosses the  $y$ -axis at 7, the  $y$ -intercept of the line is 7. Write the line in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept to get  $y = -\frac{2}{5}x + 7$ .
10. **Answer choice (C) is the correct answer.** Using the points  $(3, 1)$  and  $(0, 2)$ , find the slope of the line:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 1}{0 - 3} = -\frac{1}{3}$ . The  $y$ -intercept is where the line crosses the  $y$ -axis, so the  $y$ -intercept of this line is 2. Write the equation in *slope-intercept form*:  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Plug in  $-\frac{1}{3}$  for  $m$  and 2 for  $b$ :  
 $y = -\frac{1}{3}x + 2$ .
- 

### Finding Equations from Graphs Set 1

1. **Answer choice (A) is the correct answer.** First, write the equation of the line that is graphed in *slope-intercept form* using the slope of 3 and  $y$ -intercept of 3:  $y = 3x + 3$ . Now, rewrite the equation the form  $ax + by = c$  by subtracting  $3x$  from both sides:  $-3x + y = 3$ .
2. **Answer choice (C) is the correct answer.** The line that is graphed is *horizontal*, and the  $y$ -coordinate of every point on the line is 4. Therefore, the line is  $y = 4$ .

3. **Answer choice (C) is the correct answer.** The slope of the line that is graphed is  $-4$  and it passes through the point  $(-3, 1)$ , so write the equation of the line using *point-slope form*:  $y - 1 = -4(x + 3)$ . Simplify the equation and isolate  $y$ :  $y - 1 = -4x - 12 \rightarrow y = -4x + 11$ .
4. **Answer choice (A) is the correct answer.** The line that is graphed is *vertical*, and the  $x$ -coordinate of every point on the line is  $-3$ . Therefore, the line is  $x = -3$ .
5. **Answer choice (B) is the correct answer.** The  $x$ -intercepts of the parabola are  $-2$  and  $4$ , so the factors of the equation are  $(x + 2)$  and  $(x - 4)$ . This gets rid of answer choices (C) and (D). The parabola *opens up*, so the number in front of the factors should be *positive*. This eliminates answer choice (A). We are left with answer choice (B) as the correct answer.
6. **Answer choice (A) is the correct answer.** The parabola *opens down*, so the number in front of  $x^2$  should be *negative*. This eliminates answer choices (B) and (C). Since the graph is the graph of  $-x^2$  shifted *up 4 units*, we need to *add 4* to  $-x^2$ , so we get  $y = -x^2 + 4$ .
7. **Answer choice (D) is the correct answer.** The graph is a positive exponential and passes through the point  $(1, 2)$ , so we know that the base of our exponent is  $2$ . Therefore, the equation is  $y = 2^x$ . You can also plug the points  $(0, 1)$  and  $(1, 2)$  into each answer choice until you find an equation that works (is true) with both points. Answer choice (A) does not work because  $0^2 \neq 1$ . Answer choice (B) does not work because  $-2^0 \neq 1$ . Answer choice (C) does not work because  $\frac{1}{2}(2)^0 \neq 1$ .
8. **Answer choice (D) is the correct answer.** The graph is a *square root* function shifted *1 unit left*. Therefore, the equation of the line is  $\sqrt{x + 1}$ . You can also plug in the points  $(-1, 0)$ ,  $(0, 1)$  and  $(3, 2)$  into each answer choice until you find one that works (is true) for all three points. Answer choices (A) and (B) do not work because  $\sqrt{-1}$  is not a real number. Answer choice (C) does not work because  $\sqrt{-1 - 1} = \sqrt{-2}$  which is not a real number.
9. **Answer choice (C) is the correct answer.** A linear function is any *straight line* that is *not vertical*. Answer choice (C) is a straight, horizontal line, so it is a linear function.
10. **Answer choice (C) is the correct answer.** A quadratic function is in the shape of a *parabola*, or a u-shaped graph. Answer choice (C) is a u-shaped graph, so it's a quadratic function.

### Finding Equations from Graphs Set 2

1. **Answer choice (A) is the correct answer.** First, write the equation of the line that is graphed in *slope-intercept* form using the slope of  $-\frac{2}{3}$  and  $y$ -intercept of  $2$ :  $y = -\frac{2}{3}x + 2$ . Now, rewrite the

equation the form  $ax + by = c$  by adding  $\frac{2}{3}x$  to both sides:  $\frac{2}{3}x + y = 2$ . Finally, multiply both sides by 3 to get rid of the fraction to get  $2x + 3y = 6$ .

- Answer choice (A) is the correct answer.** The line that is graphed is *vertical*, and the  $x$ -coordinate of every point on the line is 2. Therefore, the line is  $x = 2$ .
- Answer choice (C) is the correct answer.** The slope of the line that is graphed is 5 and it passes through the point (2, 4), so write the equation of the line using *point-slope form*:  $y - 4 = 5(x - 2)$ . Simplify the equation and isolate  $y$ :  $y - 4 = 5x - 10 \rightarrow y = 5x - 6$ .
- Answer choice (B) is the correct answer.** The line that is graphed is *horizontal*, and the  $y$ -coordinate of every point on the line is  $-3$ . Therefore, the line is  $y = -3$ .
- Answer choice (D) is the correct answer.** The  $x$ -intercepts of the parabola are  $-1$  and  $3$ , so the factors of the equation are  $(x + 1)$  and  $(x - 3)$ . This gets rid of answer choices (A) and (B). Now check answer choices (C) and (D) by plugging in the vertex (1,  $-1$ ) and seeing which equation is true. Check answer choice (C):  $(1 + 1)(1 - 3) = 2(-2) \neq -1$  so answer choice (C) is incorrect. Check answer choice (D):  $\frac{1}{4}(1 + 1)(1 - 3) = \frac{1}{4}2(-2) = -1$ , so answer choice (D) is correct.
- Answer choice (B) is the correct answer.** The parabola *opens down*, so the coefficient in the front should be negative. Therefore, we can cross out answer choices (A) and (C). Now plug in one of the points into answer choice (B) and (D) and see which one is correct. Let's plug in the point (1, 0). Check answer choice (B):  $0 = -\frac{1}{2}(1 + 1)^2 + 2 = -\frac{1}{2}(2)^2 + 2 = -\frac{1}{2}4 + 2 = 0$  so answer choice (B) is the correct answer.
- Answer choice (C) is the correct answer.** The graph passes through the points (0,  $-2$ ), so plug the point (0,  $-2$ ) into each answer choice and see which one(s) work. Answer choice (A) does not work because  $-0^2 = 0 \neq -2$ . Answer choice (B) does not work because  $-2^0 = -1 \neq -2$ . Answer choice (C) works because  $-2^0 - 1 = -2$ . Answer choice (D) works because  $2^0 - 3 = -2$ . Since answer choices (C) and (D) both work, we need to test both answer choices with the point (1,  $-3$ ). Answer choice (C) works because  $-2^1 - 1 = -3$ . Answer choice (D) does not work because  $2^1 - 3 = -1 \neq -3$ . Therefore, since both points work in the equation in answer choice (C), answer choice (C) is the correct answer.
- Answer choice (B) is the correct answer.** The graph is the positive parent graph for cubic graphs, so the equation of the graph is  $x^3$ . You can also plug the point  $(-1, -1)$  into each answer choice and see which one(s) work. Answer choice (A) does not work because  $(-1)^4 = 1 \neq -1$ . Answer choice (B) works because  $(-1)^3 = -1$ . Answer choice (C) does not work because  $-(-1)^3 = 1 \neq -1$ . Answer choice (D) does not work because  $2(-1)^3 = -2 \neq -1$ .

9. **Answer choice (A) is the correct answer.** A linear function is any *straight line* that is *not vertical*. Since answer choice (A) is a *vertical* line, it is NOT a linear function.
10. **Answer choice (A) is the correct answer.** A cube function is in the form  $y = ax^3$ . As  $x$  gets more positive  $y$  gets more positive, so the graph goes up to the right. As  $x$  gets more negative,  $y$  gets more negative, so the graph goes down to the left. Since there is not a constant slope for cubic functions, the graph is not a straight line. Therefore, the correct graph is answer choice (A).

### Quantitative Comparisons Set 1

1. **Answer choice (C) is the correct answer.** The equation for the circumference of a circle is  $C = 2\pi r$ , so the radius of the circle in Column A is 7 units. The equation for the area of a circle is  $A = \pi r^2$ , so the radius of the circle in Column B is also 7 units. Column A and Column B are equal.
2. **Answer choice (B) is the correct answer.** If you draw the diagonal of a square, it cuts the square into two right triangles. For any triangle, the sum of the two smaller sides has to be *greater than* the third side. Therefore, if we have a right triangle with two legs measuring 5 inches, the third side has to be *less than* 10 inches. Therefore Column B is greater than Column A.
3. **Answer choice (C) is the correct answer.** Set up an equation for the area of the square:  $32 = y^2$ . Set up an equation for the area of the triangle and isolate  $x^2$ :  $16 = \frac{1}{2}x^2 \rightarrow 32 = x^2$ . Since  $x$  and  $y$  are both positive, and  $x^2$  and  $y^2$  each equal 32, then  $x$  and  $y$  are equal.
4. **Answer choice (A) is the correct answer.** Find the distance between the two points in Column A:  $d^2 = (0 - 4)^2 + (6 - 1)^2 \rightarrow d^2 = (-4)^2 + (5)^2 \rightarrow d^2 = 16 + 25 \rightarrow d^2 = 41 \rightarrow d = \sqrt{41}$ . Find the distance between the points in Column B:  $d^2 = (5 - 1)^2 + (7 - 10)^2 \rightarrow d^2 = (4)^2 + (-3)^2 \rightarrow d^2 = 16 + 9 \rightarrow d^2 = 25 \rightarrow d = 5$ . Column A is greater than Column B.
5. **Answer choice (A) is the correct answer.** Find the slope between the points in Column A:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-6)}{4 - (-3)} = \frac{7}{7} = 1$ . Find the slope between the points in Column B:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 2}{-2 - 5} = \frac{7}{-7} = -1$ . Column A is greater than Column B.
6. **Answer choice (B) is the correct answer.** Since the triangles are similar, we can set up the proportion  $\frac{4}{6} = \frac{3}{MJ}$ . Cross multiply and solve for  $MJ$ :  $4(MJ) = 18 \rightarrow MJ = 4.5$ . Column B is greater than Column A.
7. **Answer choice (C) is the correct answer.** Use the pythagorean theorem to find the value of  $2x^2$ :  $x^2 + x^2 = 7^2 \rightarrow 2x^2 = 49$ . Therefore, Column A and Column B are equal.

- 8. Answer choice (D) is the correct answer.** If a rectangle has an area of 25, the smallest possible perimeter is when the rectangle measures 5 by 5, so the smallest perimeter is 20. The largest possible perimeter is when the rectangle measures 25 by 1, so the largest perimeter is 52. Therefore, we cannot determine the relationship between Column A and Column B because depending on the dimensions of the rectangle, the perimeter could equal 20 or be greater than 20.
- 9. Answer choice (A) is the correct answer.** Perpendicular lines have *opposite reciprocal* slopes. Therefore, if the slope of line  $m$  is positive, the slope of line  $n$  is negative. A positive number is always greater than a negative number, so Column A is greater than Column B.
- 10. Answer choice (D) is the correct answer.** Since we do not know the values of  $x$  and  $y$ , we cannot compare the perimeters of the square and rectangle.
- 11. Answer choice (B) is the correct answer.** The two angles shown form a straight line, so they add up to  $180^\circ$ . Therefore,  $y + 20 + x = 180$ . Subtract 20 from both sides to get  $x + y = 160$ . Multiply both sides by 2 to get  $2x + 2y = 320$ . Therefore, Column B is greater than Column A.
- 12. Answer choice (B) is the correct answer.** If a rectangle has a perimeter of 32, the smallest possible area is when the rectangle measures 15 by 1, so the smallest area is 15. The largest possible area is when the rectangle measures 8 by 8, so the largest area is 64. Therefore, 65 will always be greater than the area of the rectangle, so Column B is greater than Column A.
- 13. Answer choice (C) is the correct answer.** The area of the entire square is  $x \cdot x = x^2$ . If you draw a vertical line down the center of the large square and a horizontal line across the center of the large square, you will break the square into 8 equal sized right triangles. Since there are 4 shaded triangles and 4 white triangles, the area of the shaded region is half of the area of the square. Therefore, the area of the shaded region equals  $x^2 \div 2$ , so Columns A and B are equal.
- 14. Answer choice (B) is the correct answer.** The sum of the two smallest sides in any triangle has to be greater than the third side. Therefore, the third side of this triangle must be less than 16. This means the perimeter must be less than  $7 + 9 + 16$  which equals 32. Column B is greater than Column A.
- 15. Answer choice (C) is the correct answer.** To find the side length of a cube with a surface area of  $24 \text{ cm}^2$ , divide the total surface area by 6 to get that the area of one side of the cube is  $4 \text{ cm}^2$ . Since the side of the cube is a square with an area of  $4 \text{ cm}^2$ , the side length is 2. Find the side length of a cube with a volume of  $8 \text{ cm}^3$  by finding the cube root of 8 which is 2. Therefore, the side length of the cubes in Column A and Column B are both 2 cm, so the columns are equal.

**Quantitative Comparisons Set 2**

- 1. Answer choice (A) is the correct answer.** Find the slope of the line in Column A by isolating  $y$  in the equation:  $-7x + 3y = 3 \rightarrow 3y = 7x + 3 \rightarrow \frac{7}{3}y = x + 1$ . Now the line is written in  $y = mx + b$  form where  $m$  represents the slope and  $b$  represents the  $y$ -intercept, so the slope of the line in Column A is  $\frac{7}{3}$ . Therefore, Column A is greater than Column B.
- 2. Answer choice (B) is the correct answer.** The equation for the circumference of a circle is  $C = 2\pi r$ , so the radius of the circle in Column A is 10 units. The equation for the area of a circle is  $A = \pi r^2$ , so find the area of the circle in Column A:  $A = \pi 10^2 \rightarrow A = 100\pi^2$ . Therefore, Column B is greater than Column A.
- 3. Answer choice (D) is the correct answer.** While the triangle looks like it could be a right triangle, it is not labeled as a right triangle. Therefore, we cannot use the pythagorean theorem to find the third side. All we know about the third side is that it must be less than  $5 + 12$  if it is the largest side and greater than  $12 - 5$  if it is one of the smaller sides. (The sum of the two smaller sides of a triangle must be greater than the third side). Therefore, the third side is greater than 7 and less than 17. Since 13 is in that range, we cannot compare the third side to 13. Answer choice (D) is the correct answer.
- 4. Answer choice (B) is the correct answer.** Find the radius of the circle by finding the distance between the center and the point on the outside of the circle:  $d^2 = (1 - 4)^2 + (1 - 5)^2 \rightarrow d^2 = (-3)^2 + (-4)^2 \rightarrow d^2 = 9 + 16 \rightarrow d^2 = 25 \rightarrow d = 5$  grid units. Therefore, Column B is greater than Column A.
- 5. Answer choice (B) is the correct answer.** The slopes of two perpendicular lines are opposite reciprocals; for example,  $\frac{2}{3}$  and  $-\frac{3}{2}$ . Therefore, the product of the slopes of two perpendicular lines is always  $-1$  (as long as the lines are not vertical or horizontal). The slopes of two parallel lines are the same. Therefore, the product is always positive: the product of two positive numbers is positive and the product of two negative numbers is positive. Since a positive number is always greater than a negative number, Column B is greater than Column A.
- 6. Answer choice (B) is the correct answer.** The diagonal of a square cuts the square into two congruent right triangles. In this case, 4 is the hypotenuse of the right triangles and the legs of the triangles are the side lengths of the square. Since the hypotenuse of a right triangle is always longer than the legs, the sides length of the square is less than 4. Therefore, the area of the square is less than  $4^2$  or 16, so Column B is greater than Column A.
- 7. Answer choice (D) is the correct answer.** Since we don't know the side length of the cube, we cannot compare the volume and surface area. If the side length is 1 unit, then the volume is 1 cubic unit and the surface area is 6 square units, so the surface area is larger. However, if the side length

is 10 units, then the volume is 1000 cubic units and the surface area is 600 square units, so the volume is larger.

- 8. Answer choice (A) is the correct answer.** If a rectangle has an area of 72, the smallest possible perimeter is when the rectangle measures 9 by 8, so the smallest perimeter is 34. The largest possible perimeter is when the rectangle measures 72 by 1, so the largest perimeter is 146. Therefore, the perimeter of the rectangle is always greater than 32, so Column A is greater than Column B.
- 9. Answer choice (A) is the correct answer.** The sum of any two sides in a triangle must be greater than the third side. Therefore, if we let the third side equal  $x$ , then  $x + 5 > 11$ . Solve this to get  $x > 6$ , so Column A is greater than Column B.
- 10. Answer choice (C) is the correct answer.** The angle that is a vertical angle to the angle measuring  $x^\circ$  is supplementary (add to  $180^\circ$ ) to the angle measuring  $y^\circ$  because they are same-side interior angles. Since vertical angles are congruent, the angle measuring  $x^\circ$  and the angle measuring  $y^\circ$  are also supplementary (add up to  $180^\circ$ ). Therefore,  $x + y = 180^\circ$ . Isolate  $x$  in the equation to get  $x = 180 - y^\circ$ , so Column A and Column B are equal.
- 11. Answer choice (D) is the correct answer.** Since we do not know what  $a$  is, we cannot compare the perimeter and area of the rectangle.
- 12. Answer choice (A) is the correct answer.** Let the original side length of the square be 10, so the original area is 100. Increase each side by 20% to get a new side length of 12, so the area of the new square is 144. The percent change from 100 to 144 is 44%, so Column A is greater than Column B.
- 13. Answer choice (A) is the correct answer.** To find the shaded area, subtract the area of the white circle from the area of the outer circle. The area of a circle equals  $A = \pi r^2$ , so the shaded area =  $10^2\pi - 6^2\pi = 100\pi^2 - 36\pi^2 = 64\pi^2$  m. Therefore, Column A is greater than Column B.
- 14. Answer choice is (B) is the correct answer.** Since the triangles are similar, we can set up the proportion  $\frac{8}{y} = \frac{y}{16}$ . Cross multiply to get  $y^2 = 128$ , so Column B is greater than Column A.
- 15. Answer choice (A) is the correct answer.** If the perimeter of two shapes are the same, the shape with the greater number of sides has a greater area. Imagine you have a piece of string and you want to make a shape with the greatest area: you would make a circle. However, a circle doesn't have sides, so if you wanted to make a shape that had actual sides, you would make one that is as close to a circle as possible. Shapes with more sides are closer to a circle than shapes with fewer sides, so shapes with more sides have a larger area. Therefore, the area of the square is greater than the area of the triangle.
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**Math Course 6****LCM and GCF With Variables Set 1**

- 1. Answer choice (B) is the correct answer.** The least common multiple of 2 and 6 is 6, so this eliminates answer choices (C) and (D). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 5 for  $a$  and 6 for  $b$ . Therefore, the LCM of the two expressions is  $6a^5b^6$ .
- 2. Answer choice (A) is the correct answer.** The greatest common factor of 12 and 16 is 4, so this eliminates answer choices (C) and (D). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 1 for  $z$  and 4 for  $y$ . Therefore, the GCF of the two expressions is  $4zy^4$ .
- 3. Answer choice (C) is the correct answer.** The greatest common factor of 20 and 30 is 10, so this eliminates answer choices (A) and (B). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 2 for  $a$  and 1 for  $b$ . Since  $c$  doesn't show up in the second expression, it is not a factor of the second expression, so it won't be included in the answer. Therefore, the GCF of the two expressions is  $10a^2b$ .
- 4. Answer choice (A) is the correct answer.** The least common multiple of 5 and 15 is 15, so this eliminates answer choices (C) and (D). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 2 for  $x$ , 6 for  $y$ , and 5 for  $z$ . Therefore, the LCM of the two expressions is  $15x^2y^6z^5$ .
- 5. Answer choice (D) is the correct answer.** The least common multiple of 15, 45 and 30 is 90, so this eliminates answer choices (A) and (B). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 6 for  $x$  and 8 for  $y$ . Therefore, the LCM of the three expressions is  $90x^6y^8$ .
- 6. Answer choice (D) is the correct answer.** The least common multiple of 6, 7 and 21 is 42, so this eliminates answer choices (A) and (B). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 3 for  $a$  and 5 for  $b$ . Therefore, the LCM of the three expressions is  $42a^3b^5$ .
- 7. Answer choice (C) is the correct answer.** The greatest common factor of 64, 16 and 40 is 8, so this eliminates answer choices (A) and (B). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable. If a variable does not show up in every expression, it is not a common factor. Therefore, since  $t$  and  $s$  don't each show up in all three expressions, they are not part of the GCF. The GCF is just 8.

- 8. Answer choice (B) is the correct answer.** The least common multiple of 12, 3 and 8 is 24, so this eliminates answer choices (C) and (D). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 2 for  $a$  and 6 for  $b$ . Therefore, the LCM of the three expressions is  $24a^2b^6$ .
- 9. Answer choice (A) is the correct answer.** The greatest common factor of 15, 40 and 10 is 5, so this eliminates answer choices (C) and (D). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable. If a variable does not show up in every expression, it is not a common factor. Therefore, since  $x$  and  $y$  don't each show up in all three expressions, they are not part of the GCF. The GCF is just 5.
- 10. Answer choice (A) is the correct answer.** The greatest common factor of 12, 28 and 36 is 4, so this eliminates answer choices (C) and (D). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 1 for  $n$ , 5 for  $m$ , and 2 for  $k$ . Therefore, the GCF of the three expressions is  $4nm^5k^2$ .

### LCM and GCF With Variables Set 2

- 1. Answer choice (A) is the correct answer.** The least common multiple of 8 and 12 is 24, so this eliminates answer choices (C) and (D). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 3 for  $c$  and 4 for  $d$ . Therefore, the LCM of the two expressions is  $24c^3d^4$ .
- 2. Answer choice (A) is the correct answer.** The greatest common factor of 28 and 32 is 4, so this eliminates answer choices (C) and (D). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 1 for  $q$  and 2 for  $p$ . Therefore, the GCF of the two expressions is  $4qp^2$ .
- 3. Answer choice (B) is the correct answer.** The least common multiple of 16 and 48 is 48, so this eliminates answer choices (C) and (D). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 2 for  $k$ , 3 for  $m$ , and 1 for  $n$ . Therefore, the LCM of the two expressions is  $48k^2m^3n$ .
- 4. Answer choice (C) is the correct answer.** The greatest common factor of 14 and 21 is 7, so this eliminates answer choices (A) and (B). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 1 for  $a$  and 3 for  $c$ . If a variable does not show up in every expression, it is not a common factor. Since  $b$  doesn't show up in both expressions,  $b$  is not part of the GCF. Therefore, the GCF of the two expressions is  $7ac^3$ .
- 5. Answer choice (D) is the correct answer.** The least common multiple of 4, 10 and 12 is 60, so this eliminates answer choices (A) and (B). To find the least common multiple of variable expressions,

take the *highest* exponent for each variable: 3 for  $x$ , 4 for  $y$ , and 6 for  $z$ . Therefore, the LCM of the three expressions is  $60x^3y^4z^6$ .

6. **Answer choice (C) is the correct answer.** The least common multiple of 20, 60 and 80 is 240, so this eliminates answer choices (A) and (B). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 6 for  $r$  and 9 for  $t$ . Therefore, the LCM of the three expressions is  $240r^6t^9$ .
7. **Answer choice (A) is the correct answer.** The greatest common factor of 15, 25 and 10 is 5, so this eliminates answer choice (D). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable. If a variable does not show up in every expression, it is not a common factor. Therefore, since  $v$ ,  $w$  and  $z$  don't each show up in all three expressions, they are not part of the GCF. The GCF is just 5.
8. **Answer choice (C) is the correct answer.** The greatest common factor of 12, 48 and 60 is 12, so this eliminates answer choices (A) and (B). To find the greatest common factors of variable expressions, take the *lowest* exponent for each variable: 2 for  $a$  and 3 for  $b$ . Therefore, the GCF of the three expressions is just  $12a^2b^3$ .
9. **Answer choice (A) is the correct answer.** The greatest common factor of 36, 48 and 72 is 12, so this eliminates answer choices (C) and (D). To find the greatest common factor of variable expressions, take the *lowest* exponent for each variable: 3 for  $j$ . If a variable does not show up in every expression, it is not a common factor. Since  $h$  and  $k$  don't each show up in all three expressions, they are not part of the GCF. Therefore, the GCF of the three expressions is  $12j^3$ .
10. **Answer choice (D) is the correct answer.** The least common multiple of 5, 25 and 10 is 50, so this eliminates answer choices (A) and (B). To find the least common multiple of variable expressions, take the *highest* exponent for each variable: 5 for  $x$ , 4 for  $y$ , and 8 for  $z$ . Therefore, the LCM of the three expressions is  $50x^5y^4z^8$ .
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### Challenging Number Properties Set 1

1. **Answer choice (C) is the correct answer.** Choose two different even numbers for  $p$  and  $q$  and see which answer choice is correct. Let  $p = 2$  and  $q = 4$ . Answer choice (A) equals  $2 + 4 = 6$  which is *not* odd, so answer choice (A) is incorrect. Answer choice (B) equals  $2^2 - 4 = 0$  which is *not* odd, so answer choice (B) is incorrect. Answer choice (C) equals  $2(2)(4) + 3 = 19$  which is odd, so answer choice (C) is correct. Answer choice (D) equals  $3(2) + 5(4) = 26$  which is *not* odd, so answer choice (D) is incorrect. REMEMBER: when you use the strategy of *picking numbers* you may get more than one answer choice that works with the numbers you picked. If this happens, choose new numbers and recheck the answer choices that worked.

2. **Answer choice (B) is the correct answer.** The sum of two negative numbers is *always* negative:  $-4 + (-2) = -6$ . Answer choice (A) is incorrect because the difference between two negative numbers could be positive:  $-2 - (-4) = 2$ . Answer choice (C) is incorrect because the quotient of two negative numbers is *always* positive:  $-4 \div (-2) = 2$ . Answer choice (D) is incorrect because the difference between two negative numbers could be positive:  $-2 - (-4) = 2$  (this is the same as answer choice (A), just with the letters reversed).
3. **Answer choice (C) is the correct answer.** Pick numbers for  $p$ ,  $x$ ,  $q$ , and  $y$  based on the requirements. Let  $p = 2$ ,  $x = 4$ ,  $q = 3$ , and  $y = 9$ . Check each answer choice. Answer choice (A) is incorrect because 9 is *not* a multiple of 6. Answer choice (B) is incorrect because 6 is *not* a factor of 4. Answer choice (C) is correct because 36 is a multiple of 6. Answer choice (D) is incorrect because 4 is not a factor of 6. REMEMBER: when you use the strategy of *picking numbers* you may get more than one answer choice that works with the numbers you picked. If this happens, choose new numbers and recheck the answer choices that worked.
4. **Answer choice (C) is the correct answer.** If  $a$  can be divided by both 6 and 8 without a remainder, then it can also be divided by the LCM of 6 and 8 without a remainder. The LCM of 6 and 8 is 24, so  $a$  can also be divided by 24.
5. **Answer choice (A) is the correct answer.** An odd number plus an odd number is *always* even. You can also choose an odd number for  $x$  and check each answer choice to see which one is *not* odd.
6. **Answer choice (D) is the correct answer.** If you square  $y$ , it becomes a positive number. Multiply that by a positive  $x$  value and the product is always positive: let  $x = 3$  and  $y = -2$ , then answer choice (D) equals  $3(-2)^2 = 3(4) = 12$ . Answer choices (A) and (B) are incorrect because the product or quotient of a positive and negative number is always negative. Answer choice (C) is incorrect because the sum of a positive and negative number can be negative:  $4 + -7 = -3$ .
7. **Answer choice (C) is the correct answer.** If you multiply a multiple of 6 by any whole number, then it is still a multiple of 6. Therefore, if  $x$  is a multiple of 6, so is  $3x$ , and if  $y$  is a multiple of 6, so is  $2y$ . If you add two multiples of 6, the sum is also a multiple of 6. Therefore, since  $3x$  and  $2y$  are multiples of 6, then  $3x + 2y$  is also a multiple of 6.
8. **Answer choice (C) is the correct answer.** Choose numbers for  $x$  and  $y$  so their sum is divisible by 5:  $x = 3$  and  $y = 7$ . Check each answer choice using these values for  $x$  and  $y$ . Answer choice (A) is divisible by 5:  $2(3) + 2(7) = 20$ . Answer choice (B) is divisible by 5:  $3(3 + 7) = 30$ . Answer choice (C) is *not* divisible by 5:  $2(3) + 7 = 13$ . Answer choice (D) is divisible by 5:  $3 + 7 - 10 = 0$  (0 is divisible by every number except 0).
9. **Answer choice (B) is the correct answer.** If  $x$  is a factor of 16 and 24, then it *must be* a factor of the greatest common factor of 16 and 24. The GCF of 16 and 24 is 8, so  $x$  must be a factor of 8.

- 10. Answer choice (C) is the correct answer.** Pick two different odd numbers for  $a$  and  $b$ :  $a = 3$  and  $b = 5$ . Check each answer choice using these values of  $a$  and  $b$ , and see which answer is odd. Answer choice (A) is incorrect:  $3^2 + 5 = 14$ . Answer choice (B) is incorrect:  $3^2 + 5^2 = 34$ . Answer choice (C) is correct:  $3(5^2) = 75$ . Answer choice (D) is incorrect:  $3(5) + 3 = 18$ .

### Challenging Number Properties Set 2

- 1. Answer choice (A) is the correct answer.** Choose two different even numbers for  $x$  and  $y$  and see which answer choice is correct. Let  $x = 2$  and  $y = 4$ . Answer choice (A) equals  $5(2) + 7(4) = 38$ , which is *even*, so answer choice (A) is correct. Answer choice (B) equals  $2(4) + 5 = 13$ , which is *not even*, so answer choice (B) is incorrect. Answer choice (C) equals  $3(2)(4) - 1 = 23$ , which is *not even*, so answer choice (C) is incorrect. Answer choice (D) equals  $2^2 + 7 = 11$ , which is *not even*, so answer choice (D) is incorrect. REMEMBER: when you use the strategy of *picking numbers* you may get more than one answer choice that works with the numbers you picked. If this happens, choose new numbers and recheck the answer choices that worked.
- 2. Answer choice (D) is the correct answer.** The product of two negative numbers is *always* positive. The sum of two negative numbers is always negative:  $-3 + (-5) = -8$ , so answer choice (A) is incorrect. The difference between two negative numbers is not always positive:  $-5 - (-3) = -2$ , so answer choices (B) and (C) are incorrect.
- 3. Answer choice (C) is the correct answer.** Choose an even integer for  $y$  and check each answer choice. Let  $y = 2$ . Answer choice (A) is  $6 - 2(2) = 2$ , which is even, so answer choice (A) is incorrect. Answer choice (B) is  $2^2 = 4$ , which is even, so answer choice (B) is incorrect. Answer choice (C) is  $3(2^2) + 5 = 17$ , which is *not even*, so answer choice (C) is correct. Answer choice (D) is  $2(2^2) - 2 = 6$ , which is even, so answer choice (D) is incorrect.
- 4. Answer choice (C) is the correct answer.** Choose numbers for  $x$  and  $y$  so their sum is divisible by 6:  $x = 5$  and  $y = 7$ . Check each answer choice using these values for  $x$  and  $y$ . Answer choice (A) is not divisible by 6:  $4(5) + 7 = 27$ . Answer choice (B) is not divisible by 6:  $2(5) + 3(7) = 31$ . Answer choice (C) is divisible by 6:  $5 + 7 + 18 = 30$ . Answer choice (D) is not divisible by 6:  $5 - 7 = -2$ .
- 5. Answer choice (A) is the correct answer.** Choose two different numbers for  $w$  and  $z$  and check each answer choice. Let  $w = 3$  and  $z = 5$ . Answer choice (A) equals  $3(5) + 5 = 20$ , which is even, so answer choice (A) is correct. Answer choice (B) equals  $3^2 + 2 = 11$ , which is not even, so answer choice (B) is incorrect. Answer choice (C) equals  $2(5^2) - 5 = 45$ , which is not even, so answer choice (C) is incorrect. Answer choice (D) equals  $2(3^2) - 5^2 = -7$ , which is not even, so answer choice (D) is incorrect.
- 6. Answer choice (A) is the correct answer.** Let  $z$  equals the least common multiple of 15 and 25, so  $z = 75$ . 75 is a multiple of 5, so answer choice (A) is the correct answer.

7. **Answer choice (D) is the correct answer.** If  $x$  can be divided by both 10 and 12 without a remainder, then let  $x$  equal the least common multiple of 10 and 12. The LCM of 10 and 12 is 60, so  $x = 60$ . 60 can be divided by 15, so answer choice (D) is correct.
8. **Answer choice (A) is the correct answer.** If you add two multiples of a number together, the sum will also be a multiple of the number. Therefore, since  $a$  and  $b$  are both multiples of 4, the sum of  $a$  and  $b$  is also a multiple of 4.
9. **Answer choice (D) is the correct answer.** Pick numbers for  $p$ ,  $x$ ,  $q$ , and  $y$  based on the requirements. Let  $p = 2$ ,  $x = 4$ ,  $q = 3$ , and  $y = 9$ . Check each answer choice and find one that is NOT true. Answer choice (A) is incorrect because 6 is a factor of 36. Answer choice (B) is incorrect because 2 is a factor of 36. Answer choice (C) is incorrect because 36 is a multiple of 3. Answer choice (D) is correct because 4 is NOT a multiple of 6. REMEMBER: when you use the strategy of *picking numbers* you may get more than one answer choice that works with the numbers you picked. If this happens, choose new numbers and recheck the answer choices that worked.
10. **Answer choice (C) is the correct answer.** A positive number minus a negative number is *always* positive:  $5 - (-3) = 8$ . The product of the square of a positive number and the square of a negative number is positive:  $(5)^2(-3)^2 = 25 \cdot 9 = 225$ , so answer choice (A) is incorrect. The sum of a negative and positive number can be positive:  $5 + (-3) = 2$ , so answer choice (B) is incorrect. The product of a positive and negative number is always negative:  $5(-3) = -15$ , so answer choice (D) is incorrect.
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### Number Sequences Set 1

1. **Answer choice (B) is the correct answer.** The value of each term in the sequence is equal to its  $n$  value. For example, if  $n = 1$ , which represents the first term in the sequence, the value of the term is 1. If  $n = 2$ , the value is 2. This continues for  $n = 3, 4$ , and 5.
2. **Answer choice (D) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (D), you will get the given sequence:  $2(1) + 1 = 3$ ;  $2(2) + 1 = 5$ ;  $2(3) + 1 = 7$ ;  $2(4) + 1 = 9$ ;  $2(5) + 1 = 11$ .
3. **Answer choice (B) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $3(1) - 7 = -4$ ;  $3(2) - 7 = -1$ ;  $3(3) - 7 = 2$ ;  $3(4) - 7 = 5$ ;  $3(5) - 7 = 8$ .
4. **Answer choice (D) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (D), you will get the given sequence:  $-4(1) - 2 = -6$ ;  $-4(2) - 2 = -10$ ;  $-4(3) - 2 = -14$ ;  $-4(4) - 2 = -18$ ;  $-4(5) - 2 = -22$ .

5. **Answer choice (C) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $2^1 = 2$ ;  $2^2 = 4$ ;  $2^3 = 8$ ;  $2^4 = 16$ ;  $2^5 = 32$ .
6. **Answer choice (B) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $3^{1-1} = 1$ ;  $3^{2-1} = 3$ ;  $3^{3-1} = 9$ ;  $3^{4-1} = 27$ ;  $3^{5-1} = 81$ .
7. **Answer choice (B) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $(2)3^{1-1} = 2$ ;  $(2)3^{2-1} = 6$ ;  $(2)3^{3-1} = 18$ ;  $(2)3^{4-1} = 54$ ;  $(2)3^{5-1} = 162$ .
8. **Answer choice (C) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $(-3)(-2)^{1-1} = -3$ ;  $(-3)(-2)^{2-1} = 6$ ;  $(-3)(-2)^{3-1} = -12$ ;  $(-3)(-2)^{4-1} = 24$ ;  $(-3)(-2)^{5-1} = -48$ .
9. **Answer choice (C) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $1^2 = 1$ ;  $2^2 = 4$ ;  $3^2 = 9$ ;  $4^2 = 16$ ;  $5^2 = 25$ .
10. **Answer choice (A) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (A), you will get the given sequence:  $1^3 - 1 = 0$ ;  $2^3 - 1 = 7$ ;  $3^3 - 1 = 26$ ;  $4^3 - 1 = 63$ ;  $5^3 - 1 = 124$ .

### Number Sequences Set 2

1. **Answer choice (C) is the correct answer.** The value of each term in the sequence is equal to its  $n$  value. If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $1 + 1 = 2$ ;  $2 + 1 = 3$ ;  $3 + 1 = 4$ ;  $4 + 1 = 5$ ;  $5 + 1 = 6$ .
2. **Answer choice (B) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $5(1) - 11 = -6$ ;  $5(2) - 11 = -1$ ;  $5(3) - 11 = 4$ ;  $5(4) - 11 = 9$ ;  $5(5) - 11 = 14$ .
3. **Answer choice (D) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (D), you will get the given sequence:  $-10(1) + 28 = 18$ ;  $-10(2) + 28 = 8$ ;  $-10(3) + 28 = -2$ ;  $-10(4) + 28 = -12$ ;  $-10(5) + 28 = -22$ .
4. **Answer choice (A) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (A), you will get the given sequence:  $-7(1) + 5 = -2$ ;  $-7(2) + 5 = -9$ ;  $-7(3) + 5 = -16$ ;  $-7(4) + 5 = -23$ ;  $-7(5) + 5 = -30$ .

5. **Answer choice (C) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $2^{1-1} = 1$ ;  $2^{2-1} = 2$ ;  $2^{3-1} = 4$ ;  $2^{4-1} = 8$ ;  $2^{5-1} = 16$ .
6. **Answer choice (A) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (A), you will get the given sequence:  $3^1 = 3$ ;  $3^2 = 9$ ;  $3^3 = 27$ ;  $3^4 = 81$ ;  $3^5 = 243$ .
7. **Answer choice (B) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $64(0.5)^1 = 32$ ;  $64(0.5)^2 = 16$ ;  $64(0.5)^3 = 8$ ;  $64(0.5)^4 = 4$ ;  $64(0.5)^5 = 2$ .
8. **Answer choice (D) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (D), you will get the given sequence:  $(-1)(-3)^{1-1} = -1$ ;  $(-1)(-3)^{2-1} = 3$ ;  $(-1)(-3)^{3-1} = -9$ ;  $(-1)(-3)^{4-1} = 27$ ;  $(-1)(-3)^{5-1} = -81$ .
9. **Answer choice (C) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (C), you will get the given sequence:  $1^2 + 1 = 2$ ;  $2^2 + 1 = 5$ ;  $3^2 + 1 = 10$ ;  $4^2 + 1 = 17$ ;  $5^2 + 1 = 26$ .
10. **Answer choice (D) is the correct answer.** If you plug in the values 1, 2, 3, 4 and 5 for  $n$  into the expression in answer choice (D), you will get the given sequence:  $(1 - 1)^2 = 0$ ;  $(2 - 1)^2 = 1$ ;  $(3 - 1)^2 = 4$ ;  $(4 - 1)^2 = 9$ ;  $(5 - 1)^2 = 16$ .
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### Inclusive and Exclusive Word Problems Set 1

1. **Answer choice (C) is the correct answer.** If  $x$  is the sum of the integers from 1 to 2500 inclusive, to find the sum of the integers from 1 to 2501 inclusive, we have to add the sum of the integers from 1 to 2500 inclusive plus 2501. Therefore, the sum equals  $x + 2501$ .
2. **Answer choice (C) is the correct answer.** If  $k$  is the sum of the integers from 40 to 80 inclusive, to find the sum of the integers from 38 to 80 inclusive, we have to add the sum of the integers from 40 to 80 inclusive plus 39 plus 38. Therefore, the sum equals  $k + 77$ .
3. **Answer choice (B) is the correct answer.** If the product of the integers from 1 to 30 inclusive is  $x$ , to find the product of the integers from 1 to 31 inclusive, we have to multiply the product of the integers from 1 to 30 inclusive times 31. Therefore, the product equals  $31x$ .
4. **Answer choice (C) is the correct answer.** If the sum of the integers from 1 to 1250 exclusive (doesn't include 1 or 1250) is  $x$ , then to find the sum of the integers from 1 to 1248 exclusive, we

need to subtract 1249 and 1248 from the sum of the integers from 1 to 1250 exclusive. Therefore, the sum equals  $x - 2497$ .

5. **Answer choice (C) is the correct answer.** If the product of the integers from 1 to 300 exclusive (doesn't include 1 or 300) is  $y$ , then to find the product of the integers from 1 to 298 exclusive, we need to divide the product of the integers from 1 to 300 exclusive by 299 and 298. This is the same as dividing by the product of 299 and 298. Therefore, the sum equals  $y \div (299 \cdot 298)$ .
6. **Answer choice (C) is the correct answer.** If the sum of the integers from  $-5000$  to  $-10$  inclusive is  $a$ , then to find the sum of the integers from  $-5000$  to  $-8$  inclusive, we have to add  $-9$  and  $-8$  to the sum of the integers from  $-5000$  to  $-10$  inclusive. Therefore, we have to add  $-17$  to the sum, which is the same as subtracting, so we get  $a - 17$ .
7. **Answer choice (C) is the correct answer.** The product of the integers from 1 to 50 inclusive includes 50: the product equals  $1 \cdot 2 \cdot \dots \cdot 49 \cdot 50$ . The product of the integers from 50 to 100 also includes 50: the product equals  $50 \cdot 51 \cdot \dots \cdot 99 \cdot 100$ . Therefore, if we multiply  $a$  and  $b$  together, we will have two 50s in our product:  $ab = 1 \cdot 2 \cdot \dots \cdot 49 \cdot 50 \cdot 50 \cdot 51 \cdot \dots \cdot 99 \cdot 100$ . Therefore, if we want the product of the numbers from 1 to 100 inclusive, we have to divide out a 50 from the product of  $ab$ , so we get  $ab \div 50$ .
8. **Answer choice (D) is the correct answer.** If the sum of the integers from  $-400$  to  $-100$  inclusive is  $d$ , then to find the sum of the integers from  $-400$  to  $-101$  inclusive, we have to subtract  $-100$  from the sum of the integers from  $-400$  to  $-100$  inclusive. Subtracting  $-100$  is the same as adding 100, so the sum is  $d + 100$ .
9. **Answer choice (B) is the correct answer.** The sum of the integers from 1 to 100 inclusive includes 100: the sum equals  $1 + 2 + \dots + 99 + 100$ . The sum of the integers from 100 to 200 also includes 100: the sum equals  $100 + 101 + \dots + 199 + 200$ . Therefore, if we add  $x$  and  $y$ , we have two 100s in our sum:  $x + y = 1 + 2 \cdot \dots + 99 + 100 + 100 + 101 + \dots + 199 + 200$ . Therefore, if we want the sum of the numbers from 1 to 200 inclusive, we have to subtract a 100 from the sum of  $x + y$ , so we get  $x + y - 100$ .
10. **Answer choice (B) is the correct answer.** The sum of the integers from  $-1000$  to  $-500$  inclusive includes  $-500$ : the sum equals  $(-1000) + (-999) + \dots + (-501) + (-500)$ . The sum of the integers from  $-500$  to 0 also includes  $-500$ : the sum equals  $(-500) + (-499) + \dots + (-1) + 0$ . Therefore, if we add  $a$  and  $b$ , we have two  $-500$ s in our sum:  $a + b = (-1000) + (-999) + \dots + (-501) + (-500) + (-500) + (-499) + \dots + (-1) + 0$ . Therefore, if we want the sum of the numbers from  $-1000$  to 0 inclusive, we have to subtract a  $-500$  from the sum of  $x + y$ . Subtracting  $-500$  is the same as adding 500, so the sum is  $a + b + 500$ .

**Inclusive and Exclusive Word Problems Set 2**

- 1. Answer choice (A) is the correct answer.** If  $z$  is the sum of the integers from 1 to 1250 inclusive, to find the sum of the integers from 1 to 1252 inclusive, we have to add the sum of the integers from 1 to 1250 inclusive plus 1251 plus 1252. Therefore, the sum equals  $z + 2503$ .
- 2. Answer choice (D) is the correct answer.** If  $k$  is the sum of the integers from 1 to 800 inclusive, to find the sum of the integers from 4 to 800 inclusive, we have to subtract 1, 2, and 3 from the sum of the integers from 1 to 800 inclusive. Therefore, the sum equals  $k - 6$ .
- 3. Answer choice (B) is the correct answer.** If the product of the integers from 10 to 50 inclusive is  $x$ , to find the product of the integers from 9 to 50 inclusive, we have to multiply the product of the integers from 10 to 50 inclusive times 9. Therefore, the product equals  $9x$ .
- 4. Answer choice (B) is the correct answer.** If the sum of the integers from 1 to 2500 exclusive (doesn't include 1 or 2500) is  $y$ , then to find the sum of the integers from 1 to 2499 exclusive, we need to subtract 2499 from the sum of the integers from 1 to 2500 exclusive. Therefore, the sum equals  $y - 2499$ .
- 5. Answer choice (B) is the correct answer.** If the product of the integers from 1 to 500 exclusive (doesn't include 1 or 500) is  $y$ , then to find the product of the integers from 3 to 500 exclusive, we need to divide the product of the integers from 1 to 500 exclusive by 2 and 3. This is the same as dividing by the product of 2 and 3 which is 6. Therefore, the sum equals  $y \div 6$ .
- 6. Answer choice (D) is the correct answer.** If the sum of the integers from  $-700$  to  $-200$  inclusive is  $y$ , then to find the sum of the integers from  $-700$  to  $-199$  inclusive, we have to add  $-199$  to the sum of the integers from  $-700$  to  $-200$  inclusive. Adding  $-199$  is the same as subtracting 199, so we get  $y - 199$ .
- 7. Answer choice (B) is the correct answer.** If the sum of the integers from  $-5000$  to  $-10$  inclusive is  $b$ , then to find the sum of the integers from  $-5000$  to  $-12$  inclusive, we have to subtract  $-10$  and  $-11$  from the sum of the integers from  $-5000$  to  $-12$  inclusive. Subtracting  $-10$  and  $-11$  is the same as adding 10 and 11, so we get that the sum is  $b + 21$ .
- 8. Answer choice (B) is the correct answer.** The sum of the integers from  $-300$  to  $-200$  inclusive includes  $-200$ : the sum equals  $-300 + (-299) + \dots + (-201) + (-200)$ . The sum of the integers from  $-200$  to  $-100$  also includes  $-200$ : the sum equals  $(-200) + (-199) + \dots + (-101) + (-100)$ . Therefore, if we add  $a$  and  $b$ , we have two  $-200$ s in our sum:  $a + b = -300 + (-299) + \dots + (-201) + (-200) + (-200) + (-199) + \dots + (-101) + (-100)$ . Therefore, if we want the sum of the numbers from  $-300$  to  $-100$  inclusive, we have to subtract a  $-200$  from the sum of  $a + b$ , which is the same as adding 200, so we get  $a + b + 200$ .

9. **Answer choice (B) is the correct answer.** The product of the integers from 1 to 50 *exclusive* does not include 1 or 50. The product is:  $2 \cdot 3 \cdot \dots \cdot 48 \cdot 49$ . The product from 50 to 100 *exclusive* does not include 50 or 100. The product is  $51 \cdot 52 \cdot \dots \cdot 98 \cdot 99$ . Therefore, if we multiply  $a$  and  $b$  we get  $ab = 2 \cdot 3 \cdot \dots \cdot 48 \cdot 49 \cdot 51 \cdot 52 \cdot \dots \cdot 98 \cdot 99$ . This does not represent the product of the integers from 1 to 100 exclusive because we are missing a 50. Therefore, we have to multiply  $ab$  by 50 to get  $50ab$ .
10. **Answer choice (A) is the correct answer.** The sum of the integers from 150 to 400 inclusive includes 400. The sum equals  $150 + 151 + \dots + 399 + 400$ . The sum of the integers from 400 to 800 also includes 400. The sum equals:  $400 + 401 + 799 + 800$ . Therefore, if you add  $d$  and  $e$  you get  $d + e = 150 + 151 + \dots + 399 + 400 + 400 + 401 + 799 + 800$  which includes 400 twice. Therefore, to get the sum of the integers from 150 to 800 inclusive, we need to subtract a 400 from  $d + e$  to get  $d + e - 400$ .
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### Vocabulary Set 1

1. **Answer choice (A) is the correct answer.** An irrational number is any number that cannot be written as a simple fraction. Irrational numbers include  $\pi$  and “ugly” roots: roots that have an answer that is a decimal that goes on forever without repeating. Since 5 is not a perfect square,  $\sqrt{5}$  equals a decimal that goes on forever without repeating.
2. **Answer choice (C) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Since  $\sqrt{16} = 4$ , it is a rational number.
3. **Answer choice (C) is the correct answer.** Imaginary numbers come from negatives under square roots or any even root. Therefore,  $\sqrt{-36}$  is an imaginary number.
4. **Answer choice (A) is the correct answer.** A complex number is any number with a real and imaginary part. In the number  $3 + 5i$ , 3 is the real part and  $5i$  is the imaginary part. Therefore,  $3 + 5i$  is a complex number.
5. **Answer choice (C) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Since  $\frac{4}{9}$  is a fraction, it is a rational number.
6. **Answer choice (B) is the correct answer.** The number  $i^3 = i^2 \cdot i$ , and  $i^2 = -1$ . Therefore,  $i^3 = -i$  which is an imaginary number.

7. **Answer choice (C) is the correct answer.** An integer is any positive or negative whole number or 0. If you add two integers, you will *always* get another integer. Since integers are rational numbers, when you add two integers, you will *always* get a rational number.
8. **Answer choice (D) is the correct answer.** Imaginary numbers come from negatives under square roots or an even root. There is no way to get a negative under a square root by multiplying two irrational numbers. Answer choice (A) is incorrect because the product of two irrational numbers can be an irrational number:  $\sqrt{3} \cdot \sqrt{5} = \sqrt{15}$ . Answer choice (B) is incorrect because the product of two irrational numbers can be a rational number:  $\sqrt{3} \cdot \sqrt{12} = \sqrt{36} = 6$ . Answer choice (C) is incorrect because the product of two irrational numbers can be an integer:  $\sqrt{3} \cdot \sqrt{12} = \sqrt{36} = 6$ .
9. **Answer choice (D) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Since  $(\sqrt{7})^4 = 49$ , it is a rational number.
10. **Answer choice (D) is the correct answer.** Imaginary numbers come from negative numbers *under* square roots or any even root. In the number  $-\sqrt{14}$ , the negative is not under the square root, so this is *not* an imaginary number.

### Vocabulary Set 2

1. **Answer choice (A) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Since  $0.\overline{3}$  is repeating, it is a rational number.
2. **Answer choice (B) is the correct answer.** Imaginary numbers come from negatives under even roots, so  $\sqrt{-1}$  is imaginary.
3. **Answer choice (D) is the correct answer.** An irrational number is any number that cannot be written as a simple fraction. Irrational numbers include  $\pi$  and “ugly” roots: roots that have an answer that is a decimal that goes on forever without repeating. Since 13 is not a perfect square,  $\sqrt{13}$  equals a decimal that goes on forever without repeating.
4. **Answer choice (D) is the correct answer.** A complex number is any number with a real and imaginary part. In the number  $3 - 9i$ , 3 is the real part and  $9i$  is the imaginary part. Therefore,  $3 - 9i$  is a complex number.
5. **Answer choice (A) is the correct answer.**  $\sqrt{36}$  equals 6 which is a whole number.

6. **Answer choice (B) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Anything to the 0 power equals 1, so  $i^0 = 1$  which is a whole number, so it's a rational number.
7. **Answer choice (D) is the correct answer.** If you subtract two integers, you will always get another integer. Since integers are rational, you will always get a rational number.
8. **Answer choice (D) is the correct answer.** You can get a whole number, a rational number, and an integer when dividing two rational numbers:  $10 \div 2 = 5$ . Since 5 is a whole number, rational number, and integer, answer choices (A), (B), and (C) are all incorrect.
9. **Answer choice (D) is the correct answer.** Imaginary numbers come from negatives under any even root. Therefore,  $\sqrt{-5}$  is imaginary, and if you cube  $\sqrt{-5}$  it is still imaginary.
10. **Answer choice (C) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Since  $\sqrt{9 + 36} = \sqrt{45}$ , and 45 is not a perfect square, answer choice (C) is NOT rational.
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### Imaginary Numbers Set 1

1. **Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^7$ :  
 $i^7 = (i^3)(i^4) = (-i)(1) = -i$ .
2. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{14}$ :  
 $i^{14} = (i^4)^3(i^2) = (1)^3(-1) = -1$ .
3. **Answer choice (C) is the correct answer.** Solve the equation by taking the square root of both sides of the equation:  $x^2 = 36 \rightarrow x = \pm 6$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
4. **Answer choice (A) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{28}$ :  
 $i^{28} = (i^4)^7 = (1)^7 = 1$ .
5. **Answer choice (D) is the correct answer.** Solve the equation by taking the square root of both sides of the equation:  $x^2 = -25 \rightarrow x = \pm\sqrt{-25} \rightarrow x = \pm 5i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
6. **Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{43}$ :  
 $i^{43} = (i^4)^{10}(i^3) = (1)^{10}(-i) = -i$ .

7. **Answer choice (A) is the correct answer.** Anything raised to the 0 power equals 1.
8. **Answer choice (D) is the correct answer.** Solve the equation by multiplying both sides by  $-1$  and then taking the square root of both sides of the equation:  $-x^2 = 4 \rightarrow x^2 = -4 \rightarrow x = \pm\sqrt{-4} \rightarrow x = \pm 2i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
9. **Answer choice (D) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{81}$ :  
 $i^{81} = (i^4)^{20}(i^1) = (1)^{20}(i) = i$ .
10. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{50}$ :  
 $i^{50} = (i^4)^{12}(i^2) = (1)^{12}(-1) = -1$ .
11. **Answer choice (C) is the correct answer.** Solve the equation by adding 81 to both sides and then taking the square root of both sides of the equation:  $x^2 - 81 = 0 \rightarrow x^2 = 81 \rightarrow x = \pm 9$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
12. **Answer choice (D) is the correct answer.** Solve the equation by subtracting 16 from both sides and then taking the square root of both sides of the equation:  $x^2 + 16 = 0 \rightarrow x^2 = -16 \rightarrow x = \pm\sqrt{-16} \rightarrow x = \pm 4i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
13. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{66}$ :  
 $i^{66} = (i^4)^{16}(i^2) = (1)^{16}(-1) = -1$ .
14. **Answer choice (D) is the correct answer.** Solve the equation by subtracting 50 from both sides and then taking the square root of both sides of the equation:  $x^2 + 50 = -14 \rightarrow x^2 = -64 \rightarrow x = \pm\sqrt{-64} \rightarrow x = \pm 8i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
15. **Answer choice (D) is the correct answer.** Solve the equation by adding 8 to both sides, dividing both sides by  $-2$ , and taking the square root of both sides:  $-8 - 2x^2 = 90 \rightarrow -2x^2 = 98 \rightarrow x^2 = -49 \rightarrow x = \pm\sqrt{-49} \rightarrow x = \pm 7i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.

### Imaginary Numbers Set 2

1. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{10}$ :  
 $i^{10} = (i^4)^2(i^2) = (1)^2(-1) = -1$ .

2. **Answer choice (A) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{32}$ :  
 $i^{32} = (i^4)^8 = (1)^8 = 1$ .
3. **Answer choice (D) is the correct answer.** Solve the equation by taking the square root of both sides of the equation:  $a^2 = -9 \rightarrow a = \pm\sqrt{-9} \rightarrow a = \pm 3i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
4. **Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{27}$ :  
 $i^{27} = (i^4)^6(i^3) = (1)^6(-i) = -i$ .
5. **Answer choice (C) is the correct answer.** Solve the equation by taking the square root of both sides of the equation:  $x^2 = 64 \rightarrow x = \pm 8$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
6. **Answer choice (D) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{49}$ :  
 $i^{49} = (i^4)^{12}(i^1) = (1)^{12}(i) = i$ .
7. **Answer choice (D) is the correct answer.** Solve the equation by multiplying both sides by  $-1$  and then taking the square root of both sides of the equation:  $-w^2 = 100 \rightarrow w^2 = -100 \rightarrow w = \pm\sqrt{-100} \rightarrow w = \pm 10i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
8. **Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{11}$ :  
 $i^{11} = (i^4)^2(i^3) = (1)^2(-i) = -i$ .
9. **Answer choice (A) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{56}$ :  
 $i^{56} = (i^4)^{14} = (1)^{14} = 1$ .
10. **Answer choice (D) is the correct answer.** Solve the equation by subtracting 144 from both sides and then taking the square root of both sides of the equation:  $y^2 + 144 = 0 \rightarrow y^2 = -144 \rightarrow y = \pm\sqrt{-144} \rightarrow y = \pm 12i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
11. **Answer choice (D) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{101}$ :  
 $i^{101} = (i^4)^{25}(i^1) = (1)^{25}(i) = i$ .
12. **Answer choice (C) is the correct answer.** Solve the equation by adding  $-x^2$  to both sides and then taking the square root of both sides of the equation:  $-x^2 + 16 = 0 \rightarrow x^2 = 4 \rightarrow x = \pm 2$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
13. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{74}$ :  
 $i^{74} = (i^4)^{18}(i^2) = (1)^{18}(-1) = -1$ .

- 14. Answer choice (C) is the correct answer.** Solve the equation by adding 16 to both sides and then taking the square root of both sides of the equation:  $x^2 - 16 = 9 \rightarrow x^2 = 25 \rightarrow x = \pm 5$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
- 15. Answer choice (D) is the correct answer.** Solve the equation by subtracting 8 from both sides, dividing both sides by  $-3$ , and taking the square root of both sides:  $8 - 3x^2 = 56 \rightarrow -3x^2 = 48 \rightarrow x^2 = -16 \rightarrow x = \pm \sqrt{-16} \rightarrow x = \pm 4i$ . Remember: when taking the square root of both sides of an equation, you need a  $\pm$  sign in front of your answer.
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### Matrices Set 1

- 1. Answer choice (C) is the correct answer.** When adding matrices, add the numbers in the same positions and place the sum in the corresponding position in the matrix:  $7 + 9 = 16$  in the left position,  $(-2) + (-5) = -7$  in the middle position, and  $3 + (-1) = 2$  in the right position.
- 2. Answer choice (B) is the correct answer.** When adding matrices, add the numbers in the same positions and place the sum in the corresponding position in the matrix:  $1 + 1 = 2$  in the top left position,  $2 + 2 = 4$  in the top right position,  $3 + 3 = 6$  in the bottom left position, and  $4 + 4 = 8$  in the bottom right position.
- 3. Answer choice (B) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant:  $3 \cdot 0 = 0$  in the top left,  $3 \cdot (-2) = -6$  in the top right,  $3 \cdot 1 = 3$  in the bottom left, and  $3 \cdot 5 = 15$  in the bottom right.
- 4. Answer choice (A) is the correct answer.** First, multiply the constants into each matrix. The result for the first matrix is 2 in the top left,  $-2$  in the top right, 10 in the bottom left, and 4 in the bottom right. The result for the second matrix is 12 in the top left,  $-8$  in the top right,  $-4$  in the bottom left, and 24 in the bottom right. Now subtract the numbers in the same positions and place the difference in the corresponding position.  $2 - 12 = -10$  in the top left,  $-2 - (-8) = 6$  in the top right,  $10 - (-4) = 14$  in the bottom left,  $4 - 24 = -20$  in the bottom right.
- 5. Answer choice (D) is the correct answer.** Matrices cannot be added or subtracted if they have different dimensions.
- 6. Answer choice (B) is the correct answer.** When subtracting matrices, subtract the numbers in the same positions and place the difference in the corresponding position in the matrix. Top row: left entry is  $4x - 3x = x$ , right entry is  $5 - (-8) = 13$ . Middle row: left entry is  $-8 - 6 = -14$ , right entry is  $6x^2 - (-2x^2) = 8x^2$ . Bottom row: left entry is  $x - (-5x) = 6x$ , right entry is  $0 - 3x^2 = -3x^2$ .

7. **Answer choice (D) is the correct answer.** When subtracting matrices, subtract the numbers in the same positions and place the difference in the corresponding position in the matrix. Therefore, we can set up the equation  $a - (-6) = 4$  based on the top row. Solve the equation:  
 $a + 6 = 4 \rightarrow a = -2$ .
8. **Answer choice (A) is the correct answer.** When subtracting matrices, subtract the numbers in the same positions and place the difference in the corresponding position in the matrix. Therefore, based on the top row of the matrices, we know that  $a - b = 8$ . Based on the bottom row, we can set up the equation  $6 - c = 4$  and solve for  $c$ :  $-c = -2 \rightarrow c = 2$ . Therefore,  $a - b + c = 8 + 2 = 10$ .
9. **Answer choice (D) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. Therefore, we can set up the equation  $x \cdot 6w = -3w$  based on the bottom row (we could have set up an equation for any of the three rows). Divide both sides of the equation by  $6w$  to get  $x = -0.5$ .
10. **Answer choice (B) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. Therefore, to solve for  $a$ , we can set up the equation  $a \cdot 4 = 8$  based on the top row. Solve for  $a$  to get  $a = 2$ . Now set up and solve an equation to solve for  $b$  plugging in 2 for  $a$ :  $a \cdot 2b = -12 \rightarrow 2 \cdot 2b = -12 \rightarrow 4b = -12 \rightarrow b = -3$ . Therefore,  $a - b = 2 - (-3) = 5$ .

### Matrices Set 2

1. **Answer choice (D) is the correct answer.** When adding matrices, add the numbers in the same positions and place the sum in the corresponding position in the matrix: top right =  $4 + 1 = 5$ , top left =  $-3 + (-5) = -8$ , bottom left =  $0 + 6 = 6$ , bottom right =  $-9 + 6 = -3$ .
2. **Answer choice (C) is the correct answer.** When adding and subtracting matrices, add and subtract the numbers in the same positions and place the result in the corresponding position in the matrix: top row =  $1 + 5 - 4 = 2$ , middle row =  $0 + 3 - 3 = 0$ , bottom row =  $4 + (-2) - 2 = 0$ .
3. **Answer choice (B) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant:  $-2 \cdot 4 = -8$  in the top left,  $-2 \cdot (-6) = 12$  in the top right,  $-2 \cdot (-1) = 2$  in the bottom left, and  $-2 \cdot 3 = -6$  in the bottom right.
4. **Answer choice (A) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. Multiply  $-2$  by each number in the first matrix to get  $-8, -10, -4$ . Multiply  $4$  by each number in the second matrix to get  $-12, 0, 4$ . Subtract the matrices to get  $-8 - (-12) = 4$  on the left,  $-10 - 0 = -10$  in the middle,  $-4 - 4 = -8$  on the right.
5. **Answer choice (D) is the correct answer.** When adding matrices, add the numbers in the same positions and place the sum in the corresponding position in the matrix. Top row: left is  $6a + (-6a)$

= 0, middle is  $7b + (-4b) = 3b$ , right is  $6 + 2 = 8$ . Bottom row: left is  $-1 + 1 = 0$ , middle is  $a^2 + 2a^2 = 3a^2$ , right is  $-5 + 1 = -4$ .

6. **Answer choice (D) is the correct answer.** Matrices cannot be added or subtracted if they have different dimensions.
7. **Answer choice (D) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. When subtracting matrices, subtract the numbers in the same positions and place the difference in the corresponding position in the matrix. Therefore, we can set up the following equation to solve for  $a$  based on the top right entries of the matrices:  $-2 - 4a = -10$ . Solve for  $a$ :  $-4a = -8 \rightarrow a = 2$ .
8. **Answer choice (A) is the correct answer.** When subtracting matrices, subtract the numbers in the same positions and place the difference in the corresponding position in the matrix. Set up the following equation based on the top row of the matrices:  $6 - a = b$ . Add  $a$  to both sides to get  $a + b = 6$ . Set up the following equation based on the bottom row of the matrices and solve for  $c$ :  $c - 1 = 7 \rightarrow c = 8$ . Therefore,  $a + b + c = 6 + 8 = 14$ .
9. **Answer choice (D) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. Therefore, set up the following equation based on the top row of the matrices:  $x \cdot 2a = 8a$ . Divide both sides by  $2a$  to get  $x = 4$ .
10. **Answer choice (B) is the correct answer.** When multiplying a constant by a matrix, multiply each number by the constant. When adding matrices, add the numbers in the same positions and place the sum in the corresponding position in the matrix. Therefore, solve for  $a$  by setting up the equation  $a \cdot 4 + (-8) = 4$  based on the first row. Solve for  $a$ :  $a \cdot 4 = 12 \rightarrow a = 3$ . Now set up the following equation based on the second row:  $a \cdot 2b + a = 9$ . Plug in 3 for  $a$  and solve for  $b$ :  $3 \cdot 2b + 3 = 9 \rightarrow 6b + 3 = 9 \rightarrow 6b = 6 \rightarrow b = 1$ . Therefore,  $a + b = 3 + 1 = 4$ .
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### Trigonometry Set 1

1. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ . Therefore,  $\sin(x)$  equals the ratio of the side opposite of angle  $x$  to the hypotenuse which equals  $\frac{3}{5}$ .
2. **Answer choice (A) is the correct answer.** Remember SOHCAHTOA which tells us that  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ . Therefore,  $\cos(x)$  equals the ratio of the side adjacent to angle  $x$  to the hypotenuse which equals  $\frac{4}{5}$ .

3. **Answer choice (D) is the correct answer.** Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(x)$  equals the ratio of the side opposite of angle  $x$  to the side adjacent to angle  $x$  which equals  $\frac{3}{4}$ .
4. **Answer choice (A) is the correct answer.** In the triangle,  $\frac{3}{4}$  is the ratio of the side opposite of angle  $x$  to the side adjacent to angle  $x$ . Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(x) = \frac{3}{4}$ .
5. **Answer choice (D) is the correct answer.** In the triangle,  $\frac{5}{3}$  is the ratio of the hypotenuse to the side opposite of angle  $x$ . Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ ,  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ , and  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore, none of these three trig ratios is equal to  $\frac{\textit{hypotenuse}}{\textit{opposite}}$ .
6. **Answer choice (B) is the correct answer.** Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(y)$  equals the ratio of the side opposite of angle  $y$  to the side adjacent to angle  $y$  which equals  $\frac{9}{40}$ .
7. **Answer choice (B) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Therefore,  $\sin(z)$  equals the ratio of the side opposite of angle  $z$  to the hypotenuse which equals  $\frac{40}{41}$ .
8. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$  and  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ . Use this to find that  $\cos(y) = \frac{40}{41}$  and  $\sin(z) = \frac{40}{41}$ .
9. **Answer choice (D) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ ,  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ , and  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\sin(z) = \frac{40}{41}$ ,  $\sin(y) = \frac{9}{41}$  and  $\tan(y) = \frac{9}{40}$ . None of these are equal to  $\frac{41}{40}$ .
10. **Answer choice (D) is the correct answer.** Remember SOHCAHTOA which tells us that

$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ ,  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ , and  $\tan = \frac{\text{opposite}}{\text{adjacent}}$ . Therefore,  $\cos(z) = \frac{9}{41}$  and  $\sin(y) = \frac{9}{41}$ .

- 11. Answer choice (B) is the correct answer.** Remember SOHCAHTOA which tells us that  $\tan = \frac{\text{opposite}}{\text{adjacent}}$ . Use this to set up the equation for  $\tan(x)$ :  $\frac{11}{6} = \frac{AB}{6}$ . Solve the equation by cross multiplying:  $66 = 6(AB) \rightarrow AB = 11$  in.
- 12. Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ . Use this to set up the equation for  $\sin(y)$ :  $\frac{3}{5} = \frac{6}{AC}$ . Solve the equation by cross multiplying:  $30 = 3(AC) \rightarrow AC = 10$  in. Now use the pythagorean theorem to find AB:  $6^2 + (AB)^2 = 10^2 \rightarrow 36 + (AB)^2 = 100 \rightarrow AB^2 = 64 \rightarrow AB = 8$  in.
- 13. Answer choice (B) is the correct answer.** We are given angle L and the side adjacent to angle L. We want to find the side opposite of angle L. Therefore, we want to use tangent because  $\tan = \frac{\text{opposite}}{\text{adjacent}}$ . Set up an equation for the tangent of angle L:  $\tan(28^\circ) = \frac{JK}{4}$ . Isolate JK by multiplying both sides of the equation by 4:  $4\tan(28^\circ) = JK$ .
- 14. Answer choice (D) is the correct answer.** We are given angle A and the side adjacent to angle A. We want to find the hypotenuse. Therefore, we want to use cosine because  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ . Set up an equation for the cosine of angle A:  $\cos(50^\circ) = \frac{12}{AC}$ . Isolate AC by first multiplying both sides of the equation by AC:  $AC \cdot \cos(50^\circ) = 12$ . Now divide both sides of the equation by  $\cos(50^\circ)$ :  $AC = \frac{12}{\cos(50^\circ)}$ .
- 15. Answer choice (A) is the correct answer.** We are given angle N and the side opposite to angle N. We want to find the hypotenuse. Therefore, we want to use sine because  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ . Set up an equation for the sine of angle N:  $\sin(30^\circ) = \frac{5}{NP}$ . Isolate NP by first multiplying both sides of the equation by NP:  $NP \cdot \sin(30^\circ) = 5$ . Now divide both sides of the equation by  $\sin(30^\circ)$ :  $NP = \frac{5}{\sin(30^\circ)}$ .

## Trigonometry Set 2

- 1. Answer choice (D) is the correct answer.** Remember SOHCAHTOA which tells us that

$\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Therefore,  $\sin(a)$  equals the ratio of the side opposite of angle  $a$  to the hypotenuse which equals  $\frac{12}{13}$  which is not answer choice (A), (B), or (C).

2. **Answer choice (A) is the correct answer.** Remember SOHCAHTOA which tells us that  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ . Therefore,  $\cos(a)$  equals the ratio of the side adjacent to angle  $a$  to the hypotenuse which equals  $\frac{5}{13}$ .

3. **Answer choice (A) is the correct answer.** Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(a)$  equals the ratio of the side opposite of angle  $a$  to the side adjacent to angle  $a$  which equals  $\frac{12}{5}$ .

4. **Answer choice (D) is the correct answer.** In the triangle,  $\frac{5}{12}$  is the ratio of the side adjacent to angle  $a$  to the side opposite of angle  $a$ . Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ ,  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ , and  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore, none of these three trig ratios is equal to  $\frac{\textit{adjacent}}{\textit{opposite}}$ .

5. **Answer choice (A) is the correct answer.** In the triangle,  $\frac{12}{13}$  is the ratio of the side opposite of angle  $a$  to the hypotenuse. Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Therefore,  $\sin(a) = \frac{12}{13}$ .

6. **Answer choice (B) is the correct answer.** Remember SOHCAHTOA which tells us that  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ . Therefore,  $\cos(y)$  equals the ratio of the side adjacent to angle  $y$  to the hypotenuse which equals  $\frac{8}{17}$ .

7. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(x)$  equals the ratio of the side opposite of angle  $x$  to the side adjacent to angle  $x$  which equals  $\frac{8}{15}$ .

8. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$  and  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ . Use this to find that  $\sin(x) = \frac{8}{17}$  and  $\cos(y) = \frac{8}{17}$ .

9. **Answer choice (B) is the correct answer.** In the triangle,  $\frac{15}{17}$  is the ratio of the side opposite of angle  $y$  to the hypotenuse. Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Therefore,  $\sin(y) = \frac{15}{17}$ .
10. **Answer choice (B) is the correct answer.** In the triangle,  $\frac{15}{8}$  is the ratio of the side opposite of angle  $y$  to the side adjacent to angle  $y$ . Remember SOHCAHTOA which tells us that  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Therefore,  $\tan(y) = \frac{15}{8}$ .
11. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Use this to set up the equation for  $\sin(b)$ :  $\frac{11}{15} = \frac{BC}{15}$ . Solve the equation by cross multiplying:  $165 = 15(BC) \rightarrow BC = 11$  ft.
12. **Answer choice (C) is the correct answer.** Remember SOHCAHTOA which tells us that  $\cos = \frac{\textit{adjacent}}{\textit{hypotenuse}}$ . Use this to set up the equation for  $\cos(a)$ :  $\frac{4}{5} = \frac{BC}{15}$ . Solve the equation by cross multiplying:  $60 = 5(BC) \rightarrow BC = 12$  ft. The problem asks for the length of AC, so use the pythagorean theorem to find AC:  $(AC)^2 + 12^2 = 15^2 \rightarrow (AC)^2 + 144 = 225 \rightarrow (AC)^2 = 81 \rightarrow AC = 9$  ft.
13. **Answer choice (D) is the correct answer.** We are given angle L and the hypotenuse. We want to find the side opposite of angle L. Therefore, we want to use sine because  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Set up an equation for the sine of angle L:  $\sin(41^\circ) = \frac{JK}{19}$ . Isolate JK by multiplying both sides of the equation by 19:  $19\sin(41^\circ) = JK$ .
14. **Answer choice (C) is the correct answer.** We are given angle W and the side opposite to angle W. We want to find the hypotenuse. Therefore, we want to use sine because  $\sin = \frac{\textit{opposite}}{\textit{hypotenuse}}$ . Set up an equation for the sin of angle W:  $\sin(23^\circ) = \frac{13}{WZ}$ . Isolate WZ by first multiplying both sides of the equation by WZ:  $WZ \cdot \sin(23^\circ) = 13$ . Now divide both sides of the equation by  $\sin(23^\circ)$ :  $WZ = \frac{13}{\sin(23^\circ)}$ .
15. **Answer choice (A) is the correct answer.** We are given angle A and the side opposite to angle A. We want to find the side adjacent to angle A. Therefore, we want to use tan because  $\tan = \frac{\textit{opposite}}{\textit{adjacent}}$ . Set up an equation for the tan of angle A:  $\tan(58^\circ) = \frac{7}{AB}$ . Isolate AB by first

multiplying both sides of the equation by  $AB$ :  $AB \cdot \tan(58^\circ) = 7$ . Now divide both sides of the equation by  $\tan(58^\circ)$ :  $AB = \frac{7}{\tan(58^\circ)}$ .

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### Quantitative Comparisons Set 1

- 1. Answer choice (B) is the correct answer.**  $i^2 = -1$  and  $i^4 = 1$ , so Column B is greater than Column A.
- 2. Answer choice (A) is the correct answer.** The LCM, or least common multiple, of 4 and 8 is 8. The GCF, or greatest common factor, of 4 and 8 is 4. Column A is greater than Column B.
- 3. Answer choice (B) is the correct answer.** Set up an equation based on the last row of the matrices and solve for  $b$ :  $-3 - b = -2 \rightarrow -b = 1 \rightarrow b = -1$ . Column B is greater than Column A.
- 4. Answer choice (A) is the correct answer.** The product of two negative integers is always positive, so Column A is positive. The sum of two negative integers is always negative, so Column B is negative. A positive number is always greater than a negative number, so Column A is greater than Column B.
- 5. Answer choice (D) is the correct answer.** All we know is that  $x$  is a factor of 12 and  $y$  is a factor of 30. If  $x = 2$  and  $y = 5$ , then  $xy = 10$  which is less than Column B. However, if  $x = 12$  and  $y = 30$ , then  $xy = 360$  which is greater than Column B. Therefore, the relationship cannot be determined.
- 6. Answer choice (D) is the correct answer.** A negative integer squared is positive, and a positive integer squared is positive. Therefore, both columns are positive. Since we don't know the values of  $x$  and  $y$ , we cannot determine if  $x^2$  or  $y^2$  is greater.
- 7. Answer choice (B) is the correct answer.** We know that  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$  and  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ . Since both trig ratios are divided by the hypotenuse, we only need to compare their numerators. In the given triangle, the side opposite of  $\theta$  is 7 and the side adjacent to  $\theta$  is 10. Since the adjacent side is greater, that means the  $\cos\theta$  is greater than the  $\sin\theta$ , so Column B is greater than Column A.
- 8. Answer choice (A) is the correct answer.** If the sum of the integers from 0 to 200 inclusive is  $x$ , then the sum of the integers from 0 to 201 inclusive is  $x + 201$ . Since  $x + 201$  is greater than  $x + 1$ , Column A is greater than Column B.
- 9. Answer choice (D) is the correct answer.** Since  $x^2 = 36$ , then  $x$  can equal 6 or  $-6$ . If  $x = 6$ , then Column A and Column B are equal. If  $x = -6$ , then Column B is greater than Column A. Therefore, we cannot determine the relationship.

- 10. Answer choice (A) is the correct answer.** When multiplying a matrix by a constant, multiply each number by the constant. Therefore,  $a \cdot 4 = -2$ ,  $a \cdot 2 = -1$ ,  $a \cdot 0 = 0$ , and  $a \cdot -6 = 3$ . Solve any of the equations except  $a \cdot 0 = 0$  to get that  $a = -0.5$ . Since  $-0.5$  is greater than  $-2$ , Column A is greater than Column B.
- 11. Answer choice (A) is the correct answer.** We know that  $\tan = \frac{\text{opposite}}{\text{adjacent}}$ , so set up an equation using the given information for  $\tan A$ :  $\frac{1}{2} = \frac{4}{AB}$ . Solve the equation to get  $AB = 8$ . Column A is greater than Column B.
- 12. Answer choice (B) is the correct answer.** The product of the integers from 10 to 20 exclusive does not include 10 and 20, therefore, it equals  $11 \cdot 12 \cdot 13 \cdot 14 \cdot 15 \cdot 16 \cdot 17 \cdot 18 \cdot 19$ . To find the product of the integers from 11 to 20 exclusive, we need to divide out the 11 from the product of the integers from 10 to 20 exclusive. Therefore, it equals  $a \div 11$ . Since  $a$  is the product of positive numbers, it is a positive number. Dividing a positive number by 10 is greater than dividing it by 11, so  $a \div 10$  is greater than  $a \div 11$ . Column B is greater than Column A.
- 13. Answer choice (A) is the correct answer.** The least common multiple of 10 and 15 is 30, so any multiple of 10 and 15 will be at least 30. Therefore, Column A is greater than Column B.
- 14. Answer choice (C) is the correct answer.** Set up an equation based on the middle row of the matrices:  $x - y = 8$ . Isolate the  $x$  by adding  $y$  to both sides to get  $x = y + 8$ . Therefore, Column A and Column B are equal.
- 15. Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify Column A:  $i^9 = (i^4)^2(i) = (1)(i) = i$ . Simplify Column B:  $i^{25} = (i^4)^6(i) = (1)(i) = i$ . Column A and Column B are equal.

### Quantitative Comparisons Set 2

- 1. Answer choice (C) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify Column A:  $i^{43} = (i^4)^{10}(i^3) = (1)^{10}(-i) = -i$ . Simplify Column B:  $-i^{17} = -(i^4)^4(i^1) = -(1)(i) = -i$ . Column A and Column B are equal.
- 2. Answer choice (D) is the correct answer.** The smallest multiple of 6 and 10 is 30. Therefore, if  $b = 30$ , then both columns are equal. However,  $b$  can be any multiple of 6 and 10, so if  $b$  is another multiple, such as 60, then column A and column B are not equal. Therefore, we cannot determine the relationship between the two quantities.
- 3. Answer choice (A) is the correct answer.** Use the pythagorean theorem to find the missing side length (let  $x$  represent the missing side length):  $x^2 + 6^2 = 10^2 \rightarrow x^2 + 36 = 100 \rightarrow x^2 = 64 \rightarrow x = 8$ .

Now find  $\cos\theta$ . Using SOHCAHTOA, we know  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ , so  $\cos\theta = \frac{4}{5}$ . Therefore,

Column A is greater than Column B.

4. **Answer choice (B) is the correct answer.** Since  $a$  and  $b$  are negative,  $a^3$  is negative and  $b^2$  is positive. A positive number is always greater than a negative number, so Column B is greater than Column A.
5. **Answer choice (A) is the correct answer.** A positive number minus a negative number is *always* positive:  $5 - (-3) = 8$ . Therefore, Column A is positive. A negative number minus a positive number is *always* negative:  $-3 - 5 = -8$ . Therefore, Column B is negative. Since all positive numbers are greater than all negative numbers, Column A is greater than Column B.
6. **Answer choice (C) is the correct answer.** The GCF of 30 and 20 is 10, and the LCM of 5 and 10 is 10. Therefore, Column A and Column B are equal.
7. **Answer choice (C) is the correct answer.** From the first row of the matrices we know  $a + b = 2$ . From the bottom row of the matrices, we can set up the equation  $-6 + c = -8$  and solve for  $c$  to get  $c = -2$ . Therefore,  $a + b + c = 2 + (-2) = 0$ , so Column A and Column B are equal.
8. **Answer choice (B) is the correct answer.** Since  $x$  is a factor of 12 and 16, and Column A is the smallest number that  $x$  must also be a factor of, let  $x$  equal the greatest common factor of 12 and 16. The GCF of 12 and 16 is 4. Therefore, the smallest number that 4 must be a factor of is 4, so Column B is greater than Column A.
9. **Answer choice (B) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify Column A:  $i^{18} = (i^4)^4(i^2) = (1)^4(-1) = -1$ . Simplify Column B:  $i^{20} = (i^4)^5 = (1) = 1$ . Column B is greater than Column A.
10. **Answer choice (A) is the correct answer.** The sum of the integers from 100 to 300 *inclusive* includes 100 and 300, so it equals  $100 + 101 + \dots + 299 + 300$ . The sum of the integers from 99 to 300 *exclusive* does not include 99 and 300, so it equals  $100 + 101 + \dots + 298 + 299$ . Therefore, the sum of the integers from 100 to 300 is greater because it includes the sum of the integers from 99 to 300 exclusive plus 300. Column A is greater than Column B.
11. **Answer choice (C) is the correct answer.** Using SOHCAHTOA, we know  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ , so set up an equation for the sine of angle A:  $\frac{3}{5} = \frac{9}{AC}$ . Solve the equation by cross multiplying:  $3(AC) = 45 \rightarrow AC = 15$ . Therefore, Column A and Column B are equal.
12. **Answer choice (A) is the correct answer.** Solve the equation  $x^2 = 64$  by taking the square root of both sides to get  $x = -8$  or  $8$ . Since  $|8| = 8$  and  $|-8| = 8$ , Column A equals 8. Therefore, Column A is greater than Column B.

- 13. Answer choice (A) is the correct answer.** Based on the first rows of the matrices, we can set up the equation  $-5 - (-2) = x$ . Simplify to get  $x = -3$ . Therefore, Column A is greater than Column B.
- 14. Answer choice (A) is the correct answer.** To find the product of the integers from 50 to 151 inclusive, multiply the product of the integers from 50 to 150 inclusive by 151. Therefore, Column A equals  $151x$ . Since  $x$  is the product of the integers from 50 to 150,  $x$  is positive. Therefore,  $151x$  is greater than  $150x$ , so Column A is greater than Column B.
- 15. Answer choice (A) is the correct answer.** Each number in the first matrix was multiplied by  $a$  and resulted in the corresponding number in the second matrix. For example,  $a \cdot 1 = 3$ . Solve this equation to get  $a = 3$ . Now use that to find  $b$ :  $a \cdot 3 = b \rightarrow$  plug in 3 for  $a$ :  $3 \cdot 3 = b \rightarrow b = 9$ . Since  $a = 3$  and  $b = 9$ ,  $ab = 3 \cdot 9 = 27$ . Therefore, Column A is greater than Column B.

# Reading Course

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## Reading Course

### *Main Idea Set*

#### **Passage 1**

1. The main purpose of this passage is to educate readers on how black cats are routinely overlooked for adoption. While the passage does mention that we are living in an image-conscious society, it does not criticize this fact, so answer choice (A) is incorrect. While the passage does say that people are more likely to adopt gray and white cats, it does not argue that they should not do this, so answer choice (B) is incorrect. While the passage does inform the readers about one baseless superstition people still believe, it is not the focus of the passage but it is mentioned in an effort to explain why people don't adopt as many black cats, so answer choice (C) is incorrect. The primary purpose of this passage is to educate readers that black cats are unfairly overlooked in adoption. **Therefore, answer choice (D) is the correct answer.**
2. The last line in paragraph one states “Why are black cats less likely to be adopted?” The second paragraph in the passage answers this question and goes over the reasons that black cats are less likely to be adopted. The reasons given are that people are superstitious about black cats and that black cats don't photograph as well as white and gray cats. The purpose of the second paragraph is to explain why people don't adopt black cats as frequently as other cats. **Therefore, answer choice (B) is the correct answer.**

#### **Passage 2**

1. The author's main purpose in this passage is to educate and warn potential homebuyers about splurging and buying a house that is more expensive than they can afford. The author doesn't talk about any devious lending practices in the passage, so answer choice (A) is incorrect. While the author does briefly explain the preapproval process, this isn't the main focus or purpose of the passage, so answer choice (B) is incorrect. The author does not scold or criticize people who make bad financial decisions when buying a home, so answer choice (D) is incorrect. Instead, the author's main purpose is to prevent people from making bad financial decisions and warn homebuyers against pushing the limits of their potential loan amount. **Therefore, answer choice (C) is the correct answer.**
2. The main idea of the passage is that while you may get approved for a larger loan than you anticipated, it is better to live within your means. The passage doesn't say that homebuyers should make sure that the lending institution gives them an accurate amount for your loan pre approval, so answer choice (A) is incorrect. The passage doesn't say that homeowners shouldn't try and find their dream home, it only says that they shouldn't buy a home they can't afford, so answer choice (B) is incorrect. While the passage does mention that the approval process involves many factors, this is only a small piece of the passage and is not the main idea, so answer choice (C) is incorrect.

The main idea of the passage is that although you may be able to get a loan for a high amount, you should consider a home that will allow you to take a smaller loan and provide you with more financial comfort in the future. **Therefore, answer choice (D) is the correct answer.**

### *Fact Set*

#### **Passage 1**

1. The first sentence in the passage states “Recent research by the Pew research Center has found that the youngest generation of adults, those aged 18-35, are actually the most likely to visit public libraries and boommobiles.” The author of this passage got her information from a study done by the Pew Research Center. **Therefore, answer choice (D) is the correct answer.**
2. We are looking for the library feature that the text does NOT mention. A sentence from the second paragraph states “They offer study space, community engagement programs, meeting spaces for community groups, and often additional cutting-edge technologies like 3D printers.”, so answer choice (B) is incorrect. The next sentence in the paragraph states “The King country library system in the Seattle area offers free ESL classes, free computer help, to which people can bring their own laptops, book clubs, and gaming events, which might be particularly appealing to teenagers.”, so answer choices (C) and (D) are incorrect. The only library feature not mentioned in the text is free tax preparation help. **Therefore, answer choice (A) is the correct answer.**
3. In reference to the fact that young adults go to the library more often than older adults, the first line in the second paragraph states “This is particularly interesting because of the common perception that with so much content being digitized, libraries are a relic of the past, and the equally erroneous perception that younger adults are unlikely to see any value in something as ‘old fashioned’ as a library.” From that sentence we can see the reason it is interesting that young adults go to the library more often than older adults is because people think you adults don't value certain old fashioned things. **Therefore, answer choice (A) is the correct answer.**

#### **Passage 2**

1. We are looking for the answer choice that is NOT a characteristic of a person with a fixed mindset. The first sentence of the second paragraph states “An individual with a fixed mindset believes that our attributes and talents are in-born and essentially fixed and static.”, so answer choice (D) is incorrect. Another sentence in the second paragraph states “The danger for people with a fixed mindset is they may not see a need to apply themselves in school or other areas of life.”, so answer choice (B) is incorrect. The last sentence of the second paragraph states “They may also avoid challenges for fear that not successfully meeting a challenge would prove they lack a talent or attribute they value.”, so answer choice (A) is incorrect. The only answer choice that is not a characteristic of a person with a fixed mindset is a person with a fixed mindset receives too much praise. **Therefore, answer choice (C) is the correct answer.**

2. The last paragraph in the passage talks about what educators believe is the better way to praise a child. **The last sentence in the last paragraph states** “It is unlikely adoring elders will be able to resist praising children in a variety of ways, but ideally, some of those ways should emphasize a child’s willingness to tackle the learning process.” **Therefore, answer choice (D) is the correct answer.**
3. The first sentence in the last paragraph states “Some educators therefore advise that adults focus their praise on the process of completing a task or working towards a goal, versus a quality of a person, such as intelligence.” The paragraph goes on to give examples of how you can praise a child to promote the growth mindset versus the fixed mindset, so educators are primarily focused on promoting the growth mindset. **Answer choice (B) is the correct answer.**

### *Inference Set*

#### **Passage 1**

1. The first two sentences in the passage state “California’s housing crisis continues to escalate. Rents keep increasing, new construction is not keeping pace with demand, and in some communities, gentrification is pushing out lower income residents.” Right away we can eliminate answer choice (C), because if gentrification is pushing out lower income residents it is not benefiting them. All of the examples listed are reasons why California’s housing crisis continues to escalate, so gentrification would not benefit the community overall and we can eliminate answer choice (D). The passage does not imply that gentrification benefits people who wish to build accessory dwelling units, so answer choice (B) is incorrect. We can infer that the reason gentrification pushes out lower income residents is because more middle or upper income residents move in, so the only group that gentrification benefits is middle and upper income residents. **Answer choice (A) is the correct answer.**
2. Talking about accessory dwelling units, a sentence in the middle of the passage states “This would appeal to many homeowners with enough land to build an additional unit because they can obtain a source of passive income or perhaps offer free or reduced rent to a family member.” The sentence is giving reason why ADU’s might appeal to some homeowners. One reason is that perhaps they could offer a free or rent reduced option to a family member. If the author thinks that is a reason ADU’s would appeal to many homeowners, then he/she would probably agree that people are more likely to offer free or reduced rent to family members. **Answer choice (D) is the correct answer.**

#### **Passage 2**

1. The main purpose of the passage is to educate readers on the difference between and the pros and cons of rental caps vs no rental caps on homes listed for sale. Because the passage is mostly educational, we can infer the target audience is made up of people that do not know a lot about the

subject matter in the passage. Potential homebuyers who are not investors and have an average knowledge of real estate would probably not know all the ins and outs of rental caps and why they can be positive or negative. **Therefore, answer choice (B) is the correct answer.**

2. A sentence in the second paragraph states “When a listing agent does more than objectively state the existence or lack of rental caps, but actively boasts of one or the other, she is likely envisioning the type of buyer she expects to take an interest in the property.” Since the author tells us that real estate agents boast about whether a property has rental caps or doesn’t in order to appeal to a certain type of buyer, we can infer that the author believes that real estate agents think rental caps are a relevant feature to note in property description because if they didn’t they wouldn’t boast about them. **Answer choice (C) is the correct answer.**

### *Vocabulary in Context Set*

#### **Passage 1**

1. The word *foils* is used to describe the purpose Fortinbras and Laertes serve in the play *Tragedy of Hamlet, Prince of Denmark*. The final paragraph gives us the best clue to what their purpose is. The first two sentences in the final paragraph state “Unlike Hamlet, Laertes is swift to seek vengeance. Unlike Hamlet, Fortinbras takes bold and effective action, marshaling thousands of troops to his purpose.” From those sentences we can see that both Fortinbras’ and Laertes’ purpose was to give the audience characters who, in a similar situation, acted differently than Hamlet did, or said another way, they provided a contrast to Hamlet. **Answer choice (A) is the correct answer.**
2. In the second paragraph the sentence containing the word *periphery* states “Through most of the play he remains on the periphery, but at the end, he sweeps into the palace itself.” This sentence is saying that for most of the play Fortinbras did something, but then he swept into the palace at the end, so periphery means something opposite of sweeping into the center of the battle. The opposite of the center of battle would be off to the side. **Therefore, answer choice (D) is the correct answer.**

#### **Passage 2**

1. The first two sentences in the passage state “Are your friends and co-workers raving about a new restaurant or a new coffee shop? Or maybe they’ve just been to a new comedy club and they found it cramped and overpriced.” The second sentence starts with the word “or”, implying that it is in contrast with the first sentence. Since the second sentence is saying that your friends and co-workers had a negative experience when they went out, the first sentence must be saying that they had a positive experience when they went out. This means that the word raving implies that your friends and co-workers are speaking positively about, or praising profusely, their experience going out. **Therefore, answer choice (B) is the correct answer.**

2. The last two sentences of paragraph one state “Word of mouth has always been a powerful means of generating interest, or apprehension, of business and products. But the internet has proved an even more powerful medium for disseminating reviews.” The word medium in that sentence is referring to the internet and word of mouth as ways to spread information, or a means of communication. **Therefore, answer choice (C) is the correct answer.**

### *Organization Set*

#### **Passage 1**

1. The first paragraph in the passage introduces the reader to the concept of active reading, which is a more time-consuming type of reading that is required to understand more complex college-level texts. The passage then goes on to outline all the steps someone must take when actively reading, from the first stage to the final stage, so the best way to describe the organization of the passage is,, a process is described in chronological order. **Answer choice (A) is the correct answer.**
2. We know the passage is organized as a process that is described in chronological order. During those descriptions the author analyzes each step of the process in detail and includes examples of how to perform each step, so the main organizational pattern of this passage could be described as process analysis. **Answer choice (B) is the correct answer.**

#### **Passage 2**

1. In the first paragraph, the author talks about how we live in a culture of constant innovation. The author goes on to talk about how even traditional books must now compete with e-readers. The author then compares and contrasts books and e-readers. **Therefore, answer choice (A) is the correct answer.**
2. Continuing with the organizational pattern of the first paragraph, the passage goes on to compare features and functions of books and e-readers. The passage also compares other aspects of using books compared to using e-readers such as going to a bookstore versus downloading a book from the internet. Overall the primary pattern of development of this essay is compare and contrast. **Therefore, answer choice (B) is the correct answer.**

### *Tone Set*

#### **Passage 1**

1. A sentence in the second paragraph states “Advertisers, political campaigns, and promoters of all kinds shamelessly deploy the bandwagon fallacy because they understand its strong appeal.” The fact that the author describes the use of the bandwagon fallacy by these different entities as shameless tells us that he/she does not support this practice. The author is being critical of people

who use the bandwagon fallacy to influence others. **Therefore, answer choice (C) is the correct answer.**

## Passage 2

1. **The correct answer is choice (B).** When trying to detect sarcasm through text, try and look for words or ideas that are overly exaggerated or hyperbolic. For example, in the sentence in answer choice (B), the author says that failing to offer items that are clearly stated on the menu would compromise the customer’s enjoyment of the meal *so thoroughly* that they must be consoled with free food. If the items are clearly stated on the menu we can assume that most people would have seen them and so not offering them really shouldn’t affect a customer’s enjoyment of the meal much if at all. This exaggeration of what would happen in the situation hints to the fact that the author is being sarcastic in this sentence.
  2. **The correct answer is choice (B) lurid, which means an overly bright or vivid color.** Describing the color of the buttons with a negative word such as lurid tells us that the author was trying to paint a picture of an unpleasant color that none of the employees would choose to wear.
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## Full Reading Comprehension Passages

### Passage 1

1. The main purpose of the passage is to educate the reader on different ways to train a pet hamster. The passage goes through different steps and methods that can be used and things to watch out for while training. While the passage does give techniques and recommendations on how to train a hamster, it does not compare different methods of training, so answer choice (A) is incorrect. The passage mentions that when selecting a hamster, choosing a friendly one will make training easier. However this is just a small part of the passage and not the main point, so answer choice (C) is incorrect. The passage does not try to encourage everyone to buy a pet hamster, in fact the passage warns that they are not like cats and dogs and how it takes a certain degree of patience to reap the rewards of hamster ownership, so answer choice (D) is incorrect. **The primary purpose of the passage is to provide tips and recommendations on ways to train a hamster. Therefore, answer choice (B) is the correct answer.**
2. The passage starts off by introducing the idea that hamsters can be trained and be great pets. The paragraphs are set up as step by step instructions from how to pick the best hamster all the way to specific training techniques. The best way to describe the organization of the passage is a step-by-step overview of selecting and training hamsters. **Therefore, answer choice (C) is the correct answer.**

3. We are looking for the answer choice that is NOT true. Lines 9-12 state “With hamsters, there takes a certain degree of patience from the pet owner before you start reaping the full benefits of hamster ownership.”, so answer choice (A) is incorrect. The whole passage is focused on providing the techniques to train a pet hamster, so answer choice (C) is incorrect. Lines 15-17 state ‘First, you will want to find a hamster that is around four to six weeks old, and one that is ready to begin human interaction.’, so answer choice (D) is incorrect. The only thing that is not supported by the passage is that hamsters are very loyal pets. **Therefore, answer choice (B) is the correct answer.**
4. Throughout the passage the author gives tips and techniques on how to select and train a hamster. The author clearly believes hamsters are generally trainable and can be great pets if the right steps are taken. Nowhere in the passage does the author mention what age group of people should or should not own a hamster as a pet, so it can be reasonably inferred that hamsters are good pets for children and adults alike. **Answer choice (D) is the correct answer.**
5. The second paragraph in the passage is talking about how to select the best hamster for training. The passage suggests going to the pet store and putting your hand in the tank of hamsters. Lines 20-22 state “Most of them will scurry away and hide, but eventually there might be one that approaches your hand to investigate.” If something is hiding when you put your hand in a tank it is probably running away from you hand, so the word scurry must mean moving quickly or hurrying. **Answer choice (A) is the correct answer.**
6. The phrase in lines 54-56 is trying to remind pet owners that all pets are different and some may require different care than others. The phrase is not a warning, so answer choices (A) and (D) are incorrect. The phrase is also not encouraging anything, so answer choice (C) is incorrect. **The phrase is just a gentle reminder, so answer choice (B) is the correct answer.**

## Passage 2

1. The main idea of the passage is that sometimes, fighting for what you believe is right can be challenging. Alice Paul, who was a leader in the fight for women's suffrage, had to deal with many challenges trying to achieve her goal. While Alice does say that they are going to break their friend out of jail, that was just one line at the end of the passage and is not the main idea of the passage, so answer choice (A) is incorrect. Nowhere in the passage does it say that suffragists were a diverse group of activists, so answer choice (B) is incorrect. While the author might believe that persistence can get you through the toughest situations, the passage focuses more on the challenges faced by the activists, so answer choice (D) is incorrect. The main idea of the passage is that fighting for what you believe isn't always easy. **Therefore, answer choice (C) is the correct answer.**
2. Throughout the passage we read about Alice Paul facing challenges. From knocking on strangers' doors every day, not knowing what kind of person will answer the door or whether they will support her cause, to her office being ransacked by the police and having to break her friend out of

jail. Alice Paul faced all these challenges despite the difficulty, and she faced them with courage. **Alice could best be described as courageous, so answer choice (B) is the correct answer.**

3. This passage is about a strong woman who faced many challenges in her fight for what she believed in. Alice Paul had many setbacks and roadblocks during her fight, but she kept fighting and stayed courageous. The tone of this passage reflects Alice's toughness and could best be described as determined. **Therefore, answer choice (A) is the correct answer.**
4. Lines 15-17 state "Every day, Alice found herself standing face-to-face with an increasingly arduous task --- could she go on?" The word "arduous" is describing the task Alice faced on a daily basis of if she could continue. If everyday she had to ask herself if she could continue, that implies that what she was doing must have been very hard, so the task of continuing would also be hard. **Another word for hard is difficult, so answer choice (D) is the correct answer.**
5. Lines 56-59 state "There will be many moments like this, Alice thought, and she needed to stay resilient if she ever intended to survive." The word resilient is referring to what Alice has to be in order to survive. To survive, most living organisms have to adapt and face and overcome new challenges no matter how tough they are. **Overcoming challenges requires being persistent in challenging situations, so answer choice (A) is the correct answer.**
6. In the second paragraph, we learn that the National American Women's Suffrage Association (NAWSA) struggled to recruit people to their cause due to societal and political pressure. From the middle to the end of the passage, we learn about how the police ransacked the NAWSA's office and came to arrest one of its employees. After learning this, the passage tells us that Alice thought to herself and wondered what laws they had broken besides making a frustratingly male society uncomfortable. The NAWSA clearly faced pressure and were punished by society and the law for fighting for what they believed in. **Therefore, answer choice (D) is the correct answer.**

### Passage 3

1. The author's main purpose for writing this passage was to describe all the feelings and thoughts he had leading up to meeting his biological parents for the first time. While the author does mention a couple things about growing up without parents, that is a small portion of the passage and not the main purpose, so answer choice (A) is incorrect. The passage ends with the author's parents walking in the door and smiling and we don't actually learn how the interaction went, so answer choice (C) is incorrect. While the author does go over some possible reasons his parents may have abandoned him, this is not the main focus of the passage, so answer choice (D) is incorrect. The author's main purpose is to recount how he felt and what thoughts he had while he was waiting to meet his parents for the first time. **Therefore, answer choice (B) is the correct answer.**
2. Lines 37-30 state "I look at my clothes and cringe---a pale and ragged hand-me-down suit the foster agent had whipped up for me the day before." The word "ragged" is describing the author's

suit which he said made him cringe and was a hand-me-down. If clothing is hand-me-down, we know it is not new and might be a bit worn out. If clothing makes you cringe, that would probably mean that it was not very nice or possibly embarrassing. Between the fact that his suit made him cringe and it being a hand-me-down, we can infer that the word “ragged” means old and worn.

**Therefore, answer choice (B) is the correct answer.**

3. Lines 41-43 occur while the author is waiting to meet his parents for the first time. We can infer from all the thoughts he was having and the fact that doing anything for the first time can be scary, that the author was most likely nervous during this time. There is no reason to believe the author likes the taste of blood, so answer choice (B) is incorrect. We also can't know if the author got this habit from his parents because both he and we don't know who his parents are, so answer choice (C) is incorrect. The author gives us now reason to believe he is angry during this time, so answer choice (D) is incorrect. The only logical reason that the author would be biting his lip would be out of nervousness and the fact that the line described the wound as familiar means he has done this before. **Therefore, answer choice (A) is the correct answer.**
  
4. We are looking for the statement which is NOT true. Clearly the author is resilient as growing up without parents and moving around from foster home to foster home is a tough thing for anyone to do, so answer choice (A) is incorrect. Throughout the passage, the author goes over many different scenarios for how his parents will be and why they may have left him. He questions if they will be poor or involved in drugs or travelers and clearly he has prepared for any of these situations, so answer choice (C) is incorrect. Lines 45-46 state “But there is one thing I do know for sure: I'm not going to be mad at them.” For someone who has faced the adversity that the author has faced and gone through growing up without parents, to say that he won't be mad no matter what is a pretty positive outlook, so answer choice (D) is incorrect. The only statement that can not be proven true based on the passage is that the author wants upper-class parents. **Therefore, answer choice (B) is the correct answer.**
  
5. The passage is focused on the time leading up to the author meeting his parents for the first time. His thoughts are racing and emotions are high and he's thinking about all the possible ways the event could unfold. I think that doing anything for the first time can be nerve wracking, especially something as big as meeting your parents after growing up without them. This is reinforced by lines 41-44 where the author says he was biting his lip, which was out of nervousness. Overall the tone of this passage can be described as nervous. **Therefore, answer choice (A) is the correct answer.**
  
6. Lines 23-26 state “I think of myself, and deconstruct my own face, imagining what it might look like if it were a woman or a man.” That line is in reference to the author trying to imagine what his parents will look like. He thinks of his own face and tries to break it down into its main features and imagines those features as a man or woman. The word “deconstruct” as used in the line means to break down or think about his face as separate parts. **Therefore, answer choice (D) is the correct answer.**

**Passage 4**

1. This passage mainly serves to show the differences between how you might imagine something going and how it actually happens. While the passage does describe the American Idol audition process as nerve wracking, this isn't the main purpose of the passage, so answer choice (A) is incorrect. While the passage does demythologize the process of auditioning for American idol somewhat, there are other ways to become a famous singer, so answer choice (C) is incorrect. While the author does talk positively about traveling to the U.S. to chase her dream, the passage as a whole is not encouraging others to travel to the U.S., so answer choice (D) is incorrect. Overall the passage primarily serves to explore the differences between what the author imagined auditioning for American Idol would be like and what the reality actually was. **Therefore, answer choice (B) is the correct answer.**
2. The passage is about a 19 year old woman who traveled from Brazil to the U.S. to pursue her dream of becoming a famous singer by auditioning for American Idol. She had always been told and believed that her voice would "reach millions" and she would be rich and famous. The only problem was that she needed a way to be discovered and she felt that American Idol was the solution to that problem. She worked small jobs and saved up money so she could afford a ticket and then flew to a new country by herself with the hopes of finding success. Since the speaker did all of these things so that she could simply audition for American Idol and she believed that getting discovered would lead to her accomplishing her dreams, it is clear that she believed American Idol was the key to her success in life. **Answer choice (B) is the correct answer.**
3. In the beginning of the passage the speaker believed that American Idol would make all her dreams come true and help her get discovered. She believed that she would be going to the audition and performing for the main judges like you see on TV. After getting to the audition she learned this was not the case and that there were actually 2 rounds that she would have to get through, auditioning for music producers, before she would get the chance to sing for the main judges. Each contestant had 10 seconds to sing and be judged on in the first round. Overall, the speaker's view on the American Idol auditioning process and in turn the American Dream in general was changed that day. **Answer choice (C) is the correct answer.**
4. In the beginning of the passage the speaker was excited and optimistic about flying to America to audition for American Idol. She believed it would be her ticket to fame and success. By the end of the passage, she learned that the audition process was not what she had expected and was disappointed she would not be able to sing in front of the main American Idol judges right from the start. Her tone and the tone of the passage went from hopeful to disappointed. **Therefore, answer choice (C) is the correct answer.**
5. The last line in the passage states "Ten seconds---that was my chance for the American Dream." The line is in reference to the fact that each contestant had only 10 seconds to sing for the music producers before they made their decision on whether or not they would advance to the next round.

From the time she was a little girl the speaker’s parents had fed her with the American Dream, telling her she would be rich and famous and her voice would be heard by millions. She felt that all she needed was to be discovered and that American Idol would be the way that would happen and the key to her success. Then when it came time for her audition she realized that her whole dream came down to 10 seconds and it wasn’t exactly what she had imagined. Her view on the American Dream changed after her first audition. **Therefore, answer choice (C) is the correct answer.**

6. Lines 54-57 state “By the time I got into the stadium at three in the afternoon, I was spent---my make-up was dripping, my hair was a mess, and my dress was covered in dust and sweat.” The passage tells us that the speaker had been up since 5 a.m. and had walked two miles to the stadium in the morning. After waiting for hours and hours in the heat she was finally inside the stadium but her clothes, hair and make-up were messed up. Being up for so long, walking two miles, and waiting for hours after that would most likely wear you out and you would be tired, so it makes sense that the word “spent” most nearly means exhausted. **Answer choice (A) is the correct answer.**

### Passage 5

1. The central aim of the passage is to recount the author's experience seeing a protest he would never forget in his life. While the passage does talk about the reason for the protest as being a type of religious persecution, that is not the main focus of the text, so answer choice (A) is incorrect. While the passage does talk about the death of Thich Quang Duc, the passage is not focused on him or his life in general, so answer choice (B) is incorrect. The passage does talk about the dignified and defiant death of a Buddhist monk, but the passage is more focused on the experience of the author, so answer choice (D) is incorrect. The main aim of the passage is to describe the author witnessing the powerful protest of Thich Quang Duc. **Therefore, answer choice (C) is the correct answer.**
2. Lines 56-59 state “I did not know at the time this man’s name, but I would remember it for the rest of my life and so would everyone else standing in that circle.” That sentence is referring to Thich Quang Duc, the burning monk, and how the author would remember his name for the rest of his life. He would remember this name because of what he witnessed that day, Thich Quang Duc burned himself alive in protest over the Vietnamese government. We can infer that the reason the author will never forget the monk’s name is because he will never forget the event that took place that day. **Therefore, answer choice (C) is the correct answer.**
3. From the passage we know that the burning monk happened at a protest for the persecution the Buddhist people were facing in Vietnam at the time. Thich Quang Duc sacrificed his life and did so in a particularly gruesome way when he was burned alive. Duc being a Buddhist Monk and choosing to protest in such a visible and memorable way implies that he wanted to spread awareness about the persecution his people were facing in Vietnam at the time. **Therefore, answer choice (B) is the correct answer.**

4. We know from the passage that the reason there was unrest and the protest described took place, was the fact that the Vietnamese president was promoting his catholic beliefs and suppressing the beliefs of those that practiced Buddhism. Lines 13-19 state “As you may be able to guess, this led to a lot of dissent---President Diem was very adamant in promoting Catholicism, leading to many government and military officials converting to Roman Catholicism to increase their career prospects.” The word “adamant” is describing how President Diem felt about promoting his catholic beliefs and as we know by his actions he felt strongly about this. Therefore we can infer that the word adamant most likely means unbending or unwavering. **Answer choice (B) is the correct answer.**
5. Lines 80-83 state “But no image could ever capture what I saw firsthand---the absolute defiance of a man, and the strength none could have ever thought possible.” That sentence is referring to the author witnessing Thich Quang Duc burn himself alive in an act of protest. There are many ways one can protest but choosing to burn yourself alive is an extreme way to do so and one that would certainly leave a lasting impression. It was not only courageous but a very bold way to bring awareness to a cause you believe in. **The word boldness is the closest synonym for defiance in line 81, so answer choice (A) in the correct answer.**
6. A statue is a carved or cast figure of a person or animal, so it wouldn’t make sense to describe the monk as a statue for his faith A saint is a person acknowledged as holy or virtuous and while the monk might have been both of these things, it's not explicitly stated in the passage. An outlier is a person or thing different from all other members of a particular group, and while the monk was most likely different from the rest of the monks, we don’t know for sure that other monks would not have done the same thing. Furthermore it does not make grammatical sense to call someone an outlier for something. A martyr is a person who is killed or who dies for their religious or other beliefs. Thich Quang Duc clearly fits that definition as he sacrificed himself for his belief in Buddhism. **Therefore, answer choice (C) is the correct answer.**

### Passage 6

1. The main lesson of the passage is you can’t believe everything that other people tell you. While the author of the passage does visit the cemetery with his/her friends, the passage doesn’t imply that this is what you should do, so answer choice (A) is incorrect. Nothing bad happens to the author after following his/her friends into the cemetery, so answer choice (B) is incorrect. While the passage does show that sometimes you can’t trust things that you haven't seen yourself, it does not imply that you can never trust anything you haven't seen yourself, so answer choice (D) is incorrect. The passage follows a group of friends who are exploring a cemetery they heard was haunted and upon investigation they find out that it was actually just a cat making the scary noises that people heard. The lesson of the passage is that you can’t believe everything you hear from other people. **Therefore, answer choice (C) is the correct answer.**

2. In the passage we learn that the townspeople believed that the cemetery was haunted by the ghost of the dead princess who was said to be buried there. They claimed that they could hear an old woman screaming and crying coming from the mausoleum she was buried in. Upon further investigation the author and his/her friends found out that the noises they, and most likely everyone else, were hearing were actually from a cat. It can be reasonably inferred that the townspeople never actually heard the screams of the dead princess and it was actually just the cat. **Therefore, answer choice (B) is the correct answer.**
3. The second paragraph in the passage describes the eerie and ominous feeling and environment of the cemetery and allows the author to express how he/she and his/her friends felt they may have made the wrong decision going there on Halloween. Nothing bad happens to the group in the passage, so answer choice (A) is incorrect. While the second paragraph does describe the atmosphere in the cemetery, it does so only to justify the group’s feeling that they may have made a mistake, so answer choice (C) is incorrect. The paragraph never condemns the children, so answer choice (D) is incorrect. The main purpose of the paragraph is to show that the children were questioning their decision to go in the first place. **Therefore, answer choice (B) is the correct answer.**
4. Lines 74-75 state “A small, black cat, with an insanely high-pitched wail.” This sentence is describing what the children found when they were exploring the cemetery on halloween. There had been reports that the ghost of a dead princess could be heard screaming and crying in the cemetery, but when the children went to explore they found out it was actually just a cat. **Since we can infer that the cat was the thing that was making the screaming and crying sounds in the cemetery, we know the word “wail” most closely means cry. Therefore, answer choice (A) is the correct answer.** The reason the best answer is not meow is because the passage clearly states that the sounds coming from the cemetery sounded like screaming and crying, and a typical cat’s meow isn’t described like that.
5. Lines 39-43 state “But ever since the people started digging out the graves of their departed beloveds, there were reports of an old woman screaming and crying echoing from the old stone mausoleum.” That sentence is referring to what the townspeople reported they heard coming from the mausoleum of a dutch princess who was buried in the cemetery. Since the townspeople reported hearing screaming and crying coming from a mausoleum where a dead person was buried, it can be assumed that they believed the cemetery was haunted by a ghost. **Answer choice (D) is the correct answer.**
6. The last line of the passage states “And her name? Princess.” Irony is when what on the surface appears to be the case differs drastically from what is actually the case. In the passage the townspeople thought the noises were from a ghost of a dead princess, but in reality they were from a cat. Naming the cat Princess is a way to highlight that difference in what people thought happened and what actually happened and the irony of the situation. **Therefore, answer choice (C) is the correct answer.**

**Passage 7**

1. The author's main purpose for writing this passage is to describe a trip to Disneyland and all the things that go along with that. The author describes her day and the events and challenges they faced. While the author does highlight some things that could be considered difficult about going to Disneyland, she does not complain, so answer choice (A) is incorrect. While it seems like the author enjoys going to Disneyland, she doesn't try to persuade people to visit, so answer choice (C) is incorrect. While the author clearly believes that it is important to plan ahead when visiting Disneyland, her main purpose is not to explain why this is the case, so answer choice (D) is incorrect. The author's main purpose is to describe her trip to Disneyland and all the ups and downs that go along with that. **Therefore, answer choice (B) is the correct answer.**
2. Lines 15-17 state "The morning air was still cool so I pulled on my cardigan and then reached in my purse for the requisite Disney accessory, my Minnie Mouse ears." The word "requisite" is describing the type of accessory that the author considers Minnie Mouse ears to be. She does not feel they are ridiculous or else she probably wouldn't choose to wear them, so answer choice (A) is incorrect. She might feel they are expected, but the passage does not give us any indication that that is the case, so answer choice (C) is incorrect. Understated means subtle, and wearing Minnie Mouse ears is not subtle, so choice (D) is incorrect. Requisite means necessary and Minnie mouse ears could be considered a necessary accessory while you are at Disneyland. **Therefore, answer choice (B) is the correct answer.**
3. Throughout the passage the author describes her day at Disneyland. From getting breakfast at the Rainforest Cafe to walking around in the park. Although the day doesn't go perfectly, the author does not imply that she is upset at any time and pretty much goes with the flow. An example of this is when the line for the ride she wants to go on is too long, she doesn't get upset and instead chooses to just walk around the main street and look at some shops. Overall the author's mood throughout the passage can best be described as relaxed and content. **Therefore, answer choice (C) is the correct answer.**
4. Lines 72-77 state "We walked around a little more, looking in an occasional shop, but the temperature was steadily creeping upward as a stream of sweat under my Minnie Mouse headband began to creep down. We decided to call it a day and began heading back down Main Street." Based on those two sentences we can assume that the author ended her trip due to the rising temperatures. **Therefore, answer choice (D) is the correct answer.**
5. Lines 68-72 state "We decided to forgo standing in line, but fortunately, you don't have to wait in line to stroll through the park and experience the beautiful, uplifting atmosphere of child-like joy." The word "ulifting" is clearly indicating something positive in this sentence. If we break the word down we see it is made up of the words up and lifting so we can assume that it has something to do with increasing or raising something up. Based on those two factors, the best way to describe the

author’s meaning with the word uplifting is adding to one’s overall positivity. **Therefore, answer choice (A) is the correct answer.**

6. The passage never mentions the author going on a ride, so answer choice (A) is incorrect. While the author does say they occasionally looked in a shop or two, she didn’t make it seem like this was her favorite part of Disneyland. The author clearly states that she tries to get to the park and surrounding attractions early to avoid crowds, so answer choice (C) is incorrect. Lines 68-72 state “We decided to forgo standing in line, but fortunately, you don’t have to wait in line to stroll through the park and experience the beautiful, uplifting atmosphere of child-like joy.” The aspect of Disneyland that the author enjoys the most seems to be the overall atmosphere and environment of the park itself. **Therefore, answer choice (D) is the correct answer.**

### Passage 8

1. The passage mainly focuses on the author and the bookstore she works at. The bookstore’s manager Jane is having a meeting to discuss ways to increase the profits of the bookstore because they have been having a down year. The author mentions that she had not written down any ideas in her notebook and that all that was there was a drawing of a cat. At the end of the meeting the author notices that Jane seemed stressed out and finds out that the store was actually doing worse than Jane let on. Feeling bad and guilty, the author decided to work harder on finding solutions to increase the store's profits such as going to visit other successful bookstores in the area. The central idea of this passage is that the author was not putting forth her best effort at first but in the end she decided to do everything she could to help. **“Better late than never.”, best captures the central idea of the passage, so answer choice (C) is the correct answer.**
2. Lines 8-14 state “Her tone was hopeful, not demanding or accusatory. Although she was organized and competent, she never spoke to us like she was trying to ‘manage’ us and never used us as scapegoats when the bookstore didn’t produce lavish riches, which, of course, was all the time.” The first sentence says that the manager was never demanding or accusatory and the next sentence says that she never tried to “manage” the employees or use them as scapegoats. If Jane was a demanding manager she would probably try to “manage” or tell the employees what to do often. The fact that the second sentence gives an example of how Jane was not demanding is a clue to what the word scapegoat means. Since the first sentence says Jane was not demanding or accusatory and we already have an example of how she is not demanding, the fact that she does not use the employees as scapegoats is probably an example of how Jane is not accusatory. If Jane was accusatory she would most likely blame and or punish the employees for the store not doing as well as she wanted, which is not necessarily their fault, so the word scapegoat most nearly means a person who is wrongly punished for another’s mistakes. **Answer choice (B) is the correct answer.**
3. At the end of the passage we learn that the bookstore is doing worse than Jane had let on in the meeting. Although the profits are down a lot, Jane does believe it is salvageable, so answer choice (B) is incorrect. The passage does not seem to imply that modernization is the key to mom-and-pop

businesses survival, so answer choice (C) is incorrect. Nowhere in the passage does it say that Jane was frustrated that everyone didn't come up with ideas at the meeting, so answer choice (D) is incorrect. Lines 77-79 state "I knew we would all do our best to keep the bookstore going." which shows that the author feels that she and the rest of the employees will do everything they can to keep the bookstore afloat. Furthermore she gives a couple of examples of ways she can try to increase the profits of the store. Based on those two factors we can reasonably conclude that the narrator will do her best to keep the store from failing. **Therefore, answer choice (A) is the correct answer.**

4. Ostensibly means apparently or seeming to be. For example, if a rich person is dressed in tattered clothing, he/she might, **ostensibly**, appear to be poor. **This is closest in meaning to seemingly, so answer choice (A) is the correct answer.**
5. The last paragraph in the passage tells us that the narrator feels guilty about doodling during the meeting about how to increase profits in the bookstore. Lines 68-71 state "I felt guilty for drawing cats during our planning session. Now, though, I felt a sharpened desire to do something." After realizing that Jane was more stressed about the store than she let on, the narrator decided to really try and find a solution. She felt guilty because she didn't come up with any ideas during the meeting and now realizing the situation might be worse than she thought, she wished she had. **Answer choice (D) is the correct answer.**
6. Lines 57-60 state "She would feel like she was letting down her whole family, even ones long gone, if the bookstore went under." **Therefore, answer choice (C) is the correct answer.**

### Passage 9

1. The passage mainly focuses on painting a picture of an entertaining and charming local farmer's market. The author talks about the vendors, what they sell, and how they are organized. While the author does mention some benefits of food from the farmer's market, that is not the main focus of the passage, so answer choice (A) is incorrect. While the passage does go over the various stalls and other attractions at the farmer's market, it's not advertising any prices or trying to convince anyone to shop there, so answer choice (B) is incorrect. The passage does not congratulate the farmer's market movement in the U.S., so answer choice (D) is incorrect. Overall the passage could best be summarized as a description of a lively and enticing supermarket alternative. **Therefore, answer choice (C) is the correct answer.**
2. Lines 2-5 state "In these four hours, the tedious chore of grocery shopping becomes a refreshing, family-oriented outdoors experience." Later in the passage we learn that in the middle of the farmers market there are picnic tables, space for lawn games, and a stage for community performers to play on. The passage tells us that shoppers can interact and talk to vendors about products and find out exactly where they come from. Overall the passage described the farmer's

market as a place where people can go to get some nutritious food and interact with other members of the community. **Therefore, answer choice (B) is the correct answer.**

3. The passage starts out by telling the reader when the local farmers market takes place. It then goes on to describe visually how the market is set up and oriented. The passage goes through each type of vendor that sells there and typical things they sell. The walks you through the famer’s market step-by-step, ending with the last vendors in the circuit, so the organization of the passage is best described as a walkthrough of the aisle features of the farmer’s market. **Answer choice (C) is the correct answer.**
4. The main purpose of the passage is to describe a local farmer’s market and its vendors. While the passage does illustrate some benefits of the famer’s market, it does not focus on this, so answer choice (A) is incorrect. The passage never talks about prices or tries to convince the reader to shop at the farmer’s market, so answer choice (C) is incorrect. While the passage does talk about some benefits of a farmer’s market over a grocery store, it also acknowledges that a farmer’s market may not be a complete substitute for a supermarket, so answer choice (D) is incorrect. **The central purpose of the passage is to explain the format of a local farmer’s market, so answer choice (A) is the correct answer.**
5. Lines 32-35 state “It’s a small farm and the attendant can tell you anything you'd like to know about the goats, who spend their days frolicking outdoors as opposed to crammed into tight stalls.” Since the sentence says that the goats spend their day frolicking outdoors as opposed to being crammed into tight stalls, we know that frolicking outdoors must be the opposite of being crammed into tight stalls. When something is crammed into a tight space, it doesn’t have much room to move around, so we can assume that frolicking has to do with being free to move how you want. Racing is too specific of a movement to be the correct answer as it implies a very fast pace, so answer choice (B) is incorrect. Bleating means crying, so answer choice (C) is incorrect. Resting is the opposite of moving, so answer choice (D) is incorrect. The best answer choice is “playing” because crammed in a tight space the goats would not be able to move around and play, but in an open field they could. **Therefore, answer choice (A) is the correct answer.**
6. We are looking for the answer choice that the passage does NOT strive to accomplish. The whole passage is describing the farmers market and how lively it is, so answer choice (A) is incorrect. Throughout the passage the author is describing the features and benefits of the famer’s market and this encourages readers to shop at a farmer’s market, so answer choice (C) is incorrect. Lines 2-5 state “In these four hours, the tedious chore of grocery shopping becomes a refreshing, family-oriented outdoors experience.” Clearly the passage is trying to convince readers that shopping at a farmer’s market is more family-friendly than commercial shopping, so answer choice (D) is incorrect. The only thing the passage does not try to do is persuade readers of the superiority of farmer’s markets when compared to commercial shops, citing benefits of both and explaining that they each have their place. **Therefore, answer choice (B) is the correct answer.**

**Passage 10**

1. The main idea of the passage is the enjoyment and appreciation felt by someone experiencing their first professional soccer match. While the passage does mention that the fans of the team were a diverse group, it doesn't talk about the unification of the team, so answer choice (A) is incorrect. The passage focuses on the time before the match starts, so answer choice (C) is incorrect. The passage is written from the perspective of a player and not someone watching the soccer match, so answer choice (D) is incorrect. Overall, the main idea of the passage is the celebration and excitement felt by a soccer player during a first experience. **Therefore, answer choice (B) is the correct answer.**
2. In line 25, the author compares the sound of the audience all singing together to the experience of "standing in the presence of a god." If we think about how a whole crowd of cheering fans would sound, we can assume it would be one of the loudest things someone could experience and the fact that they were all surrounding the field where the player was standing would just make it even more of a powerful experience. The author compared it to standing in the presence of a god to emphasize just how powerful the experience was. **Therefore, answer choice (A) is the correct answer.**
3. Throughout the passage the author describes how every aspect of lead up to the soccer match made him/her feel. Saying things like the crowd singing in unison was like being in the presence of a god and that the noise bled through his/her skin. he/she describes the lights in the stadium by saying "It as as if, that night, we roped in the stars and trapped them in the stadium." The way the author describes the things he/she is feeling and seeing tells us that he/she is emotionally excited or intoxicated by the whole experience. **Therefore, answer choice (C) is the correct answer.**
4. Lines 9-14 state "Each letter stood hundreds of meters tall and half as many wide, each vibrating with the tenacity and energy bursting out of every loyal supporter filling up the forty thousand seat stadium." That sentence is describing the home crowd at a soccer match that has dressed in a way to form the letters of the team they are cheering for and how the letters are vibrating with the energy and tenacity of the crowd. Clearly the crowd was excited and were determined to show their support in any way they could. When the passage says the letters, made up of the crowd, were vibrating with the energy and tenacity bursting out of every supporter, it is saying the crowd had vitality and determination. **Therefore, answer choice (C) is the correct answer.**
5. The passage tells us that the younger players were terrified, not the senior players, so answer choice (B) is incorrect. The passage does not give any indication that the senior players are bored or anticipating a difficult match, so answer choice (C), and (D) are incorrect. **We are left with answer choice (A) as the correct answer.** It would make sense that the more experienced players are taking the game seriously. They most likely avoided eye contact with the fans in order to stay concentrated.

6. The first line in the passage states “The electricity of my first professional soccer match gripped me from the first second we stepped out of the tunnels and onto the pitch.” The passage goes on to describe everything the narrator saw and felt during the build up to that first match. Since this was the narrator’s first professional soccer match, we know that he/she must be a new member of a professional soccer club. **Answer choice (D) is the correct answer.**

### Passage 11

1. The main purpose of the passage is to educate readers on the importance of libraries in our current world and encourage people to go visit them. The passage goes over the many different benefits that libraries still possess. While the passage does encourage people to visit libraries, it is not just to read more and borrow more books, so answer choice (B) is incorrect. While the passage does talk about some of the extracurricular and social activities that libraries have, this is not the main focus of the passage, so answer choice (C) is incorrect. Similarly, the passage does mention that libraries are vital community and informational centers, but this is not the main idea of the passage, so answer choice (D) is incorrect. The primary purpose of the passage is to educate readers on all of the benefits and resources offered by libraries. **Therefore, answer choice (A) is the correct answer.**
2. In the first paragraph, the author discusses how people tend to view progress as linear and how we think we are always improving and developing better technologies. The author feels that because of this, we often undervalue things that we feel are old or out of date. Lines 9-10 state “One institution that is often regarded as obsolete, or at best quaint, is the public library.” The author then goes on to show why he/she feels that not only are they not obsolete, but that libraries are essential resources for the community. Based on that, we can assume that the author would most likely agree that people often underestimate the importance of libraries. **Therefore, answer choice (C) is the correct answer.**
3. The passage starts out by telling the reader that many people feel libraries are obsolete in today’s society. The author then goes on to explain why this is not true and defends the value that he/she feels libraries still have. The author supports this stance with examples of the features and benefits that many libraries have today and why he/she feels they are so important. The best way to describe the organization of this passage would be that an institution is defended and then explored in more detail. **Therefore, answer choice (C) is the correct answer.**
4. Lines 66-67 state “Far from being obsolete, libraries are vital community and informational centers.” From that sentence we can infer that obsolete means the opposite or something close to the opposite of vital. Vital means necessary or essential, so the opposite would be unnecessary or no longer needed. **Outdated is the closest in meaning to unnecessary, so answer choice (B) is the correct answer.**

5. Throughout the passage the author explains and gives examples of the many benefits libraries provide to the community. Things like giving people access to numerous subscription-based databases that would be unlikely for individuals to have access to on their own. The author argues that libraries are far from obsolete and the tax money that goes to support libraries is more than worth it. The author doesn't mention anything about believing that libraries are doomed or on their way out and will cease to exist in the future. Based on the passage the reader can infer that libraries will continue to support and enliven local communities as resource centers. **Therefore, answer choice (D) is the correct answer.**
6. The last line of the passage states "You'll find more than you imagined." The sentence is referring to the reader going to explore their local library. The author believes that if you go to explore your local library, you will discover more resources and benefits than you probably would have thought. The last line serves as a reminder to the reader to not underestimate the richness of local libraries. **Therefore, answer choice (B) is the correct answer.**

### Passage 12

1. The main idea of the passage is the love a mother has for her child and the sacrifices she is willing to make. While the passage does discuss the financial difficulties faced by the girl's mother, the difficulties are not the main idea or focus of the passage, so answer choice (A) is incorrect. While Maria does end up getting what she wants in the end, that is not what the passage is trying to convey is important, so answer choice (B) is incorrect. The passage takes place before Maria gets to buy her first pet and is focused on the events leading up to that, so answer choice (C) is incorrect. **The main idea of the passage is the beauty of Maria's mother's sacrifice for her daughter, so answer choice (D) is incorrect.**
2. In the middle of the passage we learn that Maria's mother had taken her shopping for supplies for the new kitty. They already bought a little box, food dishes, and a scratching post. The passage says Maria feels guilty because she knew the scratching post was a bit of an indulgence as it was quite large and Maria knew that her mom had stayed late at work a couple of nights to offset the cost. Later when Maria reads there is an adoption fee of 50 dollars for Princess, she feels guilty about telling her mother, knowing that 50 dollars is equivalent to a night of work at the diner where she works. **She is nervous to tell her mother because her mother had already spent a lot of money on pet supplies, so answer choice (A) is the correct answer.**
3. We are looking for the answer choice that does NOT describe Maria's mother. The passage tells us that Maria's mother worked and would work more extra shifts at her job to be able to afford the pet supplies needed and the adoption fee to adopt Princess from the shelter. That is a personal sacrifice, so answer choice (A) is incorrect. Conscientious means wanting to do what's right. The passage tells us that Maria's mom bought the new cat a big scratching post even though it was expensive, saying that a cat needs a place to scratch. The passage also tells us that Maria's mother tried to cook from scratch at least 3 times a week even when she was exhausted. Buying the scratching post

and making a home cooked meal for your daughter even when you are tired are examples of being conscientious, so answer choice (C) is incorrect. We already established that Maria’s mother had worked and would pick up more extra shifts to afford adopting Princess, so she is clearly hardworking and answer choice (D) is incorrect. Based on the passage, the only word that does not describe Maria’s mother is calculating, which means acting in a ruthless way. **Therefore, answer choice (B) is the correct answer.**

4. Paragraph 5 in the passage describes all of the supplies Maria and her mother got for the new cat. The paragraph tells us that Maria feels guilty that her mother spent so much money and had to pick up extra shifts in order to do so, but that she thinks Princess will love all the new things. Maria’s attitude in this paragraph is that she feels guilty about her mother having to work more, but she feels excited about getting a new pet. **Therefore, answer choice (A) is the correct answer.**
5. Lines 41-45 state “Her mom agreed a cat needed a scratching surface other than the furniture, but this scratching post currently dominating their tiny living room was more of an Olympic-sized cat playground.” From that description we can assume the scratching post is quite large. The word dominating probably has to do with the size of the cat post. If we think about a large piece of furniture, it would cover a large area of a room. **Therefore, answer choice (B) is the correct answer.**
6. Paragraph 4 talks about Princess and the animal shelter where she would be adopted from. The paragraph tells us that when Princess had been found by a passerby, she was slightly undernourished and defending herself from a dog. Lines 32-25 state “But now Princess had been at the shelter for a month and had gained a healthy weight. She was ready to go home to her forever home.” Knowing that Princess was undernourished when she arrived at the shelter and then a month later had gained weight and was ready to be adopted, we can infer that the reason she was unable to be adopted immediately was that she was malnourished and sick. **Answer choice (C) is the correct answer.**

### Passage 13

1. The main idea of the passage is that marketing and advertising focused on selling to children is a complicated issue. While the passage does make the case that advertising something like fast food, which is not the healthiest food, to children may be unethical, it does not call for it to be made illegal, so answer choice (A) is incorrect. Similarly, the passage does not necessarily say the methods used by advertisers are unethical, but the products being marketed to children might make the advertisements unethical, so answer choice (B) is incorrect. While the argument about the ethics of advertising fast food to children centers around the public’s health, the passage does not argue that currently the marketing is destroying the population’s health, so answer choice (D) is incorrect. The main idea of the passage is that child-focused marketing is a complex issue, especially regarding fast food. **Therefore, answer choice (C) is the correct answer.**

2. Lines 1-5 state “Fast food is one of the most ubiquitous components of the American culinary landscape. One significant cause of the proliferation of fast food is advertising directed towards children.” The word “ubiquitous” is describing fast food in American cuisine. The following sentence says that advertising to children has caused the proliferation of fast food. Proliferation means a rapid increase in number or large number of something. Since the passage is telling us there has been a rapid increase in fast food, we can infer that fast food would be a big part of the American culinary landscape. The answer choice with a meaning closest to something being a big part of something else is universal, which means done by all people in a particular group. **Therefore, answer choice (A) is the correct answer.**
3. Paragraph 5 talks about the cradle-to-grave advertising strategy. The paragraph gives an example of this by saying a child who has positive experiences with fast food will grow up and feel nostalgia later in life. This will translate into those same customers buying fast food as an adult. This is closest to a child who has fond memories of riding in his dad’s BMW, buys BMW cars as an adult. **Therefore, answer choice (D) is the correct answer.**
4. Lines 45-47 state “Positive experiences with fast food as a child will translate into nostalgia later in life.” The paragraph goes on to say that those children will then as adults buy fast food and give it to their kids as they have an emotional and habitual tie to fast food. Since the paragraph tells us that nostalgia will cause the young customers to buy fast food as an adult, the word “nostalgia” must be something that creates desire. **Longing means a yearning desire, so answer choice (A) is the correct answer.**
5. The final sentence in the passage states “While the ethical debate is unsettled, the effectiveness of advertising fast food to children is certain.” The author clearly believes that marketing strategies aimed at children can be and are effective. **Therefore, answer choice (A) is the correct answer.**
6. According to the passage, the phrase “a cradle-to-grave strategy” refers to the marketing technique of creating a positive association of a product or item with a customer when they are young so that they will continue to buy that product or item throughout their lives. Essentially, it’s a method of making lifelong customers. **Therefore, answer choice (B) is the correct answer.**

#### Passage 14

1. The main idea of the passage was a young girl witnessing first hand the reality that some people are born with less opportunities and privilege than others. While the passage does create an image of the homeless that would suggest a lack of hygiene and medical care, that is not the main focus of the passage, so answer choice (A) is incorrect. While Lety and the group of girls probably did feel uncomfortable having money around the homeless, the passage is not focused on this feeling, so answer choice (C) is incorrect. The passage also never implies that volunteering at homeless shelters is pointless, so answer choice (D) is incorrect. The main idea of the passage is Lety

realizing the differences in class and privilege that exist in society. **Therefore, answer choice (B) is the correct answer.**

2. The first paragraph of the passage describes everything that Lety was feeling when she first arrived at the homeless shelter. The paragraph talks about the look of the shelter and how it was smaller than what Lety expected. It goes on to talk about the heat that day and how Lety was sweating and it was dripping down her back. Lety describes the smell as putrid and notices the paint peeling off the walls like scabs. Overall Lety seems pretty uncomfortable as she is in a new and unknown situation and physically she is not comfortable in the heat, so her experience started off badly because she was uncomfortable. **Answer choice (C) is the correct answer.**
3. Lines 49-53 state “Blue orbs for eyes in keen observation on the sight before them; specifically one of them, a young woman, maybe in her twenties, carrying a young child in her arms.” Later in the paragraph Lety says that woman and child combined probably weighed less than her. At the end of the paragraph Lety smiles at the woman but the woman does not smile back. We can infer that the woman did not smile because the life she has endured up until this point did not afford her the luxury of smiling in this moment. She was hardened by the challenges that she had experienced. The reason she stood out to Lety was because she was young and toughened by the misfortunes of her life. **Therefore, answer choice (D) is the correct answer.**
4. Lines 3-4 state “The shelter’s facade embodied those inside it.” The paragraph goes on to describe what the shelter looked like on the outside of the building. It was worn down and dirty and had a similar look to the people who were inside it. We can infer that the word facade means the outside of a building, or exterior. **Therefore, answer choice (B) is the correct answer.**
5. Lines 39-42 state “The entire place was like a malady, Lety thought: people in all shapes and colors walked around with their eyes downcast.” Nothing in the passage implies that Lety had an expectation of what the homeless would look like, so answer choice (B) is incorrect. Observing what the homeless looked like would not be a way to make fun of the people in line, so answer choice (C) is incorrect. The passage does not imply that Lety is confused by the homeless people’s diversity, so answer choice (D) is incorrect. The reason she noted this diversity was to show that poverty is not determined by your appearance. **Therefore, answer choice (A) is the correct answer.**
6. Lety describes the shelter as small and having appealing characteristics. The plastic coating on the windows was peeling off and that instead of a door the building had a decrepit frame in its place. Later she says that there was a rusty sign hanging from two rusty bars on the front of the building. The building can clearly be described as old and worn down which is another way of saying dilapidated. **Therefore, answer choice (B) is the correct answer.**

**Passage 15**

1. The main purpose of the passage is to educate the reader on how to cook healthier meals and in turn live a healthier lifestyle. The passage does not scold anyone for not being able to cook at home and actually talks about why it is sometimes hard to do so, so answer choice (B) is incorrect. The passage does not explain various ways the obesity epidemic can be reduced but instead focuses on one way. While the passage does mention some types of food people should avoid, it is much more focused on the process of cooking than the ingredients, so answer choice (D) is incorrect. The primary purpose of the passage is to suggest that people start cooking healthy meals at home and explain ways to be able to do this efficiently. **Therefore, answer choice (A) is the correct answer.**
2. Lines 18-21 state “For many, the word ‘healthy’ may be an immediate turn-off, but healthy eating doesn’t mean subsisting on nothing but kale and brown rice.” The word “subsisting” is referring to what some people think healthy eating is: they think it is subsisting off of kale and brown rice. On a healthy diet people usually eat healthy foods like kale and brown rice, so it would make sense that people might think a healthy diet only consisted of these foods. The word substituting then must mean only eating or living exclusively on. **Therefore, answer choice (A) is the correct answer.**
3. Overall the passage is talking about making a dietary change that will lead to a healthy lifestyle. The passage gives tips and ideas on how to do this including things like hiring a nutritionist or signing up for a meal delivery service. Both of those things cost money and would not likely be able to be afforded by children. Furthermore, the passage mentions it may be hard for parents to find time to cook as well as adults without children who lead a busy life. Many of the tips and advice provided by the passage would be considered basic by professionals and exercise enthusiasts, but this is done on purpose so as to not intimidate the average person. Based on those factors, the audience for the passage is most likely adults seeking a nutrition-based lifestyle change. **Therefore, answer choice (B) is the correct answer.**
4. Throughout the passage, the author is giving tips and explaining ways that normal people can make dietary changes to improve their lifestyle. The passage provided examples of techniques people can use to save time as well as ways to make cooking less intimidating. Overall the passage provides a lot of information to the reader and the overall tone could best be described as informative. **Therefore, answer choice (C) is the correct answer.**
5. Lines 14-17 state “Exercise is certainly part of the equation, but anyone who is serious about becoming healthy needs to put effort into healthy, home cooked food.” The passage focuses mainly on ways to be able to cook more healthy food at home and suggests some techniques on how to make this easier. Based on the passage the author’s main suggestion for losing weight would be learning to prepare home cooked meals. **Therefore, answer choice (C) is the correct answer.**

6. While discussing exercise regimens of many adults lines 11-14 state “While many are willing to sweat it out on the treadmill at least for a few weeks, we can quickly undo any progress with a diet made up of processed, sugary foods.” This shows that the author claims that most adults' exercise regimens will end because their progress will be undercut by unhealthy eating. **Answer choice (B) is the correct answer.**

### Passage 16

1. The main purpose of the passage is to describe *The Elevation of the Cross*, which is a famous triptych. A triptych is a piece of art composed of three separate wooden panels---a square central panel, and two rectangular outer panels. While the passage does mention the famous artist who created *The Elevation of the Cross*, the passage focused more on the artwork itself, so answer choice (A) is incorrect. While the passage does focus on *The Elevation of the Cross*, the author does not critique the work, so answer choice (B) is incorrect. While *The Elevation of the Cross* depicts a biblical story, the story itself is not the focus of the passage, so answer choice (C) is incorrect. **Overall, the primary purpose of the passage is to analyze *The Elevation of the Cross*, so answer choice (D) is the correct answer.**
2. According to the passage, *The Elevation of the Cross* is a massive piece of art, measuring fifteen-feet tall and twenty-one-feet wide, and it is housed in an equally impressive cathedral in Antwerp. Lines 23-24 state “The triptych itself is perhaps the magnum opus of Rubens’ career.” The term magnum opus is used to describe the greatest achievement of an artist or writer, so we know that this work is considered to be artist Peter Paul Rubens’ best work. Based on this, *The Elevation of the Cross* can best be described as a powerful example of a famous 17th century artist’s work. **Therefore, answer choice (C) is the correct answer.**
3. Lines 7-11 state “As a traditional triptych, the work is composed of three separate wooden panels---a square central panel, and two rectangular outer panels which fold over the central panel and reveal another image behind it.” **Therefore, answer choice (C) is the correct answer.**
4. The entire passage is dedicated to analyzing a single piece of art created by Peter Paul Rubens, so we can assume that it is probably considered very important. We can infer then that calling it perhaps Rubens’ magnum opus is another way of saying it is perhaps his most important work. **Therefore, answer choice (D) is the correct answer.**
5. According to the passage, the left panel depicts St. John the Evangelist and the Virgin Mary at the top of the panel, and below them on the same panel a line of women and children with frightened and horrified expressions. All the characters on the left panel are looking right where we presume they are looking at the suffering body of Christ. The center panel depicts Christ’s cross being raised to its upright position. The right panel depicts Roman soldiers preparing the two thieves who are to be crucified beside Christ. Lines 63-68 state “Every piece of the right panel seems to diagonally lean away from the central image, to the opposite angle of the left panel, creating a sense that both

sides are pointed to the crucified Christ in the center of the triptych.” It’s as if the outer panels are pointing and drawing your eyes to the center panel. Based on this, we can infer that the rectangular panels on either side of the center panel of *The Elevation of the Cross* serve to provide narrative context to the central panel’s image. **Therefore, answer choice (A) is the correct answer.**

6. We can assume the author does not believe that *The Elevation of the Cross* will always be the most famous triptych because he/she cannot know all the triptychs that will ever be created in the future, so answer choice (A) is incorrect. While the author does believe that *The Elevation of the Cross* is perhaps Rubens’ most important work, nowhere does the passage imply that he would not be famous without it, so answer choice (B) is incorrect. Similarly, while the author does believe that *The Elevation of the Cross* is the most famous triptych, the passage does not imply that triptychs in general would not be famous if it didn’t exist, so answer choice (C) is incorrect. Based on the passage, the author would most likely agree that Rubens’ attention to detail and talent can be seen in *The Elevation of the Cross*. **Therefore, answer choice (D) is the correct answer.**

### Passage 17

1. The author’s purpose in writing this passage is to inform readers about an organization called Girls Who Code. While the passage does say that many girls lose interest in computer science as they get older, it does not say they are discouraged from pursuing careers in technology, so answer choice (A) is incorrect. While the author might believe that Girls Who Code is one of the most important initiatives of its kind, the passage does not focus on praising the organization, so answer choice (C) is incorrect. Nowhere in the passage does the author solicit, or ask for, donations to Girls Who code, so answer choice (D) is incorrect. The primary purpose of the passage is to educate readers on an organization for girls who are interested in technology. **Therefore, answer choice (B) is the correct answer.**
2. The entire passage focuses on an organization called Girls Who Code. The author describes why the organization was created and the impact it has had on the community it serves. Girls Who Code was developed to provide girls with education in computer science and information about technical careers as well as offer a supportive community of like-minded peers and mentors. Lines 34-38 state “Hopefully, with expanded community awareness and interest, this worthwhile organization will be able to expand and offer their empowering technical education program to more girls.” Describing Girls Who Code as worthwhile and the education they provide as empowering shows how positive the author feels about this organization and its mission. Based on that, the author would most likely agree that it is culturally beneficial to encourage girls to pursue careers in technology. **Therefore, answer choice (D) is the correct answer.**
3. The first paragraph in the passage tells us that 66% of six to twelve year old girls say they are interested or enrolled in a computer science program. Lines 7-13 state “However, as girls age, their interest in computer science wanes. Only 32% of girls aged thirteen to seventeen are interested in or enrolled in a computer science program and amongst college freshman females, the figure is a

mere 4%.” The word “waned” is describing what happens to girls' interest in computer science as they age. We can see that the percentage of girls who are interested in computer science programs decreases with age, so the word waned must mean decreases or lessens. **Answer choice (C) is the correct answer.**

4. Lines 32-34 state “At present, Girls Who Code clubs and programs are predominantly located in large cities.” The paragraph goes on to say that hopefully, with more awareness and interest from the community, Girls Who Code can expand and offer their program to more girls. We can infer then that at the present time Girls Who Code is only located in a handful of places. Those places are cities according to the paragraph, so the word “predominantly” must mean only or mainly. **Answer choice (B) is the correct answer.**
5. The passage starts off by telling the reader that women are underrepresented in the technology industry in this country. It goes on to tell the reader about an organization called Girls Who Code, that aims to provide girls who want to code all the resources to be successful. The passage finishes by providing some statistics on the success Girls Who Code has had so far. Overall the organization of the passage can best be described as an introduction of an issue, exploration of a new organization, and analysis of its effectiveness. **Therefore, answer choice (B) is the correct answer.**
6. The premise of the passage is that women are underrepresented in the technology and computer science industry in this country and an organization called Girls Who Code is trying to help change that. The author gives statistics to support the fact that Girls Who Code is already making an impact, so it can be reasonably assumed that if the reach of Girls Who Code was increased, it could directly increase the number of women in the technology field. **Answer choice (C) is the correct answer.**

### Passage 18

1. The main idea of the passage is that the internet is full of useful and accurate information, but not everything you find on the internet is credible. Wikipedia is a good example of this, as it provides an abundance of useful information but can be edited by anyone without any sort of peer review or vetting process. While the passage does caution about believing everything you read on the internet, it does not imply that you cannot believe anything without it being backed up by a well known source, so answer choice (A) is incorrect. While the passage does say that Wikipedia can have false or misleading information, it doesn't say this happens regularly, so answer choice (C) is incorrect. Nowhere in the passage does it say that readers of internet news and information should not believe anything they read until they also see it in a print source, so answer choice (D) is incorrect. The main idea of the passage is that the internet is a wealth of information, but you should use good judgment when evaluating sources. **Therefore, answer choice (B) is the correct answer.**

2. Lines 70-73 state “Occasionally people insert funny bits of misinformation as a clear joke, but rogue editors also write hoax articles of pure fabrication.” The word fabrication is referring to the hoax articles that rogue editors occasionally write. A hoax is a deception or a fake article, so we can assume that a fake article would be full of made-up information. **Answer choice (C) is the correct answer.**
3. The phrase passage saying that knowledge has largely been democratized refers to the fact that almost anyone with access to a computer and internet connection has access to a wealth of knowledge that used to only be found in large libraries or expensive encyclopedias. Furthermore, anyone can edit information on huge open-edit websites like wikipedia without having to have any special knowledge or certification. The best example of how knowledge has largely been democratized is students being able to edit information on an open edit website. **Therefore, answer choice (B) is the correct answer.**
4. The main message of the passage is that while the internet is a great source of information and it has made that information easier to access than ever before, we still have to be careful and take care to try and make sure what we read is the truth. Based on the passage, all information from an unknown source should be analyzed carefully. **Therefore, answer choice (D) is the correct answer.**
5. Lines 8-9 state “Now more than ever, knowledge has largely been democratized.” This sentence is referring to the fact that the internet had provided all kinds of information and knowledge to many different people, many of whom would never have had access to this knowledge without the internet. Based on that we can infer that the invention of the internet has equalized opportunities for different kinds of knowledge. **Therefore, answer choice (C) is the correct answer.**
6. Lines 70-73 state “Occasionally people insert funny bits of misinformation as a clear joke, but rogue editors also write hoax articles of pure fabrication.” This sentence is referring to the fact that not everything on Wikipedia is true since anyone can edit and add to articles published on the website. Since we know that the sentence is talking about misinformation, we can infer that a hoax article would be a fake or untrue article. **Therefore, answer choice (B) is the correct answer.**

### Passage 19

1. The main idea of this passage can best be described as a look at how people react to different gender castings in some of their favorite shows and movies, and why they react this way. While the passage does offer some defense of casting women actors for previously male roles, it does this while exploring the reasons people are upset in the first place and not as the main idea of the passage, so answer choice (A) is incorrect. While the passage does compare the original and modern interpretations of *Othello*, the comparison is not the main idea of the passage, so answer choice (B) is incorrect. While the passage does try to get to the root of why some people think some roles should only ever be played by men, it does not condemn anyone who thinks this but

rather questions their reasoning, so answer choice (D) is incorrect. The main idea of this passage is the exploration of why some people have negative reactions to casting different genders.

**Therefore, answer choice (C) is the correct answer.**

2. Lines 19-20 state “Some see this as pandering to vocal feminists and/or liberals.” This sentence is referring to the recasting of women in roles that were previously played by men. We can infer that the sentence is saying that some people see this as only trying to appease vocal feminists and/or liberals. A reason for trying to appease, or make someone happy, would be to gain popularity, so pandering means seeking popularity by changing something. **Answer choice (D) is the correct answer.**
3. In the beginning of the passage, the author talks about a growing trend of TV shows and movies recasting females to play previously male roles. The passage then goes on to talk about examples of this and how some fans are not happy with it. The author explores some of these examples to try and find out why people are upset and if it is justified. Overall the organization of this passage can best be described as an emerging social movement is introduced and then explored through examples. **Therefore, answer choice (A) is the correct answer.**
4. Throughout the passage, the author is trying to argue that changing the casting of a role is perfectly fine unless that change takes away from some central part of the character. The author uses *Othello* as an example, citing that in the play the main character's skin color was essential to his otherness and if you changed that then you would still have to provide another way for him to be an outsider. Since the author is making a point and backing it up with examples, the tone of the passage can best be described as persuasive. **Answer choice (A) is the correct answer.**
5. The main argument the author tries to make in the passage is that recasting a role should be uncontroversial as long as that change does not hamper the show or the character in any way. Specifically, changing a role from a male to a female should not upset anyone unless maleness was essential to the role in the first place. Speaking to that argument, the last line in the passage states “If not, then there is no reason these roles can’t be played by women, and the anger against these casting choices takes on a more sexist, reactionary quality.” Based on that, the author would most likely agree that discomfort with traditionally male roles being played by women could indicate sexism. **Therefore, answer choice (C) is the correct answer.**
6. The examples used in this passage are from shows, movies, and plays that many people would know and could relate to. The author uses a variety of examples to allow the most people possible to make a personal connection to what he/she is saying. The reason these examples are effective is because they are popular (many people would know of them) and varied (he/she uses examples from tv shows, plays, and movies). **Therefore, answer choice (A) is the correct answer.**

**Passage 20**

1. The passage is focused on a woman trying to get to her first day of a college class on time. The passage starts with the woman struggling to find a spot to park, which leads to her going from being an hour ahead of schedule, to only getting to her class 3 minutes early. Throughout the passage the author describes the woman trying to navigate through the crowded campus and use her map to find her way to a class that she had never been to before. The woman starts to get a little nervous throughout all of this, but never loses her cool and tries to remind herself that she started with a big cushion and it will all be fine. She finally arrives at class with only minutes to spare and sees that it is overcrowded and people are standing along the wall and sitting on the floor. It is explained to her that due to insufficient funds, classes had been cut and many of these students were on a waitlist to get into this class. The whole passage is very nerve wracking and the tone of the passage can best be described as concerned. **Answer choice (B) is the correct answer.**
2. The second half of the passage discusses the fact that the class the woman was trying to get to in the first half of the passage is overcrowded. The reason is because the school was forced to cut classes due to insufficient funds. This caused the class to implement a new rule that students had to be present the first day of class and one time for roll call to keep their space in the class. At the end of the passage we learn this is a community college because the woman says that maybe it was time for her to pay attention to politics so she could understand how this could happen. The main conflict in this passage is the community college vs Government Budgets. **Therefore, answer choice (D) is the correct answer.**
3. Lines 18-20 state “She briefly considered parking in a staff spot, but parking enforcement was already on the prowl.” This sentence is referring to the woman in the passage parking in a spot designated for staff, even though she was a student, because she was worried about being late for class. The reason she did park in the spot was because the parking enforcement was on the “prowl”. Since this caused the woman to not park in the spot, we can infer that the word prowl must mean something close to lurking around or on the lookout for violators. **Therefore, answer choice (A) is the correct answer.**
4. Late in the passage the narrator reflects on something the teacher had said. She questions how the school could have insufficient funds that caused classes to be cut. This questioning leads her to think that maybe she should pay more attention to politics so that she can understand how something like this could happen. The fact that she never really paid attention to politics but this incident is making her reconsider implies that this is something she cares about. The woman cares that classes were cut and not every student could take the classes they wanted, so it can be reasonably inferred that the woman believes those who desire an education should have access to it. **Answer choice (B) is the correct answer.**
5. We can infer from the last passage that the narrator is not happy with the fact that not every student who wanted to take the class she was in was able to do so due to insufficient funds. The narrator

says that maybe it was time for her to figure out how that happened and what candidates wanted to fix it. This all points to the narrator becoming an advocate for education in the future. **Therefore, answer choice (C) is the correct answer.**

6. We are looking for the answer choice that is NOT true. The entire passage is focused on the narrator trying to get to her class on time. The passage tells us that she had initially been an hour ahead of time to make sure she could be on time to class, so answer choice (A) is incorrect. The end of the passage tells us that the narrator is questioning how the college could have insufficient funds for classes and realizing that maybe she needed to figure out which political candidates were interested in fixing that problem. The narrator is clearly concerned about the college’s funding, so answer choice (B) is incorrect. Similarly, the narrator saying that maybe it’s time to pay more attention to politics implies that she wants to get more involved in creating changes at her school, so answer choice (C) is incorrect. Since the narrator wants to get more involved in creating changes at her school, and this was all spurred by the fact that there were insufficient funds for classes and some students lost their spot just for being late, we can assume that the narrator does NOT think it is reasonable that late students cannot enroll in classes. **Therefore, answer choice (D) is the correct answer.**

### Passage 21

1. The primary purpose of the passage is to educate readers on some way to avoid unintentional plagiarism. The passage goes over the most common ways students unintentionally plagiarize and why this usually happens. While the passage does mention that unintentional plagiarism is the most common form of plagiarism, it does not say that plagiarism is the most common form of academic dishonesty, so answer choice (A) is incorrect. While the passage does say that unintentional plagiarism is the most common form of plagiarism, the passage focuses more on correcting the problem than the problem itself, so answer choice (C) is incorrect. The passage does explore some ways that students plagiarize when writing research papers, but again the focus is more on helping students to stop plagiarizing, so answer choice (D) is incorrect. The main purpose of the passage is to explain how students can steer clear of unintentional plagiarism when completing assignments. **Therefore, answer choice (B) is the correct answer.**
2. Lines 6-9 state “Plagiarism is easily facilitated by numerous websites that offer essays on subjects likely to come up in a variety of classes.” The word “facilitated” is describing how plagiarism is affected by the websites that offer these essays. If the websites offer pre-written essays that students can just copy and use, that would make plagiarizing a lot easier, so facilitated must mean made easier, or simpler. **Answer choice (C) is the correct answer.**
3. While the passage does give some tips on how to avoid plagiarism, using an online plagiarism-checker is not one that is mentioned, so answer choice (A) is incorrect. The second paragraph in the passage discusses self plagiarism and makes it clear that just because you are recycling work that you wrote, doesn’t mean that it is not plagiarism and still cheating in most

circumstances, so answer choice (C) is incorrect. Answer choice (D) says that students *always* have no idea they are being dishonest when plagiarizing. While the passage mentions that some students' plagiarism is unintentional, it does not say that students' plagiarism is always unintentional, so answer choice (D) is incorrect. The passage focuses on explaining ways that students unintentionally plagiarize and highlights the fact that plagiarism comes in many more forms that most students realize. **Therefore, answer choice (B) is the correct answer.**

4. We are looking for the answer choice that is NOT a way to cite sources throughout an essay. Lines 68-72 state “With a paraphrase, there are no quotation marks, so signal phrases and parenthetical citations are especially important for alerting the reader as to when source material is being used.” Lines 81-83 state “Signal phrases, citations, and quotation marks for direct quotes will create clarity for the reader and give credit to the original author.” Between those two sentences the only answer choice that isn’t mentioned as a way to cite sources is a bibliography. **Therefore, answer choice (D) is the correct answer.**
5. Lines 6-9 state “Plagiarism is easily facilitated by numerous websites that offer essays on subjects likely to come up in a variety of classes.” As mentioned in question 2, this means that plagiarism is made easier by websites that offer essays on common college subjects. The passage also says that many times students don’t understand the source material to a degree that will allow them to properly cite and integrate them into their own work. This would imply that some of the time, plagiarism occurs because students are a bit overwhelmed with the complexity of scholarly sources. Based on this, we can infer that plagiarism is often made easier by vast internet resources and overwhelmed students. **Therefore, answer choice (A) is the correct answer.**
6. The passage as a whole focuses on highlighting the ways that students unintentionally plagiarize while writing essays and educating them on ways they can try to avoid doing this. The author gives examples of unintentional plagiarism such as self plagiarism and improper paraphrasing. Overall the author seems to care most about helping people understand the ways that students unintentionally plagiarize and how they can avoid them in the future. **Therefore, answer choice (A) is the correct answer.**

## Passage 22

1. The main purpose of the passage is to investigate why some parents don’t always feel comfortable showing the world that they have a nanny. The passage talks about how many families will not include the nanny in the family pictures and some of the reasons why they do this. The passage does not condemn parents for treating nannies poorly, instead it offers explanations as to why some parents take certain actions, so answer choice (A) is incorrect. The passage does not try to persuade the reader of anything and instead focuses on exploration, so answer choice (B) is incorrect. While the passage does go over the role and duties of nannies, that is a small section of the passage and not the main focus, so answer choice (D) is incorrect. The purpose of the passage is to explore why

some parents are uncomfortable with being open about having a nanny. **Therefore, answer choice (C) is the correct answer.**

2. Lines 20-22 state “It is perhaps odd, then, that nannies are often conspicuously absent from the photos shared on social media.” This sentence is referring to the fact that it is odd for nannies to not be in social media posts when they are such an important part of the lives of the children they care for. Maliciously means something done with bad intent, and nothing in the passage implies that parents do this with a bad intention, so answer choice (B) is incorrect. Frequently means that something happens a lot, and while parents may leave the nanny out of social media posts frequently, this is not the best choice for this question, so answer choice (C) is incorrect. The passage does not imply that leaving nannies out of social media posts is wrong, so answer choice (D) is incorrect. Since the nannies are such a big part of the lives of the children they care for, you would think that the parents of those children would want to bring attention to how important they were by including them in photos, but this is not the case. The sentence is trying to say that it is odd that nannies are left out of social media posts in a clearly visible, or noticeable, way. **Therefore, answer choice (A) is the correct answer.**
3. Throughout the passage, the author explores different reasons why some parents are hesitant to include their nannies in family pictures and social media posts. The author goes over the role most nannies play in these families and the complicated nature of this role in a familial setting. He/she explains why some parents don’t like to be open about the fact that they employ a nanny and gives examples of ways they try to avoid this. Overall, the author seems to care most about educating the reader on the role of a nanny and the complexities of their role in the family. **Therefore, answer choice (C) is the correct answer.**
4. Lines 42-45 state “The parents may feel a sense of guilt that they are abdicating too much of their parental responsibility to an outsider.” Right before this sentence the passage says that one reason parents might not be open about having a nanny is that it makes it clear that the parents need help in raising their child. The word “abdicating” is referring to what the parents feel guilty about by hiring a nanny. If the parents don’t want people to know that they need help raising their child, it would make sense that they would feel guilty about giving up too much of their parental responsibility to an outsider, in other words, they feel guilty for abandoning their responsibility. **Answer choice (B) is the correct answer.**
5. In the final paragraph of the passage, the author highlights the important role nannies play in many families and the fact that parents shouldn’t be embarrassed about this. The author is trying to show that having a nanny should not be a shameful thing and that it does not lessen the accomplishments of parents who hire one. He/she is trying to stress that some parents might have misguided beliefs that lead them to pretend that their nanny does not exist. **Therefore, answer choice (B) is the correct answer.**

6. We are looking for the answer choice that is NOT mentioned in the passage as a reason why some parents downplay the presence of their nanny. Lines 23-26 state “One reason the presence of a nanny is often downplayed is that families may be uncomfortable with the level of privilege having a nanny implies, so answer choice (B) is incorrect. The fourth paragraph talks about the liminal position that nannies occupy in the family. The paragraph explains that it can be potentially awkward that nannies are paid but still love and care for the children of the family because people usually don’t associate love with monetary compensation. This means that the nanny is occupying a conflicting role in the family, so answer choice (C) is incorrect. The third paragraph in the passage talks about parents not wanting to be open about having a nanny because they don’t want people to know they need help parenting. Having a nanny makes it clear that they do need help and many parents feel guilty about not being able to have a career and parent without assistance. The paragraph focuses on the fact that many parents don’t want to feel like they aren’t adequate parents because they have a nanny, so answer choice (D) is incorrect. The only reason why some parents downplay the presence of their nanny that is not mentioned in the passage is that parents are worried that their children will love the nanny more than them. **Therefore, answer choice (A) is the correct answer.**

### Passage 23

1. The primary point of the passage is to educate readers and explore the pros and cons of working a part-time job while attending college. While the passage does mention that the cost of college has increased in today’s world, the passage does not encourage parents to provide more financial support to their kids, so answer choice (A) is incorrect. Nowhere in the passage does it criticize students who are trying to pay off their debt while enrolled in college, so answer choice (B) is incorrect. While the passage does talk about how expensive college is, it doesn’t focus on how to avoid debt specifically, so answer choice (D) is incorrect. The main point of the passage is to evaluate the costs and benefits of working and paying off debts while enrolled in college. **Therefore, answer choice (C) is the correct answer.**
2. We are looking for the answer choice that is NOT a reason students should limit how much they work based on the passage. The second paragraph in the passage talks about how meaningful learning is a very involved process and takes a lot of time and effort. The paragraph also says that working too many hours could be counterproductive to the goal of learning. Answer choice (A) is incorrect because we can infer that if meaningful learning takes a lot of time and effort that working too many hours would be detrimental to this because it would potentially tire out a student to a point where they could not study effectively. Lines 35-39 state “A job on campus is ideal because it eliminates the need for commuting (for those students who live on campus), and a campus employer would understand that student-employees are students first.” If an on campus job is ideal because it eliminates the need for commuting, we can infer that commuting is problematic because it can take up a lot of educational time, so answer choice (C) is incorrect. Lines 14-17 state “As expensive as college is, it is unlikely most full time college students making minimum wage or not much more will be able to put a significant dent in their college costs.”, so answer choice (D) is

incorrect. Based on the passage, students not enjoying working while in school is not a reason they should limit how many hours they work. **Therefore, answer choice (B) is the correct answer.**

3. Lines 18-20 state “It is more likely that working too many hours would negatively impact a student’s learning experience.” The paragraph goes on to say that meaningful learning takes a lot of time and effort, so we can infer that working while attending college would allow less time for learning, which is detrimental. **Answer choice (C) is the correct answer.**
4. While talking about the importance of a college degree, lines 25-28 state “They will do better competing against other graduates in the job market if they’ve developed strong writing, research, and critical thinking skills.” This sentence tells us that the author believes that the skills you learn in college are very important to helping you get a job when you graduate. Lines 51-55 state “The educational potential of college is too important to risk diluting by working too many hours at a job that will not come close to paying for the cost of college anyway.” This sentence emphasizes the author’s belief that the educational potential of college is immensely important. Between these two sentences and the rest of the passage as a whole, we can infer that the author would most likely agree that the skills you learn in college can be invaluable throughout your life. **Therefore, answer choice (A) is the correct answer.**
5. Lines 51-55 state “The educational potential of college is too important to risk diluting by working too many hours at a job that will not come close to paying for the cost of college anyway.” Based on the fact that the entire passage is about how working a part time job might not be worth it while enrolled in college because of the negative impact it could have on a student’s education, we can infer that the word “diluting” in this sentence means lessening, or weakening. **Answer choice (B) is the correct answer.**
6. Throughout the passage the author is trying to show the reader that the costs of working a part time job while enrolled in college probably outweigh the benefits. The author argues that college work takes a lot of time and effort and a student probably won’t be able to pay off their loan debt with a part time job anyway. Overall the author’s tone throughout the passage can be described as persuasive or convincing. **Therefore, answer choice (A) is the correct answer.**

## Passage 24

1. The main focus of this passage is examining the pantsing vs. the plotting style when writing a novel. The author goes over the characteristics of both and gives examples of writers who fall into each category. At the end of the passage, after going over the pros and cons of each style, the author says that each method has its merits and that the method you decide upon is the method that helps you write the best story possible. Based on the text, the author hopes the reader will learn that there is no single, correct path to writing high-quality fiction. **Therefore, answer choice (B) is the correct answer.**

2. The primary point of the passage is to explore and examine two distinct methods of writing a fiction novel. The passage describes the processes of each method and gives examples of authors who employ them. While the passage does explore two writing methods, it does not advocate for any particular style, so answer choice (A) is incorrect. The passage doesn't stress the importance of any particular step of the creative process over the other, so answer choice (C) is incorrect. The passage does not focus on encouraging young people to write, so answer choice (D) is incorrect. The main point of the passage is to present two equal and opposite creative processes. **Therefore, answer choice (B) is the correct answer.**
3. The final paragraph in the passage concludes that the best method for writing a novel really depends on the writer's style. Lines 70-72 state "The method that you decide upon before you write your story relies entirely on you and your creative vision." It can be safely inferred from the passage that pantsing and plotting are equally effective writing methods depending on the writer's personality and discipline. **Therefore, answer choice (D) is the correct answer.**
4. Lines 29-31 state "However, those who argue against plotting often argue that the act of planning the story from the beginning stifles creativity." If people who are arguing against plotting say that it stifles creativity, we can infer that stifling creativity is a negative thing. When writing a fiction novel you need to be creative so something that reduces creativity would be negative. Suffocates is the best synonym for the word "stifles." **Therefore, answer choice (C) is the correct answer.**
5. Lines 44-49 state "You may ask why a writer would begin writing a story that hasn't been planned. The answer is that many pantsers believe that planning a story is the equivalent of choking it of the ability to manifest organic surprises." To understand what "manifest organic surprises" means, let's look at the words surprise and organic. Organic means something natural or original and surprise means something unexpected or shocking. So we can assume that manifest organic surprise must have something to do with developing naturally unexpected aspects of a novel. This is in line with how pantsers view the writing process, as they don't believe you can know where a novel is going until you get there and to plan it out would deprive the end reader of the spontaneity that occurs when you write as you go. Based on that we can infer that manifest organic surprise most likely refers to the potential for a novel to surprise its readers naturally and spontaneously. **Therefore, answer choice (C) is the correct answer.**
6. The author includes this sentence to reinforce that he/she does not believe one method of writing is superior to the other. The author believes that the method you chose to write a novel just depends on what works best for your personality and that writing is an individual process. **The sentence in question stresses this fact, so answer choice (D) is the correct answer.**

### Passage 25

1. The main purpose of the passage is to examine the belief that the media we consume influences us. The passage argues that this belief is not a modern one, but one that had existed for hundreds of

years. While the passage does show that some aspects of Jane Austen’s novels are still relevant to today’s problems, the passage focuses on the idea that the media influences our actions and not Austen’s novels as a whole, so answer choice (A) is incorrect. The passage doesn’t argue that overconsumption of media negatively affects today’s culture, so answer choice (B) is incorrect. While the passage does talk about how one of Austen’s characters in her novel believes that another character should consume poetry in moderation, this is a small portion of the passage, so answer choice (D) is incorrect. The main purpose of the passage is to show that people questioned the impact of media in the past and still do today. **Therefore, answer choice (C) is the correct answer.**

2. In the third paragraph we read about one of Jane Austen’s characters, Anne Elliot. In the novel *Persuasion* Elliot tells her friend Captain Benwick that she hopes he reads genres other than poetry. She does this because she believes that the people who can completely and fully feel and understand poetry are the same ones who should only read it sparingly. Anne is worried that by reading so much poetry, Captain Benwick will “amplify his melancholy”; this is the same as saying the poetry might increase his grief. **Therefore, answer choice (A) is the correct answer.**
3. Lines 10-11 state “We then bemoan the modern degradation of art and culture.” This sentence is referring to what happens in the aftermath of a shocking example of destructive behavior. The public wonders if some form of negative or violent media played a part in influencing the perpetrator of this behavior. Therefore, we can infer that bemoaning the modern degradation of art and culture most likely means mourning, or feeling badly about, the modern degradation of art and culture. We are looking for the antonym of the word bemoan, so we are looking for the opposite of mourning or feeling badly about. **Celebrate is the opposite of mourn, so answer choice (B) is the correct answer.**
4. The second paragraph introduces the reader to the idea that the concern over the impact of certain media is not just a modern one. The paragraph goes on to bring up a two hundred year old novel by Jane Austen that talks about media's impact on people. The organization of this paragraph could best be described as an introduction of a modern issue and a comparison to a literary example. **Therefore, answer choice (A) is the correct answer.**
5. Lines 29-31 state “Anne grew alarmed at how deeply the lines of poetry Benwick recites echo and perhaps even amplify his melancholy.” This sentence is referring to the fact that Anne is worried that reading and reciting poetry is adding to and possibly intensifying Captain Benwick’s sadness about his fiancée. **A synonym for the word amplify in this sentence would be increase, so answer choice (B) is the correct answer.**
6. The main question the author is trying to answer in this passage is is all media just mindless entertainment or can it have an effect on our behavior and mindset. Throughout the passage the author argues that media does affect our behavior and that this is not just a modern issue, but one

that has existed for hundreds of years. Through literary examples the author indicates that certain media can affect our behavior. **Therefore, answer choice (A) is the correct answer.**

### Passage 26

1. The central purpose of the passage is to educate readers on the benefits of buying their meat from smaller local farms. The passage goes over the health benefits of buying meat this way as well as other positive aspects. While the passage does mention that there is concern that purchasing meat from large supermarket chains can pose a greater health risk, the passage aims to inform the reader rather than convince, so answer choice (A) is incorrect. The passage doesn't try to combat consumerism but instead it provides an alternative perspective on where to buy meat from, so answer choice (B) is incorrect. While the passage does mention some consequences of commercially-raised meat, it does not list all the antibiotics, pesticides, and consequences specifically, so answer choice (D) is incorrect. The main purpose of the passage is to examine the reason that purchasing and consuming meat raised on smaller farms can be the healthiest option. **Therefore, answer choice (C) is the correct answer.**
2. Throughout the passage the author talks about the potential health benefits of purchasing and consuming meat raised on small local farms. He/she talks about the risks of food-borne illness and pollution created by large factory farms that can pose health risks to consumers. The author also talks about the biggest challenge for most people when trying to buy meat this way, which is convenience. He/she mentions that it might entail a separate trip to the store and some extra research to find these smaller farms, but that the health benefits are worth it. Overall we can reasonably infer that the author would agree that increasing the availability of these small-farm products would improve overall population health. **Therefore, answer choice (A) is the correct answer.**
3. Lines 3-7 state “What they may not offer, however, are meat products from smaller, organic farms that eschew conventional factory-inspired mass-production methods.” This sentence is referring to the type of meat that modern supermarkets can provide consumers. The word “eschew” is describing something that small organic farms can do. The main point of the passage is to show how small organic farms can produce meat without many of the concerns that arise in large-scale factory farms. Essentially, small organic farms can avoid conventional mass-production methods. **The word eschew in line 6 means avoid, so answer choice (C) is the correct answer.**
4. Lines 77-82 state “Researching such farms will yield purchasing options beyond those offered by the typical supermarket, and supermarkets themselves may provide more diverse options as they continue to gauge consumer interest.” This sentence is talking about consumers doing their own research to find small local farms. The sentence says that supermarkets themselves might start providing more diverse options when it comes to buying meat. The word “gauge” is referring to the reason supermarkets would start offering these options. Most businesses try to provide products that meet the wants and needs of the customers. The way they figure this out is by observing and

measuring consumer demand and interest. We can infer then that the word gauge most nearly means measure. **Therefore, answer choice (B) is the correct answer.**

5. We are looking for the answer choice that is NOT true based on the passage. Lines 43-47 state “When cattle are fed grass, however, the acid-resistant strains of E. coli they may be carrying are drastically reduced, thus decreasing the chance that humans will be infected.”, so answer choice (A) is incorrect. Lines 20-24 state “They are tightly packed and produce a huge amount of waste. This makes it more likely for the animals to become ill and pass their illness on to their neighbors.”, so answer choice (B) is incorrect. The passage implies that the biggest challenge facing consumers and supermarkets when it comes to purchasing meat from local farms is availability. Supermarkets usually buy in large quantities that are hard for small farms to accommodate and consumers have to do extra research and take extra time to find these farms. This means that both supermarkets and consumers would benefit from an increase in availability of small farm meat, so answer choice (C) is incorrect. The only statement that is not true based on the passage is that the use of growth hormones and antibiotics is the main cause of illness in meat eating populations. **Therefore, answer choice (D) is the correct answer.**
6. Throughout the passage the author is providing information to the reader on the potential benefits of purchasing and consuming meat raised on small organic farms. He/she backs up these claims with evidence and facts. Overall the tone of the passage is best described as explanatory as the author is trying to explain a view he believes. **Therefore, answer choice (A) is the correct answer.**

### Passage 27

1. The main point of the text is to examine the creation and evolution of an important art form known as a triptych. The passage discusses the aspects of a triptych that make it different from a regular painting and compares two famous triptychs to illustrate how triptychs matured over centuries. While the author of this passage most likely appreciates triptychs, the point of the passage is not to instill an appreciation but to inform, so answer choice (A) is incorrect. While the passage does explain that triptychs are different from paintings, it does not go into detail about the technical differences, so answer choice (C) is incorrect. While the passage does discuss two triptychs from history, it does not mention if they were the most important or focus on this as a distinguishing factor, so answer choice (D) is incorrect. The central point of the text is to explore the development of the triptych as an art form and a movement. **Therefore, answer choice (B) is the correct answer.**
2. The passage tells us that over time, triptychs evolved and became more sophisticated. In the 15th century they were simple and followed basic rules. Many triptychs of the time depicted religious symbolism as the Catholic Church funded and supported their creation. We can see how understanding triptychs from this time would help us to understand the culture that existed when they were created. Lines 58-62 state “Many art historians now argue that the value of the triptych

can be seen in establishing an artistic and cultural movement that led to the foundation of late Gothic and Early Netherlandish art styles.” This sentence further supports the idea that the triptych helped to establish artistic and cultural movements. Based on this we know that an understanding of triptychs is helpful in understanding European cultural development. **Therefore, answer choice (B) is the correct answer.**

3. While talking about the conventional rules of the triptych, lines 53-56 state “...the main subject contained solely in the central panel, and little focus on the flanking panels...” We know from the passage that a triptych is made up of one central square panel and two rectangular side panels, one attached on each side. We can infer then that the word flanking refers to the two side panels being attached to the central panel. **Therefore, answer choice (A) is the correct answer.**
4. The third paragraph in the passage talks about how triptychs evolved from the 15th century to the 16th century. It states that early examples of triptychs were more basic and followed a set of unwritten rules but that later examples were able to be more unconventional. The passage tells us that during this time there was an overwhelming brand of religious art due to the fact that the Catholic Church funded and supported its creation. As artists became more creative and took more risks creating triptychs, we can infer that the ideas represented in them were more bold and extreme, and, because religion was so influential to the art of the time, we can infer that many of those ideas were centered on religion. **Answer choice (D) is the correct answer.**
5. Lines 51-57 state “No longer were artists confined to the conventional yet unwritten rules of the triptych---the main subject contained solely in the central panel, to be read sequentially from left to right, and little focus on the flanking panels---thus setting the foundation of more audacious and bold pieces.” This sentence tells us that once artists no longer had to follow the “conventional” rules about triptychs, they were free to be more bold and expressive in their art. The word conventional is referring to the rules that shaped what a triptych customarily was. Another word for customarily is traditionally, so the word conventional is a synonym for traditional. **Answer choice (D) is the correct answer.**
6. Lines 10-15 state “By creating a panorama of images across three panels abreast one another, the triptych offers an opportunity to artists that the traditional painting could never satisfy---the telling of a story from one piece to the next.” The author believes the most important difference between a triptych and a painting is the ability for a triptych to tell a story. **Therefore, answer choice (A) is the correct answer.**

### Passage 28

1. The passage begins by introducing the reader to the concept of myths and a common myth that perpetuates our society in America today: that America is a classless society. The author examines this myth and talks about why it is important to both acknowledge this issue and work on ways to

change it. Therefore, the passage can best be described as a reflection on the necessity of both recognizing and actively fixing a social issue. **Answer choice (A) is the correct answer.**

2. Throughout the passage, the author talks about the fact that hard work and determination are not all that is needed to change one's financial circumstances. Even with hard work and determination, many of the advantages the wealthy already have make it increasingly hard for a “regular guy” to succeed beyond his wildest dreams. The author emphasizes that we need to change policies that benefit only the wealthy in our society if we want to fix this problem. The final line in the passage states “We need politics to support the majority of the citizens, not just those who are already stable and wealthy.” This is an exclamation point on the passage as a whole and illustrates the author’s belief that we need to take active steps to encourage the economic success of vulnerable citizens. **Answer choice (D) is the correct answer.**
3. Lines 30-32 state “We have a huge disparity of wealth with the vast amount of it concentrated with a relatively small number of people.” This sentence is referring to the fact that a small percentage of the population holds a very large percentage of the wealth in this country. The word disparity is referring to the difference in wealth between the upper and lower classes. We know there is a huge gap in wealth, so the word disparity most nearly means gap. **Answer choice (A) is the correct answer.**
4. We are looking for the statement which is NOT true based on the passage. Lines 32-34 state “We also lack the economic mobility that we like to think we have.”, so answer choice (A) is incorrect. The main point of the passage as a whole is that there are many factors outside of hard work and determination that have an impact on one's ability to become successful and change their wealth. These factors include policies and benefits that the wealthy enjoy and the lower classes simply cannot, so answer choice (B) is incorrect. While discussing policies that allow the perpetuation of advantages among the wealthy, lines 42-43 state “An example is legacy university admissions or tax breaks for the wealthy under the misguided notion that these advantages will somehow “trickle down” to the rest of us.” Tax breaks would be considered governmental policies, so answer choice (D) is incorrect. The only statement not supported by the passage is that the class, race, and family situation of an individual completely determine their economic flexibility. **Therefore, answer choice (C) is the correct answer.**
5. Lines 46-49 state “Stories of the underdog who starts with nothing or who is just a ‘regular guy’ but nonetheless succeeds beyond his wildest dreams are very captivating.” Stories such as the one referred to in this sentence are usually pretty interesting and entertaining to hear, so we can infer that captivating means interesting and/or entertaining. Something that is interesting is able to hold or attract our attention, so the opposite of this would be unattractive. **Answer choice (B) is the correct answer.**
6. At the start of the passage, the author introduces the reader to a pervasive cultural myth in today's society. He/she then goes on to show why that myth is untrue with arguments based on examples

and facts. The author argues that without active steps to change social policy, the problem he/she feels is facing our country will continue to exist. Based on this, the best way to describe how the passage is organized is a debunking of a myth to posing a social policy argument. **Therefore, answer choice (B) is the correct answer.**

### Passage 29

1. The primary purpose of the passage is to show how a woman found refuge in a coffee shop during a large rainstorm. The passage does not try to persuade the reader of anything, it simply tells a story, so answer choice (A) is incorrect. While the passage does talk about one way to escape a storm, it doesn't try to explain it but rather just shows how someone else did it, so answer choice (C) is incorrect. While the passage does describe the atmosphere of the coffee shop, this is not a large portion of the passage and is not the main point, so answer choice (D) is incorrect. The main purpose of the passage is to show the feeling of finding comfort in an unfortunate situation. **Therefore, answer choice (B) is the correct answer.**
2. **The correct answer is choice (A) observant and bookish.** Observant means quick to notice things. Throughout the passage the girl notices many things about the coffee shop. For example, she noticed the rickety chair in the corner that no one else had decided to sit in, she noticed the other patrons seemed to be less bothered by the rain now that they were in the coffee shop, and she noticed a drenched man enter the coffee shop to meet up with his friends. Bookish means devoted to reading. The end of the passage illustrates that the girl likes to read by telling us that she pulled out a large book and thought to herself *"I've got more than enough to keep me occupied."*
3. We are looking for the answer choice that is NOT true. Lines 6-9 state "She hunched down and lowered her face further, the way was familiar to her and she knew she was almost at her destination." The girl would only know the way and know that she was close to her destination if she had been to the coffee shop before, so answer choice (A) is incorrect. Throughout the passage the rain is described as "apocalyptic" and the "worst storm is years!" We know it had been raining hard when the girl got there and still was at the end of the passage, so answer choice (C) is incorrect. Lines 23-28 state "The line was daunting, but the employees moved with a practiced efficiency and soon she found herself at the front of the line and only a couple of minutes later she gratefully wrapped her hands around a blissfully warm cup of coffee." We know the cafe was busy because the line was daunting and the employees still worked efficiently, so answer choice (D) is incorrect. The only statement that we don't know is true based on the passage is the girl enjoys reading world literature. **Therefore, answer choice (B) is the correct answer.**
4. Lines 54-56 state "The rain continued unabated. 'Worst storm in years!' opined the man who had recently found his friends." The word opined comes after the man describes the storm as the worst in years. The exclamation point implies emphasis and lets us know that the man said this with confidence and enthusiasm, so answer choice (D) is incorrect. The man didn't seem angry when he said this, so answer choice (C) is incorrect. Nothing about the sentence implies that the man said

this with any regret, so answer choice (A) is incorrect. The word opined more nearly means the man declared this assuredly. **Therefore, answer choice (B) is the correct answer.**

5. Lines 32-38 state “She set her bag and coffee down and then fished a notebook out of her bag. It was the perfect thickness to support the too-short chair leg which probably bore a great deal of the blame for the seat’s unpopularity with the coffeehouse patrons.” The reason the girl pulled out her notebook was to prop up the chair she was sitting in and make sure it was functioning correctly. **Therefore, answer choice (B) is the correct answer.**
6. Lines 32-38 state “She set her bag and coffee down and then fished a notebook out of her bag. It was the perfect thickness to support the too-short chair leg which probably bore a great deal of the blame for the seat’s unpopularity with the coffeehouse patrons.” The likely reason the table and chair were still open when the girl arrived is because one of the chair’s legs was too short. **Therefore, answer choice (D) is the correct answer.**

### Passage 30

1. Throughout the passage, the author talks about the science of getting rich. He/she argues that in order to be everything you can be in life, you need to get rich in order to have access to as much as possible. The passage implies that no man can be truly successful without accumulating wealth because life today has advanced so far, and become so complex, that even ordinary people need a great amount of money to live a life that is even a bit complete. Overall, the passage can be summarized as a look at the connection between wealth and success. **Therefore, answer choice (B) is the correct answer.**
2. The entire purpose of the passage is to argue that without money, no person can truly live a successful complete life. Lines 4-6 state “No man can rise to his greatest possible height in talent or soul development unless he has plenty of money...” The passage is saying that personal development is dependent on money. **Therefore, answer choice (A) is the correct answer.**
3. The first sentence in the passage states “Whatever may be said in praise of poverty, the fact remains that it is not possible to live a really complete or successful life unless one is rich.” Right from the start, the author rejects a way of thinking that some people have. He/she then goes on to explain why the way people should view the world and the things they should focus on. Therefore, the organization of the passage can best be described as the rejection of common knowledge followed by an explanation of a new way of thinking. **Therefore, answer choice (C) is the correct answer.**
4. The passage focuses on the idea that without money a person can not live a complete and successful life. Throughout the passage the author makes claims about this belief as if they are commonly accepted knowledge. For example, lines 16-18 state “The object of life is development; and everything that lives has an inarguably right to all the development it is available to achieve.”

The author does not ask the reader what the object of life is and then proceed to give an answer, he/she just flat out tells the reader what the object of life is. There are many more examples within the passage of this type of writing and it creates an overall matter-of-fact tone throughout the passage. **Therefore, answer choice (B) is the correct answer.**

5. If we look at the sentences surrounding the phrase “unfold the soul” we see that the author is talking about achieving personal growth and development. One way to achieve personal growth is to understand your own self better and saying unfold the soul is a creative way to imply this. The act of unfolding something means to open it up or unbundle it, usually to see what’s inside or depicted on something. For example, if you are looking at a t-shirt at a store, you might unfold it to see what the design of the shirt is. Unfolding something usually leads to a better understanding of whatever that thing is, so we can infer that when the author says unfold the soul, he/she is saying we can better understand the many layers of one’s self and soul. **Answer choice (D) is the correct answer.**
6. We are looking for the answer choice that the passage does NOT strive to achieve. The overall theme of the passage is that money is the key to success and personal achievement. The author encourages people to understand the science of getting rich and argues that it is a person's right to become wealthy. The author asserts that the purpose of life is development and the only way to achieve full development is through the accumulation of things that cost money. The only thing the passage does not do is try to provide any sort of moral support for those who wish to live modestly, instead it argues that being content with less than the most you can achieve is sinful. **Therefore, answer choice (D) is the correct answer.**

### Passage 31

1. The main purpose of this passage is to argue that restaurants should do away with tips for servers and instead charge a little more for menu items in order to pay servers a fair hourly wage. The passage backs this argument up with well thought out explanations and reasons that the perceived negatives of this change are actually not much of a concern. The passage is mainly focused on arguing for increased hourly wages for restaurant servers and the elimination of tipping culture. **Therefore, answer choice (D) is the correct answer.**
2. As previously stated, the main purpose of this passage is to argue for higher wages for restaurant servers in place of tips. The passage argues that currently servers' income is too dependent on tipping which can lead to inconsistent earnings and puts servers' livelihood at the mercy of customers. The passage aims to suggest changes that would make payment practices in wages and tipping more equitable for servers. **Therefore, answer choice (C) is the correct answer.**
3. The passage argues that currently many servers have to have multiple jobs to be able to support themselves financially. The passage states that servers have to work multiple shifts and many times are worn out or stressed because of this. Getting rid of tipping as a form of payment for servers and

paying them a livable wage would decrease the need for this and allow servers to be more productive and lower their stress levels. Some people think that getting rid of tips would lead to lower incentives to provide good customer service, but the passage argues the result would be the opposite. Servers would be more appreciative of their job and pay and not want to lose it, so they would work just as hard if not harder to keep customers satisfied. According to the passage, servers would most likely be more satisfied in their jobs if they were able to earn a living wage. **Therefore, answer choice (A) is the correct answer.**

4. Lines 37-39 state “Servers’ financial security should not be at the mercy of fickle customers.” This sentence is referring to the idea that servers make most of their money in tips, so if a customer is unhappy or just decides to leave a bad tip, the server loses out on substantial money. The passage states that unhappy customers often don’t tip but that even customers who appear to be completely satisfied with the service will sometimes not leave a tip either. The word “fickle” is referring to this unpredictable nature of customers. **Therefore, answer choice (A) is the correct answer.**
5. We are looking for the answer choice that is NOT true based on the passage. Lines “27-31 state “Servers make minimum wage, which by itself is not adequate compensation for constantly running back and forth to ensure timely delivery of beverages and multiple stages of a meal for numerous tables.” This sentence is saying that servers’ jobs are demanding and is arguing they should be able to make at least a livable wage, so answer choice (A) is incorrect. The main argument of the passage is that restaurants should pay their servers more and get rid of tipping cultures. In lines 34-37, the passage states, “In some states, servers make even less than minimum wage because of the expectation that tips make up the difference.” This tells us that some restaurants sometimes take advantage of this tipping culture and pay their employees less, so answer choice (C) is incorrect. One of the main arguments against eliminating tipping is that servers would no longer care about customer satisfaction. The passage argues that this is not the case and better job satisfaction would lead to a more competitive market for servers and longer term employees, so answer choice (D) is incorrect. The only thing that isn’t true based on the passage is that customers cheat servers out of money and decrease their employment satisfaction. **Therefore, answer choice (B) is the correct answer.**
6. The last paragraph in the passage is a good conclusion to the overall argument the author is trying to make. The first sentence in the paragraph states “Ultimately, replacing tipping with a higher hourly wage will not lead to a decline of service quality.” The author goes on to outline how this change will actually be beneficial for all parties involved: the restaurant, the server, and the customer. It can be reasonably inferred from this last paragraph that the author would support a change in laws that would require restaurants to pay servers minimum wages. **Therefore, answer choice (C) is the correct answer.**

**Passage 32**

1. The main idea of the passage is that the damage and destruction that is caused by wildfires is a lot more than people understand. The passage explains how wildfires devastate not only a region's natural beauty, but many man made structures as well. While climate change might be one of the reasons for increased wildfires, the passage does not mention this, so answer choice (A) is incorrect. While the passage mentions that the firefighters are working tirelessly to contain the fires, this is just the last line of the passage and not the main focus, so answer choice (B) is incorrect. While the author is able to be cool and safe as he/she does not live near enough to the wildfires to have to evacuate, some people do not have this choice and the passage acknowledges that, so answer choice (D) is incorrect. Overall the main idea of the passage is that wildfires are more devastating than many people realize. **Therefore, answer choice (C) is the correct answer.**
2. The main purpose of this passage is to inform readers about the destruction that wildfires can cause. The speaker describes how wildfires can destroy large swaths of land filled with natural beauty and threaten many man made structures in the surrounding areas. The speaker seems to care most about representing the devastation of wildfires to readers. **Therefore, answer choice (A) is the correct answer.**
3. The first sentence of the passage states “The sky is a dull post-apocalyptic orange, unnatural, like this heat.” The narrator is describing what the sky looks like because of the wildfires that are raging somewhere near where he/she lives. Although the narrator says that he/she lives relatively far away from the most dangerous areas, it is clear that he/she can still see the effects of the wildfires (ie. the orange sky) from where he/she lives. **Therefore, answer choice (A) is the correct answer.**
4. Throughout the passage, the author describes the destruction and devastation that the wildfires are causing and potentially could cause to the surrounding area. The narrator talks about how people have to evacuate and animals are forced to flee to avoid the heat. Obviously living close enough to see the effects of the wildfires is concerning for the narrator but he/she describes the scenes and explains the potential devastation in a calm and informative manner. Overall the tone of the passage can best be described as concerned but calm. **Therefore, answer choice (B) is the correct answer.**
5. While talking about the rain that everyone hopes will come, lines 55-57 state “We can imagine nature’s cooling balm misting down from the sky and quelling the flames.” We know that rain would help with the wildfires and the water would put out or at least slow down the flames, so we can infer that the word quelling means to slow down or calm the flames. **Answer choice (A) is the correct answer.**
6. We are looking for the answer choice that can NOT be reasonably inferred from the passage. The third paragraph in the passage talks about the area that is being most affected by one of the wildfires, an area between Washington and Oregon. The paragraph says that not only in the natural

beauty of the land being destroyed, but that significant man made structures like the Multnomah Falls Lodge are threatened as well, so answer choice (A) is incorrect. The final sentence in the passage states “Hopefully, the rain will arrive to help the thousands of firefighters tirelessly striving to contain the flames and halt the destruction.” We can infer that not only are the firefighters helping to fight the fire but also provide relief to some of the victims, so answer choice (C) is incorrect. The third paragraph also talks about the communities surrounding places like Multnomah Falls. The paragraph talks about how it is a well-loved tourist destination that has not had its natural beauty blemished. We can infer that this will affect the tourism business of the town and have lasting emotional and physical effects on the community, so answer choice (D) is incorrect. The only thing we can’t infer from the passage is that the government does not always have the ability or means to evacuate everyone from a wildfire. **Therefore, answer choice (B) is the correct answer.**

### Passage 33

1. The primary purpose of the passage is to educate readers on the benefits of yoga versus trendy exercise routines that fizzle out quickly. While the passage does mention that yoga doesn’t have to be intimidating and many local yoga studios offer beginner packages, the passage does not try to convince anyone to do anything, so answer choice (A) is incorrect. While the passage does talk about how many yoga celebrities might misrepresent what a yoga class is actually like, the passage does not condemn them, so answer choice (C) is incorrect. While we can infer that the author of the passage would probably believe you should not be embarrassed to try new things, the passage itself does not focus on this directly, so answer choice (D) is incorrect. The main purpose of this passage is to briefly inform readers of the benefits and accessibility of yoga as exercise. **Therefore, answer choice (B) is the correct answer.**
2. Lines 25-31 state “When we think of yoga, we often think of lithe, beautiful twenty-something women in impossible poses, and indeed, many yoga celebrities or aspiring celebrities use social media to broadcast professionally rendered pictures of themselves performing astounding feats of strength and flexibility.” The word “lithe” in this sentence is describing the young yoga celebrities that post pictures on social media who are holding impossible poses. If we think about what most people think of when they think of these women, it’s a thin and flexible person contorting their body. The word lithe in this sentence most nearly means flexible. **Answer choice (B) is the correct answer.**
3. The main purpose of this passage is to inform readers about yoga's effectiveness and accessibility. The author stresses that yoga isn’t as intimidating as some of the yoga celebrities make it seem and that if you are interested in trying it out, many local yoga studios offer beginner packages. He/she emphasizes that during a yoga class the instructor will offer modifications for those who might not be able to perform the pose or who just don’t feel up to it on that day. The author seems most concerned with helping readers understand that yoga can be for anyone who wants to do it. **Therefore, answer choice (A) is the correct answer.**

4. The entire passage is focused on informing the reader about the benefits of yoga as an exercise. The passage identifies why yoga has been around so long and been successful for so many people. The final sentence in the passage states “A regular yoga routine will lead to improved fitness and reduced stress, two things just about everyone needs!” A regular practice implies that someone practices yoga on a regular basis over the course of a reasonable amount of time and the benefits mentioned are just a couple of benefits mentioned that people can expect from yoga. Based on this it can be reasonably inferred that yoga has long-term benefits. **Therefore, answer choice (B) is the correct answer.**
5. We are looking for the answer that the author does NOT recommend. The first paragraph talks about how a new yoga student might feel intimidated about joining a yoga studio but that in reality they are much more approachable than most people realize. Besides this the passage as a whole lists many benefits of yoga and overall encourages readers to try it out, so answer choice (A) is incorrect. Lines “39-40 state “Practitioners are not encouraged to ‘feel the burn’ or push themselves unreasonably.” The author is recommending that you adjust your yoga poses to avoid physical discomfort, so answer choice (B) is incorrect. The third paragraph talks about how many yoga studios offer beginner packages that make it financially feasible for new students to try a few different studios until they find one that fits their needs, so answer choice (C) is incorrect. The only thing the author does not recommend is viewing yoga as a deeply spiritual practice. While he/she mentions that there is a spiritual aspect to yoga, there are studios that focus more on the physical practice. **Therefore, answer choice (D) is the correct answer.**
6. Overall the passage aims to inform the reader about a type of exercise that would be potentially beneficial to them. The passage gives recommendations about how to find and join a local yoga studio and what one can expect if they start a yoga practice. Overall the tone of the passage can best be described as encouraging because the author is trying to inspire people to start a new exercise routine. **Answer choice (B) is the correct answer.**

### Passage 34

1. The main purpose of the passage is to educate the reader on the life and feats of Alexander the Great. The passage describes his upbringing and how he conquered and united parts of the world like nobody before him. While the passage does mention that Alexander’s legacy can be seen in the synthesized cultures of Greece, Africa and Asia, it does not go into a detailed explanation of these cultures, so answer choice (A) is incorrect. While the passage does explain some of the reasons Alexander failed to conquer more of the world, this is a small portion of the passage and not the main focus, so answer choice (B) is incorrect. While the passage does allude to Alexander’s influence on today’s cultures, it does not try to help students of history trace these influences, so answer choice (D) is incorrect. The primary purpose of the passage is to convey the fascinating and unlikely history of one history’s greatest leaders. **Therefore, answer choice (C) is the correct answer.**

2. The fourth paragraph in the passage details some of Alexander’s military feats. Lines 34-36 state “Alexander accomplished countless extraordinary military feats that many thought to be impossible.” If Alexander was able to accomplish military feats thought to be impossible he must have been a brilliant military strategist. **Therefore, answer choice (C) is the correct answer.**
3. The final sentence in the passage states “However, his legacy would go on and continues to go on today, in the synthesized cultures of Greece, northern Africa, and Asia.” We know from earlier in the passage that Alexander had a great influence on all of these cultures throughout his life, so we can infer that the sentence is saying his legacy can be seen in all of these cultures. Another way of saying this is saying his legacy can be seen in the combined cultures of Greece, northern Africa, and Asia. **Therefore, answer choice (A) is the correct answer.**
4. The last paragraph in the passage discusses the ways in which Alexander changed the cultures of half the world. It tells us that he mixed traditions and customs in a way that no one had ever done before. The purpose of this passage is to highlight the impact that Alexander has on much of the world's history and culture. **Therefore, answer choice (C) is the correct answer.**
5. Lines 45-50 state “With such a long journey, he was forced to take on foreign troops from the countries he conquered, and the cultural differences between his Macedonian forces and his Persian forces caused dissent amongst his men.” The clue here is the fact that the troops came from different parts of the world and had different cultures. We can assume that these cultural differences would lead to misunderstandings and eventually disagreements. **Therefore, answer choice (A) is the correct answer.**
6. The main focus of the passage is the life and accomplishments of Alexander the great. The author tells us that Alexander accomplished military feats thought to be impossible. He defeated his enemies multiple times despite having less men and changed the world in ways that are still visible today. Based on this, we can assume the author would most likely agree with the statement Alexander is one of the most important military leaders in history. **Therefore, answer choice (B) is the correct answer.**

### Passage 35

1. The primary purpose of this passage is to examine the idea of the frontier and how it shaped the American identity. The passage explores how even though the frontier does not exist as it once did, we can still use the idea of the frontier as a metaphor for moving forward through innovation. While the passage does say the frontier no longer exists in the form it once did, the passage argues that there is a new frontier, so answer choice (A) is incorrect. While the passage does say that the frontier was a significant piece of the American identity, the passage doesn’t aim to explain this to people from different countries necessarily, so answer choice (B) is incorrect. While the passage does explain some of the philosophies behind frontier identities in America, it does so more to

show how we can use that moving forward, so answer choice (D) is incorrect. The main purpose of the passage is to explore the idea of a frontier as a metaphor for life and development in America moving forward. **Therefore, answer choice (C) is the correct answer.**

2. Lines 3-6 state “In it he argues that the frontier was the most significant component in the development of a uniquely American culture and personality.” This sentence is referring to a paper written by Fredrick Turner about how the frontier shaped the American identity. The word “component” is referring to what the frontier was in relation to the development of American culture. The paper was arguing that the frontier was a very important part of American culture, so the word component most nearly means part or piece. A synonym for these words would be aspect. **Answer choice (A) is the correct answer.**
3. The second paragraph in the passage tells us that the frontier as early generations of Americans knew it, no longer exists, but that there can still be a unifying feature, or modern day frontier. Lines 35-38 state “The concept of defining ourselves by our relationship to a frontier is still relevant but the frontier is now metaphorical more so than physical.” The passage goes on to say that we can use this idea of a frontier and define ourselves by innovation and discovery. The passage is saying that today’s frontier is more of a metaphor that we can still use to define our American culture today. **Therefore, answer choice (B) is the correct answer.**
4. The last paragraph in the passage is explaining that Americans can still define themselves through the frontier, but that today’s frontier is no longer a physical one but a metaphorical one. The paragraph talks about how through innovation and discovery and valuing knowledge, we can shape a better world. We can infer from this paragraph that the author believes people should be creatively constructive in their concepts of frontiers because while the new frontier is not a tangible concept, through creativity we can still use the idea of a frontier to shape how we live. **Answer choice (A) is the correct answer.**
5. Lines 44-48 state “We must also recognize our membership in a global community and innovate not for the sake of our country alone, but for the betterment of humanity and the world that sustains us.” The word “sustains” refers to the world in relation to America. The passage is saying that we have to innovate not just for America but to help the world that also helps us. Another word for help is support, so the word sustains is a synonym for supports. **Answer choice (B) is the correct answer.**
6. As stated in the previous answer, the final paragraph talks about how the modern idea of the frontier is a metaphor for continuing discovery and innovation. The author believes that we need to continue to value knowledge and use innovation to create a better world. The author believes that we must continue to push society forward not just for America’s sake, but for the sake of the global community as a whole, so he/she believes that the modern idea of the frontier should support global citizenship. **Answer choice (A) is the correct answer.**

**Passage 36**

1. The primary purpose of the passage is to explain to readers the idea that a garden can be created anywhere there is unused soil. The passage talks about the fact that any soil can be used to grow, you just have to find what grows best in the solid you have. The passage focuses more on being responsible for one's home plant populations rather than the entire earth's, so answer choice (A) is incorrect. While the passage does say the only way to keep land unproductive is to keep it moving, it does not scold anyone that keeps the earth moving, so answer choice (C) is incorrect. While the passage does talk about the growth and life of many plants, it doesn't really get into the meaning of this, so answer choice (D) is incorrect. The main point of the passage is to remind readers that a garden can exist in many places, no matter how bad the soil seems. **Therefore, answer choice (B) is the correct answer.**
2. The passage starts off with the speaker introducing the idea of a garden. The passage explains that a garden is the part of the home ground devoted to ornament, and the growing of vegetables and fruits. The passage goes on to talk about how any solid can be used to garden if you just find what grows well in that soil. The passage encourages the reader to try and cultivate a garden of their own wherever they may live. Overall the passage's organization could be described as the introduction of a concept followed by encouragement to take action. **Therefore, answer choice (C) is the correct answer.**
3. We are looking for the answer choice that the author would NOT agree with. The third paragraph in the passage talks about how even the banks where plaster and waste were dumped, are still rich enough to grow sweet clover and burdocks. This implies the author would probably agree that the earth, no matter its appearance, is rich, so answer choice (A) is incorrect. Lines 42-45 state "If burdocks will grow, something else will grow; or if nothing else will grow, then I prefer burdocks to sand and garbage." This implies the author would rather grow weed than nothing at all, so answer choice (C) is incorrect. Lines 15-17 state "In other words, this book declares that every bit of land that is not used for buildings, walks, drives, and fences, should be planted." This implies the author believes that the world should be green and planted in every possible space, so answer choice (D) is incorrect. The only thing that the author wouldn't agree with based on the passage is that people destroy most beautiful things on earth. **Therefore, answer choice (B) is the correct answer.**
4. Lines 31-34 state "Even the banks where plaster and waste were dumped two or three years ago are now luxuriant with burdocks and sweet clover..." The word "luxuriant" in this sentence is describing the banks where boondocks and sweet clover now grow. We know the author believes that every place that can be planted should be, so we can assume that he/she feels positively about the burdocks and sweet clover and that luxuriant has a positive meaning. Since we are talking about plants and gardening, the word rich makes the most sense as the definition of luxuriant. **Therefore, answer choice (B) is the correct answer.**

5. The last line states “If burdocks will grow, something else will grow; or if nothing else will grow, then I prefer burdocks to sand and garbage.” This line is significant because it shows that the author believes anything that is planted is better than bare earth. Burdocks are weeds that can pretty much grow anywhere, and while some people might not think of them as pleasant, the author is arguing that even burdocks can be beautiful and worth planting. The sentence is saying that even nature’s worst can be people’s best. **Therefore, answer choice (C) is the correct answer.**
6. The author says this because in his opinion the definition of a garden is not a good one. The author is commenting on what the current definition of a garden is, not what he feels it should be. The author feels that the definition of a garden is vague and open to interpretation and that this leads to confusion for many people. **Therefore, answer choice (A) is the correct answer.**

### Passage 37

1. The main purpose of the passage is to educate the reader on the reasons why some people decide to surrender their pets. The passage talks about unavoidable reasons such as an employment change, and also avoidable reasons such as adopting a pet on a whim. The passage does not focus on adult animals from shelters or encourage their adoption, so answer choice (A) is incorrect. While the passage does mention some things about animal shelters, it does not focus on the condition inside of animal shelters, so answer choice (B) is incorrect. The passage does not condemn anyone who has had to give up their pet and notes that sometimes it is unavoidable, so answer choice (D) is incorrect. The primary purpose of the passage is to educate readers and the public on common reasons for pet surrender. **Therefore, answer choice (C) is the correct answer.**
2. Lines 4-9 state “As the puppies and kittens mature into adulthood, they will grow in loyalty and devotion to their families, and yet animal shelters are regularly inundated with pet owners relinquishing their furry companions.” This sentence is saying that as puppies and kittens grow up they become more attached to their families. It would stand to reason that their families would also grow more attached to them and so we would assume that animal shelters would not have many people giving up their pets. The words “and yet” tell us that this sentence is saying the opposite of what we would think so it is saying that animal shelters do have many people giving up their pets. The word inundated refers to the many people who are going to animal shelters to relinquish their pets. If we think about it, if a lot of pet owners are all coming to do the same thing, the animal shelter could possibly be overwhelmed by the amount of people and pets. Therefore, inundated most nearly means overwhelmed. **Answer choice (A) is the correct answer.**
3. The author discussed the popular TV show *Game of Thrones* to give an example of a time when a pet became trendy and many people bought one because of this trend. The author goes on to say that many of these people ended up giving up their pets when the novelty of the trend wore off, so we can infer that the reason he brought this up in the first place was to emphasize to readers to think before following pet-owning trends. **Answer choice (A) is the correct answer.**

4. The second paragraph talks about some of the common reasons people are forced to surrender their pets. The paragraph says that when someone has an unexpected life change such as losing a job or ending a relationship, they often have to change their living situation. This can lead to people moving to apartments where animals aren't allowed or charge a fee that may be too high for the pet owner in their current situation. Overall, the central reasons that people give up their pet according to this paragraph are unexpected life changes and expenses. **Therefore, answer choice (B) is the correct answer.**
  
5. The final paragraph talks about what animal shelters do to screen potential adopters. Shelters ask potential adopters questions about their lifestyle and ability to care for an animal as well as charge a fee to weed out people who might adopt a pet on a whim. All of this is done to protect the animal, so the final paragraph is describing to readers how shelters protect the animals they care for. **Answer choice (D) is the correct answer.**
  
6. The passage discusses pet owners who are forced to give up their pets to shelters due to life changes, expenses, and/or poor planning. Based on the passage, the best definition of pet surrender would be the ending of pet ownership by bringing the animal to a shelter. **Therefore, answer choice (C) is the correct answer.**

### Passage 38

1. The main purpose of the passage is to show how the man in the passage was frustrated with traffic but then found an audiobook which helped ease his frustration. While the passage does illustrate the frustrations of traffic jams, its focus is more on the person experiencing it, so answer choice (A) is incorrect. The passage does not mention carpooling for entertainment, so answer choice (B) is incorrect. While the passage does show the man used an audiobook to distract himself from the traffic jam, the passage is not promoting this, so answer choice (C) is incorrect. The central purpose of the passage is to illustrate frustration and then relief in an unpleasant situation. **Therefore, answer choice (D) is the correct answer.**
  
2. The whole passage revolves around the fact that the driver is frustrated with the traffic he is in, so we know he is impatient. Lines 35-38 state “He reached down to the floor in front of the passenger seat and moved aside a few papers and some fast food wrappers.” The passage goes on to say that the man thought to himself he should probably clean his car soon. This shows that the man is also quite messy as he has left old food wrappers and papers on the floor of his car. **Therefore, answer choice (A) is the correct answer.**
  
3. Lines 12-14 state “All around there was nothing but desert punctuated by scraggly brush and an occasional abandoned, dilapidated building.” The word “punctuated” is referring to the scraggly brush and buildings seen in the desert. If we think about what this sentence is trying to say, we can infer that the driver is seeing a bunch of desert with some scraggly brush and a few abandoned buildings. The fact that it is a desert and is described as being nothing but desert implies that those

other things are only seen every once in a while. Seeing those things every once in a while would mean they are spread out or scattered throughout the landscape. Another way to say this is they are interspersed. **Answer choice (C) is the correct answer.**

4. Lines 40-42 state “Beneath the random refuse was a bag from the local bookstore with his latest treasures...” Based on the previous sentences, we can infer that the divers' latest treasures were buried under the papers and food wrappers that he moved to find what he was looking for. Since it was on the ground of his car and was old and messy, we can assume the word refuse means something similar to garbage. Rubbish is a synonym for garbage and also for refuse. **Therefore, answer choice (B) is the correct answer.**
5. Lines 42-45 state “...a fiction text he'd picked up to balance out his preference for non-fiction, and, blessedly, an audiobook with glowing reviews.” This sentence is referring to the “treasures” the driver was looking for and found under the passenger seat of the car. The sentence tells us that the driver has a preference for non-fiction so we can infer that's what he usually listens to. This would mean that he would not typically listen to fantasy audiobooks because they are fiction. **Therefore, answer choice (A) is the correct answer.**
6. The passage starts out by introducing the reader to the driver and the unfortunate situation he is in of being stuck in traffic (the driver's dilemma). The passage illustrates his frustration with the traffic and his lack of power to do anything about it. The passage then goes on to show us how he came up with a way to reduce his frustration by listening to an audiobook to pass the time (the solution to his problem). Overall the organization of the passage can best be described as the driver's dilemma is introduced, followed by his eventual solution of his problem. **Therefore, answer choice (C) is the correct answer.**

### Passage 39

1. *Why Grandfathers are the Best Relatives* doesn't really work for the entire passage. While Johnny's grandfather does take him on a train and tell him he is in for the sight of a lifetime, the passage isn't focused on Johnny and his grandfather's relationship, it is focused on Johnny's experience, so answer choice (B) is incorrect. *Trains: The Best Way to Travel* seems like it could work at first, but if we really think about what the passage is talking about, we realize that the fact that they are on a train is actually not that important. The passage mentions this and describes a couple features on the train, but the focus is on Johnny and what he is feeling and seeing, so answer choice (C) is incorrect. *Good Things Come to Those Who Wait* is not a terrible title, but it implies that the reason Johnny got to see the incredible sights is because he waited and restrained himself from doing something. The passage isn't trying to teach a lesson that being patient leads to good things, so answer choice (D) is incorrect. *The Excitement of First Experiences* captures the main point and focus of the passage. The passage is focused on Johnny and his first time riding on a train. It talks about how he feels and what he sees and it ends with him having an experience that he will remember for the rest of his life. **Therefore, answer choice (A) is the correct answer.**

2. The last paragraph describes Johnny’s astonishment when the train leaves the tunnel and he sees the green plains and the animals for the first time. The thing that causes his astonishment is the fact that his grandfather had told him that he was in for the sight of a lifetime but up until that point all John had seen was desert. Then the train entered a long tunnel and when it came out, the whole landscape had shifted, as if by magic. The change from desert to green grasslands is what was so amazing to Johnny. **Therefore, answer choice (D) is the correct answer.**
3. The passage starts out with the reader learning that it is Johnny’s first time riding on a train and that he is very excited. His grandfather had fallen asleep but Johnny chalks that up to him not having as much excitement due to him probably having ridden on hundreds of trains, so answer choice (B) is incorrect. We learn later Johnny’s grandfather had promised him the sight of a lifetime. It would make sense that Johnny would be anticipating this, so answer choice (A) is incorrect. . The train then goes into a tunnel and Johnny impatiently wonders how long it's going to last before he gets to see this sight, so answer choice (D) is incorrect. Eventually he gets there and sees what his grandfather had promised him and it’s everything he had hoped for. The only thing that Johnny does not seem to be in this passage is tired in any way. **Therefore, answer choice (C) is the correct answer.**
4. Lines 40-41 state “Darkness. I almost scream, pulling both hands to my mouth.” The reason Johnny is frightened is the darkness that seemingly came out of nowhere. The paragraph goes on to say that his grandfather explains to him that they are in a tunnel and it will end soon. Having never been on a train before, it would make sense that going into a dark tunnel might startle someone, so the reason Johnny was frightened was that he had never been in a dark train tunnel before. **Answer choice (A) is the correct answer.**
5. We are looking for the contrast which can NOT be found in the passage. Experience vs. innocence can be found in the fact that Johnny had never ridden on a train before and his grandfather, being much older, had ridden on hundreds of trains, so answer choice (A) is incorrect. Barren desert vs. green growth can be found in the fact that at the beginning of the train ride all Jonny saw was desert and after the tunnel he saw lush green fields, so answer choice (B) is incorrect. Heat vs. coolness can be found in how the desert is described and the heat that is laid over the entire landscape compared to the coolness of the train cabin, so answer choice (D) is incorrect. The only contrast that can’t be found in the passage is sadness vs. joy because nothing in the passage implies that Johnny is ever sad. **Therefore, answer choice (C) is the correct answer.**
6. The first paragraph talks about how this is Johnny’s first time riding on a train. It describes his excitement and his grandfather’s lack of excitement. The passage tells us that Johnny believes his grandfather is asleep and not as excited because he had ridden on hundreds of trains. The final sentence of the paragraph states “No wonder he let me sit in the window seat.” We can infer that Johnny’s grandfather let him sit in the window seat because he knew sitting next to the window

would provide more excitement and enhance Johnny’s first train ride. **Therefore, answer choice (D) is the correct answer.**

### Passage 40

1. The main idea of this passage is understanding how remedial classes work and if there are better options for students when attending college. While the passage does say that many schools have found that lengthy remedial courses don’t seem to benefit and may actually negatively impact students, the passage does not call for the complete abolition of remedial education, so answer choice (B) is incorrect. While the passage does mention high textbook costs as one of the negatives of remedial courses in college, this is only one part of the passage and not the main focus, so answer choice (C) is incorrect. While the passage does mention some alternatives that certain schools are trying in place or alongside remedial courses, the passage does not propose that all remedial courses be replaced, so answer choice (D) is incorrect. The main idea of the passage can best be summarized as an exploration of the effectiveness of remedial classes and some of their alternatives. **Therefore, answer choice (A) is the correct answer.**
2. The term “remedial sequence” is used multiple times throughout the passage. The first paragraph tells us that remedial classes are meant to help students develop the skills they don't have but will need to complete college coursework, but it does not define remedial sequence. One sentence in the passage tells us that the longer the remedial sequence is, the less likely the student is to complete his or her degree program. Another sentence states that lengthy remedial sequences are clearly not promoting student success. Since the remedial sequences are described as long in both of those examples, we can infer that there is no set length for a remedial sequence, so answer choices (A) and (D) are incorrect. We can also eliminate answer choice (C) because the first example tells us that lengthy remedial sequences actually make it less likely for a student to graduate. Overall, the best definition for remedial sequence is classes providing extra support to struggling students. **Therefore, answer choice (B) is the correct answer.**
3. The main focus of the passage is on the idea that remedial courses are not as effective as people thought they were. The author explores this idea and presents examples of how remedial sequences can actually hinder many students. The author then gives examples of some alternatives and how schools are trying to find different ways to help these students. The final sentence in the passage states “If lengthy remedial sequences are counter to that goal, as they seem to be, we must employ different methods.” The goal the sentence is referring to is the goal of school to place students and get them the education they need. Based on these facts, we can infer that the author would most likely agree that there are more effective alternatives than remedial sequences that exist for student skill development. **Therefore, answer choice (C) is the correct answer.**
4. The second paragraph in the passage talks about how the longer the remedial sequence is the less likely a student is to complete his or her degree program and graduate. The reason this can happen is students will often feel discouraged by seeing work they recognize from highschool or by feeling

like they are not progressing at a fast enough rate. Overall the paragraph is trying to say that remedial sequences not only frustrate and discourage many students, but they hinder those students from graduating and completing their degree. **Therefore, answer choice (A) is the correct answer.**

5. The third paragraph talks about how schools are exploring new ways to place students into classes more effectively. Lines 44-46 state “They are using multiple methods to determine placement, including high school grades and coursework.” **Therefore, answer choice (B) is the correct answer.**
6. We are looking for the statement that is NOT true based on the author’s research. Lines 19-21 state “Unfortunately, the longer a student is in a remedial sequence, the less likely the student is to complete his or her degree program. This means that lengthy remedial sequences may contribute to students leaving their degree unfinished, so answer choice (A) is incorrect. In regards to schools using multiple ways to place students in classes lines 46-47 state “this generally results in higher placement for the students.”, so answer choice (B) is incorrect. Since we know that remedial sequences, especially when they are lengthy, seem to hinder students education, and we also know that placement tests alone result in more students being placed in these sequences, we can reason that alternative methods to both of these things could benefit a significant number of students, so answer choice (C) is incorrect. The only thing that is not true based on the author’s research is that remedial classes cause minority students to drop out of college. **Answer choice (D) is the correct answer.**

### Passage 41

1. The central aim of the passage is to educate readers on a side of feminism that they may not have considered. The passage explores the roles that both men and women have traditionally been confined to and the problems that can arise from that. The passage does not mention anti-feminists or try to defend feminism against them, so answer choice (A) is incorrect. While some of the readers may be male, the passage is not trying to turn anyone feminist by sympathizing with their difficulties. It is instead trying to illuminate another side of feminism, so answer choice (B) is incorrect. The passage does not try to convince the reader that man and women share similar gender struggles, in fact it points out the differences in the struggles each sex faces, so answer choice (D) is incorrect. The central aim of the passage is to explore a more well-rounded view of feminism that includes both genders. **Therefore, answer choice (C) is the correct answer.**
2. The passage focuses on the fact that traditional roles for both men and women can be confining and constricting to people in today’s world. Women were typically considered the nurturing and subordinate positions and men were typically considered the breadwinner and primary repository. The passage explores how both of these narrowly defined roles can be detrimental and how if the aims of feminism want to be fully realized, both genders have to be considered. Women need to be allowed to be comfortable as the primary earner in a family and men need to be allowed to be

comfortable as the primary caregiver if that is what makes the most sense given the situation. Lines 10-12 state “While continuing to question the socially constructed roles for women, we must do the same for men.” The author seems to be most focused on showing that the feminist view should include men and women equally and in all roles. **Therefore, answer choice (A) is the correct answer.**

3. Lines 46-50 state “This artificial reduction of a father’s potential contribution to his family may make him feel less supported and valued in this role, thus creating an unnecessary emotional obstacle.” This sentence is referring to the fact that our society tends to equate manliness with only the financial form or support and not as a caregiver or nurturer. In essence our culture does not fully and completely acknowledge how men can contribute to the family, or said another way, there is a cultural oversimplification of how men can contribute to the family. **Answer choice (B) is the correct answer.**
4. The main idea of the passage is that traditional gender roles hamper the full potential of both men and women when it comes to providing for their families. The author argues that if a woman makes more money and is able to support the family on just her income alone, then it would make more sense for the man to stay home and take care of the children and that traditional roles may create an unnecessary obstacle to this. Overall the author seems to be arguing that lessening the judgment regarding gender roles would benefit men, women, and society as a whole. **Therefore, answer choice (D) is the correct answer.**
5. Lines 5-10 state “As a society, we have also challenged the restrictive gender roles that for many years relegated women to the domestic sphere or a narrow array of professional choices, primarily in nurturing or subordinate positions.” The word relegated is referring to what restrictive gender roles have done to women, which is only allowing them a narrow array of professional choices. We can infer from this sentence and the surrounding sentences that these professional choices are not as highly valued culturally as the professional choices men typically have. Based on that, the word relegated means the gender roles lowered women to the domestic sphere. **Therefore, answer choice (C) is the correct answer.**
6. The last sentence in the passage states “Real life is not a sitcom and real people should not be constrained by two-dimensional roles.” The sentence summarizes the author’s central argument that both men and women have been constrained by traditional gender roles and overall society would be better off if people were judged less by these roles. The author contrasts real life to a sitcom to show that unlike a sitcom, real life has many complexities and both men and women should be allowed to explore what makes them happy and what interests them. **Therefore, answer choice (B) is the correct answer.**

**Passage 42**

1. The main purpose of the passage is to show readers that happiness comes from many things but that our cultural obsession with money has hindered many people from finding true happiness. While the passage does say that the relentless pursuit of money and material things will not usually lead to happiness on its own, it does not discourage people from trying to become happy by earning more money. Instead it encourages people to pursue other avenues for happiness, so answer choice (A) is incorrect. While the passage does say that it is important that we make sure we give a healthy environment to the next generation and this will contribute to the community of earth's happiness, the passage does not say happiness is solely a result of this, so answer choice (C) is incorrect. While the passage does point out some of the disadvantages of networking when forming relationships that will enhance happiness, it does not criticize it as being selfish, so answer choice (D) is incorrect. Overall the main purpose of the passage is to encourage readers to view happiness as a complex, non-material process. **Therefore, answer choice (B) is the correct answer.**
2. The fourth paragraph of the passage focuses on how self improvement can lead to greater happiness. The paragraph explains that self-improvement goals could take the form of things like reading, volunteering, or picking up an abandoned hobby from your youth. The paragraph states that although these things may be enjoyable, they are distinct from mere self-gratification because they entail some form of effort. Even with the effort required however, many of these activities could still be defined as recreational, so the statement that self-improvement and recreation are important parts of overall happiness is true. **Answer choice (C) is the correct answer.**
3. Lines 25-27 state “Our perspective of happiness needs a cultural shift to place greater emphasis on community and personal growth.” The author then goes on to talk about how there is no bigger community than the planet itself and we have to make sure we leave a planet that is stable for the next generation. He/she argues that working towards this goal is not only the responsible thing to do, but it will bring us self-gratification from working on something bigger than ourselves. The third paragraph in the passage talks about how another aspect of our happiness is the need for smaller more intimate communities in addition to the larger planetary community. The author argues that we are social creatures and require meaningful relationships to feel fulfilled in life. Overall a large portion of the passage is dedicated to explaining why communities both large and small are vital for our overall happiness, so we can infer that the author values community most. **Answer choice (D) is the correct answer.**
4. We are looking for the statement which is NOT true based on the passage. Lines 57-62 state “While networking has its place, its focus is on cultivating connections based on what people can do for you, not based on similar interests or other qualities that might make for a strong friendship. This implies that networking is sometimes more self-centered than making connections as friends, so answer choice (A) is incorrect. Lines 41-43 state “Not only will this ensure resources for future generations, it will give us a sense of connection to the global community.” This sentence is referring to countries reducing their carbon footprint and supporting policies to support the

environment. We can infer that the author believes that protecting the environment will positively affect communities around the world, so answer choice (B) is incorrect. Lines 68-69 state “One should be willing to pursue goals and interests not necessarily tied to profit.” This sentence supports the main point of the passage which is that in order to find true happiness, people need to pursue avenues of fulfillment where profit is not the end-goal, so answer choice (D) is incorrect. The only statement that is not true based on the text is that self-gratification is the process of re-learning the things that make you happy. **Therefore, answer choice (C) is the correct answer.**

5. Lines 4-9 state “Definitions of happiness will vary because each individual will filter his ideas of happiness through his own experiences and environment, but one pervasive idea about happiness is that it’s related to money.” Based on the sentences around this sentence and the context of the passage as a whole, we can infer that the author believes the idea that happiness is related to money is common or widespread throughout society, so he/she probably means common and persistent when using the word pervasive. **Answer choice (D) is the correct answer.**
6. Throughout the passage the author is informing readers on ways that they can try to increase their happiness. He/she believes that there are many factors that influence one's happiness and it's not as simple as just having more money. Overall the tone of the passage can be described as encouraging because the author encourages people to try to incorporate some of these ideas and practices into their everyday life so that they can experience true fulfillment. **Answer choice (C) is the correct answer.**

### Passage 43

1. The central aim of the text is to illustrate how Leavenworth Washington revitalized their economy by transforming their town into an old Bavarian village. While the passage does say that the change was successful in revitalizing Leavenworth’s economy, the passage is not focused on the economics of the change, so answer choice (A) is incorrect. While the passage does mention that Leavenworth had traditional Bavarian celebrations, it does not examine how these traditions are expressed all over the country, so answer choice (C) is incorrect. While the passage does mention that another Washington town has emulated Leavenworth in creating their own themed town, the passage does not aim to create a blueprint or provide steps for them to follow, so answer choice (D) is incorrect. The central aim of the passage is to celebrate a community-based renovation of a struggling U.S. town. **Answer choice (B) is the correct answer.**
2. The passage focuses on the town of Leavenworth and how they reinvented themselves by modeling their town after a Bavarian village. While they were a struggling town and improved their economy by imitating a European town, this does not mean that any struggling U.S. town can just imitate a European city and find success, so answer choice (B) is incorrect. The passage talks about how some of the German festivals that Leavenworth holds each year are very popular but it does not tell us enough about German festivals' success in the U.S. as a whole for us to know if they are highly successful elsewhere, so answer choice (C) is incorrect. While the passage does say that another

struggling town in Washington modeled their reinvention on Leavenworth’s success, that does not mean that Leavenworth’s model is the correct model for every struggling town, so answer choice (D) is incorrect. The only thing we know for sure from the passage is that Leavenworth used a focused and community-wide effort to transform their town and find economic success. **Therefore, answer choice (A) is the correct answer.**

3. Lines 54-58 state “Oktoberfest is routinely celebrated in cities throughout America, but many people make a trip to Leavenworth to celebrate this quintessential German festivity in a Bavarian village.” The word “quintessential” is describing the celebration of Oktoberfest in this sentence. The sentence before this one calls Oktoberfest a traditional German festivity that the town of Leavenworth holds each year, so the word quintessential is just another way of saying traditional. **Answer choice (C) is the correct answer.**
4. The passage starts off by introducing the reader to the idea of reinvention. It talks about the town of Leavenworth and how it was once a prosperous railroad town but it fell on hard times when the railroad was rerouted to a different town (the city’s decline). The passage goes on to explain and celebrate the decision of Leavenworth to reinvent itself as a classic Bavarian village. This ultimately led to the revitalization of the town’s economy (the city’s success). Overall the organization of the passage can best be described as the exploration of a city’s arc from its decline to its success. **Therefore, answer choice (C) is the correct answer.**
5. Lines 69-70 state “Leavenworth has changed dramatically from its days as a spurned railroad town.” The word “spurned” is describing the way Leavenworth used to be. We know from earlier in the passage that when the railroad left Leavenworth, the town's economy was crushed and the city itself was demoralized, so spurned must mean those things. A synonym for crushed and demoralized is dejected. **Answer choice (B) is the correct answer.**
6. Lines 26-29 state “They were inspired in part by their proximity to the Cascade Mountains, which put them in mind of the famous Alps.” **Mountains are geographical features, so answer choice (A) is the correct answer.**

#### Passage 44

1. The central idea of the passage is that many religious leaders exhibit similar characteristics that may seem strange to the general population. While the passage does mention that religious leaders are often “geniuses”, it does so to compare them to other geniuses who have mental instability, so answer choice (A) is incorrect. While the passage mentions that many people who follow a religion do so in part out of habit, it does not say that religion is only a habit, so answer choice (B) is incorrect. The passage never refers to religious leaders or the people who follow them as crazy, so answer choice (C) is incorrect. The main idea of the passage is that religious authorities often share certain features that may seem psychologically strange. **Therefore, answer choice (D) is the correct answer.**

2. Lines 10-11 state “It would profit us little to study this second-hand religious life.” The term second-hand religious life is referring to the sentence that preceded this one where the author is describing the ordinary religious believer. The author describes the ordinary religious believer as someone whose religion has been taught to him by tradition and normalized by imitation. **Therefore, answer choice (A) is the correct answer.**
3. The passage as a whole is examining religious leaders and some of the eccentric characteristics they seem to possess. Nothing in the passage suggests that the author is trying to discredit religious authorities, so answer choice (A) is incorrect. The passage does not use highly technical jargon or speak in a way that only psychologists would understand, so answer choice (C) is incorrect. The passage does not try to convince religious people to leave their religion or even suggest that they should consider this, so answer choice (D) is incorrect. The passage only aims to educate and is written in such a way that most people would understand it, so it can be inferred that the author is addressing readers interested in religious histories and religious leaders. **Answer choice (B) is the correct answer.**
4. We are looking for the answer that is NOT a reason people have religion. Lines 4-10 state “I speak not now of your ordinary religious believer, who follows the regular traditions of his country, whether it be Buddhist, Christian, or Mohammedan. His religion has been made for him by others, taught to him by tradition, normalized by imitation, and kept by habit.” Those two sentences mention that people have religion based on traditions, habits, and the country where they reside (geography), so answer choices (A), (B), and (D) are all incorrect. The only reason not mentioned in the passage for people having religion is family pressure. **Therefore, answer choice (C) is the correct answer.**
5. The last sentence in the passage states “Often, moreover, these pathological features in their career have helped to give them their religious authority and influence.” The pathological features are mentioned in the previous sentence and include falling into trances, hearing voices, and seeing visions. The reason this gives them religious authority is because they claim to see and hear things that other people cannot. **Therefore, answer choice (C) is the correct answer.**
6. Throughout the passage, religious leaders are described as one group and all the characteristics they are said to have seem to refer to the group as a whole. Lines 17-23 state “But such individuals are ‘geniuses’ in the religious line; and like many other geniuses who have brought forth fruits effective enough to be remembered and celebrated in the pages of biography, such religious geniuses have often shown signs of nervous instability.” Nervous instability is a characteristic of temperament and personality and making a blanket statement about religious leaders like this implies the author believes that most religious “geniuses” share these traits. **We can infer from the passage that a certain temper and personality is shared by most religious “geniuses.” Therefore, answer choice (A) is the correct answer.**

**Passage 45**

1. The main point of the passage is to celebrate the distinguished guests attending a dinner at the white house. The passage tells us that at least some of the guests are winners of the Nobel Prize and it also goes over some of the history of the prize and its past winners. While the passage does mention that the Nobel Prize has no nationality and that anyone from any country can win, it does not focus on the idea that knowledge has no boundaries, so answer choice (A) is incorrect. While the passage does revolve somewhat around the Nobel Prize, it does not explain the importance of it or focus on the prize itself, so answer choice (B) is incorrect. While the passage goes over some of the history of the Nobel Prize and its creator, this is a brief portion of the passage, so answer choice (D) is incorrect. The main idea of the passage is to honor and celebrate important guests. **Answer choice (C) is the correct answer.**
2. The passage tells us that Mr. Nobel wanted the awarding of the Nobel Prize to not have anything to do with the recipient's nationality. Lines 21-26 state “He declared it to be ‘my express desire that in awarding the prize, no consideration whatsoever be paid to the nationality of the candidates; that is to say, the most deserving be awarded the prize, whether he or she be Scandinavian or not.’” Based on this, we can infer that the Nobel Prize prioritizes merit over nationality. **Answer choice (B) is the correct answer.**
3. Lines 16-17 state “I know the Nobel Prize does not have any geographic or national implications.” We know from the next couple of sentences that the Nobel prize is not based on nationality or where a recipient was born. We can infer then, that the sentence is saying that the Nobel Prize does not have any national or geographic connection. **Therefore, answer choice (C) is the correct answer.**
4. The sixth paragraph of the passage talks about how the speaker intended the dinner in the passage to recognize the great efforts of the past Nobel Prize winner and in that recognition, encourage young Americans and young people in the western hemisphere to cultivate the same drive and desire for knowledge as the guests. Since a dinner that included Nobel Prize winners was intended to encourage young Americans, we can infer that the author most likely believes that the Nobel Prize encourages young people to seek knowledge and peace. **Therefore, answer choice (B) is the correct answer.**
5. The passage begins with the speaker telling the guests how welcome they are at the White House. The speaker goes on to say that he/she thinks that the guests comprise the most extraordinary collection of talent, of human knowledge, that has ever been gathered together at the white house, except for possibly Thomas Jefferson when he dined alone. The passage keeps this overall tone throughout and the final paragraph reiterates the sentiment that the speaker wants the guests to know that they are welcome. **Overall the tone of the passage can best be described as impressed. Answer choice (C) is the correct answer.**

6. Lines 27-29 serve to show that the act of acquiring or obtaining knowledge is not based on your nationality or ethnicity. In other words, no nation or ethnicity is superior when it comes to their desire and willingness to learn. **Therefore, answer choice (A) is the correct answer.**

### Passage 46

1. The main idea explored in the passage is the need for more classes in highschool that help to prepare students for adulthood by teaching them skills in areas like personal finance and home economics. While the passage mentions that many young adults are lacking in some of the more basic life skills they need to live on their own, it does not say they have an inability to learn these skills, so answer choice (A) is incorrect. While the passage does say that many highschools do not offer these skill based classes that would be beneficial to students in young adulthood, it does not say it is because of a lack of gap in funding, so answer choice (B) is incorrect. While the passage does mention that some schools may want to include these basic skill classes in a series of classes that could prepare students for professional careers in the hospitality and financial fields, that is just one option presented in the passage and not the main focus, so answer choice (C) is incorrect. The central idea explored in the passage is the need for finance and skill-based class options in highschool. **Therefore, answer choice (D) is the correct answer.**
2. We are looking for the statement that can NOT be reasonably inferred based on the passage. The fourth paragraph in the passage talks about a potential series of classes schools could offer that could prepare students for careers in the hospitality or financial industry. Lines 75-78 state “This could prepare students to transfer into a community college program focused on the hospitality or financial industry.” If the skill based classes will prepare students to transfer to community colleges, we can infer that skill-based learning will encourage enrollment in community colleges, so answer choice (A) is incorrect. The focus of the passage is how skill-based classes in highschool can better prepare students for living on their own. Things like learning to cook and manage their finances will help students eat healthier, save money, and not make financial mistakes that could be devastating. All of these things would improve these student’s lives, so answer choice (B) is incorrect. While talking about how many young adults don’t feel prepared for adulthood, lines 6-8 state “They lament their inability to cook, manage personal finances, and understand taxes.” Based on that, we can infer that most of the stress of entering adulthood is due to lack of practical domestic and financial knowledge, so answer choice (D) is incorrect. The only statement that can’t be inferred from the passage is the U.S. education system is failing students by denying them access to basic life-skills training. **Therefore, answer choice (C) is the correct answer.**
3. Throughout the passage the author talks about how many young adults don’t feel they are prepared for adulthood. The author gives suggestions for how schools can improve their offerings to help students transition to this phase of their lives. While he/she clearly cares a lot about this issue, he/she does not seem nervous or scared while discussing it but there is a slight sense of urgency. Overall the tone of the passage could best be described as concerned. **Therefore, answer choice (B) is the correct answer.**

4. The entire passage is based on the idea that highschools need to offer more skill-based learning to their students to prepare them for adulthood. The final paragraph says that the transition to adulthood is never going to be perfectly smooth, but with the right preparation students will have the best possible foundation. It is clear that the author believes that skill-based learning is an important part of becoming an adult. **Therefore, answer choice (C) is the correct answer.**
5. Lines 40-42 state “Money is a pressing concern for most young adults, whether they go on to college after highschool or not.” The paragraph goes on to say that young adulthood will probably be the lowest earning time in their lives and that they will be particularly vulnerable to financial mistakes. This makes sense because money would be more important to someone who earns less of it and making a financial mistake would also be a lot more stressful. Based on this, we can infer that the phrase “pressing concern” means immediate and possibly stressful. **Therefore, answer choice (D) is the correct answer.**
6. The last paragraph in the passage talks about the transition to adulthood and how it will never be entirely smooth. Still, the author believes that giving students the best possible foundation will help them make the least amount of mistakes during this transition. Overall the author seems to be genuinely concerned with the welfare of young students transitioning to adulthood. **Therefore, answer choice (C) is the correct answer.**

#### Passage 47

1. The main idea of this passage is that store design has a significant influence on how much money a customer spends. Many stores place items in strategic ways that lead to customers spending the maximum time possible in the store which in turn increases their spending. While the passage focuses on store design and how that affects profit, it does not say it is the main profit driver, so answer choice (B) is incorrect. While customers might be more mindful of marketing strategies after reading this passage, the passage itself does not focus on helping customers be more mindful, so answer choice (C) is incorrect. While marketers and store designers may work together, the passage does not talk about or focus on this, so answer choice (D) is incorrect. This passage is focused on the idea that a marketing-minded store design can increase customer purchases. **Therefore, answer choice (A) is the correct answer.**
2. The first sentence in the passage states “Marketing pervades every aspect of modern life.” The next sentence goes on to talk about the many ways we are targeted by advertisements in our daily lives. Advertisements are everywhere according to the passage which is another way of saying our daily lives are saturated with marketing. **Therefore, answer choice (A) is the correct answer.**
3. Lines 60-65 state Accordingly, the displays here feature inexpensive products that lend themselves to impulse buys; these might be things like gum, candy, or small items we often forget we need, like batteries and nail clippers.” The term “impulse buy” is describing all the small inexpensive

items that are placed near the register at many grocery stores. Many of these items listed are not necessary like candy or gum, but things customers want when they see them. Based on this, we can infer that impulse buy refers to an unexpected or unnecessary purchase based on a sudden desire. **Therefore, answer choice (D) is the correct answer.**

4. In the second paragraph of the passage it says that some grocery stores have started to place small, in-house coffee shops near the entrance of the store with the hope that if a customer buys a cup of coffee it will increase the amount of time they spend in the store while they drink that coffee. We can infer that the last line saying “and their lattes have gotten cold” signifies that if the coffee shop tactic has worked, then the customer will have spent more time in the store than they had expected, and in doing so the coffee they bought at the start of their trip will have gotten cold. **Answer choice (A) is the correct answer.**
5. We are looking for the way that store design does NOT support marketing goals. The second paragraph tells us that some stores add a coffee shop (a feature) near the entrance of their store to help keep customers shopping longer, so answer choice (A) is incorrect. The third paragraph tells us that many stores will have attractive product displays and group similar items together to make the purchasing decision easier for the customer, so answer choice (B) is incorrect. The second paragraph tells us that one of the reasons grocery stores put all the essential items on the perimeter is that it forces shoppers to make a full circuit of the store and, in doing so they are exposed to more products to potentially purchase, so answer choice (D) is incorrect. The only goal store design does not support is helping customers quickly achieve their shopping goals on the store perimeter. In fact, this is the opposite of why stores are designed this way. **Therefore, answer choice (C) is the correct answer.**
6. Lines 45-49 state “For example, an end cap display near the baking aisle might include pre-made pie crust, filling, and sugar. When customers see these items together, they may get the great idea to make a pie.” All of the items listed in this sentence are used to make a pie and the store grouped them together to entice a customer to buy them without having to think too much about a recipe. **Therefore, answer choice (C) is the correct answer.**

### Passage 48

1. The main purpose of the passage is to inspire readers to think about what it means to have freedom and be able to express the ideas you believe in. While the passage does discuss an annual literary event called Banned Books Week, the focus of the passage is not on the event itself, so answer choice (A) is incorrect. While the passage does mention some books that would be considered classical fiction, it does not encourage young people to read these books, so answer choice (C) is incorrect. The passage does not explicitly talk about or try to educate readers on their right to read and speak freely, so answer choice (D) is incorrect. The central purpose of the passage is to encourage readers to think about the meaning of freedom as it relates to expressing ideas. **Therefore, answer choice (B) is the correct answer.**

2. We are looking for the answer that is NOT a reason a book might be banned according to the passage. Lines 42-45 state “Other common reasons are explicit language and scenes, homosexuality, drug use, religious viewpoint, violence and various forms of offensiveness.” The only reason not listed in that sentence is socialism. **Answer choice (C) is the correct answer.**
  
3. Lines 24-28 state “There have also been challenges to books used in college classes, even though college students are adults and colleges are meant to be marketplaces of ideas.” The author is saying colleges are meant to be marketplaces of ideas as a way to argue against books being challenged there. Basically he/she is saying that it is strange that books are challenged in colleges because college students are adults and colleges are supposed to be places where controversial ideas are supposed to be discussed. Another way to say this is that college is a place where trading concepts and challenging ideas is accepted. **Therefore, answer choice (A) is the correct answer.**
  
4. Lines 7-11 state “The purpose of Banned Books Week is to celebrate the freedom to read and remind ourselves of the continued advocacy needed to protect the free exchange of ideas.” Based on that we can see that Banned Books Week is a celebration. The last paragraph of the passage talks about our founding fathers and how the American Library Association supports the freedom of speech, particularly through the freedom to read. Overall, based on the passage, the central purpose of Banned Books Week is to celebrate America’s dedication to freedom of speech. **Therefore, answer choice (C) is the correct answer.**
  
5. The second paragraph in the passage talks about why Banned Books Week is shocking to some Americans. Many people believe that because this is not Nazi Germany and we don’t have oppressive events like book burnings, that books are not banned in the U.S. The paragraph goes on to tell us that just because it isn’t as overtly oppressive as some other times in history, books are still banned and challenged in the U.S. Based on this, the reason some Americans are shocked by Banned Books Week is because they find it hard to believe that books are still banned in the U.S. **Answer choice (D) is the correct answer.**
  
6. To understand how the author connects Banned Books Week to democracy, we need to look at the first and last paragraphs in the passage. The first paragraph tells us that Banned Books Week is a celebration of our freedom to read and it reminds us of the continued fight needed to protect the free exchange of ideas. The last paragraph tells us that our founding fathers knew that policing ideas was a slippery slope and so they gave us the right of freedom of speech. Banned Books Week is a reminder of these rights and freedoms to speak, protest, and think freely in the U.S., and a reminder that we must continue to advocate for them. **Therefore, answer choice (A) is the correct answer.**

**Passage 49**

1. The main idea of the passage is that gamers are often thought of as teenagers locked away in their parents' basement, but this is far from the truth. The passage goes on to explain that the average gamer is actually thirty-eight years old. While the passage does say that video games are entertaining, the focus of the passage is on the types of people who play video games more than the games themselves, so answer choice (A) is incorrect. While the passage goes over how video games have become more and more complex over time, this is done to show why they may appeal to an older audience and not the focus of the passage, so answer choice (C) is incorrect. While the passage does say that video games can provide a distraction from the mundane travails of adulthood, it never says this is ideal and this is only one sentence at the end of the passage, so answer choice (D) is incorrect. The main idea of the passage is that typical stereotypes of gamers are outdated and misleading. **Therefore, answer choice (B) is the correct answer.**
2. Lines 2-4 state “Sometimes they contain a grain of truth or, more insidiously, perceived truth.” The passage goes on to say that through repetition these perceived truths start to feel natural. A perceived truth is something that someone thinks is true but it actually is not. Believing these perceived truths could be dangerous and lead to people acting on or judging people based on these false beliefs. Overall we can infer the author is saying these perceived truths are a negative thing and believing them could be dangerous. The answer choice that best captures this negative view of people believing perceived truths is damaging. **Therefore, answer choice (C) is the correct answer.**
3. As mentioned in the previous answer, from the context of the first paragraph, we can infer that the author believes it is a negative for people to believe perceived truths. Believing something that is not actually true and forming opinions based on that can be dangerous. This is all talked about in the discussion of stereotypes, so we can infer that the author would most likely agree that stereotypes can start off as harmless, but can ultimately be damaging. **Answer choice (D) is the correct answer.**
4. The last sentence in the passage states “This reveals that gaming is a hobby that can grow with people as they age, providing a welcome distraction from the mundane travails of adulthood.” If video games are a welcome distraction, we know that the author is saying adulthood can be less than ideal sometimes, so we can eliminate answer choice (D) because a life full of novelty and interest would not need distractions. The word mundane means dull or boring, so when the author says “the mundane travails of adulthood” he is trying to say adulthood is tedious and difficult. **Answer choice (A) is the correct answer.**
5. We are looking for the answer choice that can NOT be inferred from the passage. While talking about *Pokemon Go*, the passage mentions that older gamers might enjoy it because it encourages walking which is a healthy activity. We can infer that this means some adults play video games designed to facilitate exercise, so answer choice (A) is incorrect. Lines 30-33 state “In a

fantasy-oriented game, for example, a player might choose a human warrior blacksmith or perhaps an elven mage alchemist.” The passage is talking about a human player making their avatar an elf. We can infer then that some adult gamers create avatars unlike their real selves, so answer choice (C) is incorrect. Lines 60-64 state “Some of these games might also enable one to accomplish a worthwhile task while playing the game, thus alleviating any guilt busy adults might feel for taking time for a game.” This implies that some adults feel bad for playing video games, so answer choice (D) is incorrect. The only thing that can not be inferred from the passage is that some adults neglect their kids to play video games. **Therefore, answer choice (B) is the correct answer.**

6. We are looking for the answer choice that the author did NOT state is true of adult gamers. Lines 42-45 state “Games with extensive storylines appeal to older players who may have a longer attention span and a higher reading level than a stereotypical teenage gamer.” The author is saying that older gamers often enjoy more complex storylines, so answer choice (A) is incorrect. Lines 65-69 state “While the game has a strong audience base of younger gamers, older gamers might particularly enjoy how it encourages walking by offering in-game rewards.” The author is saying that a game that requires activity, like walking, might appeal to older gamers, so answer choice (B) is incorrect. The last sentence in the passage states “This reveals that gaming is a hobby that can grow with people as they age, providing a welcome distraction from the mundane travails of adulthood.” This sentence implies the author believes that some adults use video games to escape the tediousness of their day-to-day lives, so answer choice (D) is incorrect. The only thing that the author does not state as true about adult gamers is that they are more intelligent and mature than younger gamers. **Therefore, answer choice (C) is the correct answer.**

### Passage 50

1. The main idea of the passage is that throughout our lives, we as moral people, should notice and actively fight against any evil which we encounter. The passage does not say that no one is able to see the evil and immorality of our friends, so answer choice (A) is incorrect. While the passage does mention that it is necessary that we not flinch from seeing evil, it does not say that people are, in general, too scared to see evil, so answer choice (B) is incorrect. While the passage does mention that there is importance in seeking a “heavenly crown”, it does not say that this is all we should do all the time, so answer choice (D) is incorrect. The main idea of the passage is that we as people should pay attention to, and fight evil practices in society as best we can. **Therefore, answer choice (C) is the correct answer.**
2. The third paragraph in the passage talks about the Man with the Muck Rake. The paragraph tells us that the man could look nowhere but downward and even when offered a heavenly crown for his mud rake, he did not look up but continued to rake the dirt floor. From this description we can see that a muck rake is literally a rake for moving dirt and/or waste. **Therefore, answer choice (C) is the correct answer.**

3. Lines 35-38 state “Yet he also is typical for a man who in this life refuses to see anything great, and fixes his eyes with intent only on the things that are filthy, or bring him morally low.” This sentence is talking about a person who only focuses on the negative aspects of life and are so singularly focused on these aspects that they don't have any room to see anything positive. The author believes that focusing on the negatives is sometimes necessary, but that doing it all the time is more counterproductive than helpful. The author would most likely agree that muck rakers never become great, because they are too focused on the negative aspects of life. **Therefore, answer choice (A) is the correct answer.**
4. The passage starts off talking about how the U.S. government has grown a lot since George Washington laid the first stone of the Capital, and that this growth was needed as the nation itself grew. The passage says that the problems we face today are different from the problems faced by Washington in his time, but that we still face, and must fight, the same evil tendencies that he did. The passage goes on to warn the reader about social morality and how to fight against the evils that one may encounter. Overall the organization of the passage can best be described as a commentary on U.S. growth, followed by a warning about social morality. **Therefore, answer choice (B) is the correct answer.**
5. As mentioned in the previous answer, much of the passage is a warning on social morality and how to combat it. The author talks about the need to speak out and fight evils in society but also warns against burying your head in the filth and never looking up. Overall the tone of the passage can be described as cautionary because the author is cautioning the reader on how to navigate through society in the way he/she feels is best. **Therefore, answer choice (B) is the correct answer.**
6. We are looking for the answer choice that is NOT true based on the passage. The first paragraph in the passage tells us that the nation's capital started when Washington laid the first stone in a little bit of forested wilderness. The next paragraph tells us that the nation experienced extraordinary growth and needed many additional buildings to house the government, so we can infer that the U.S. developed from wilderness to urban spaces in a short time and answer choice (A) is incorrect. The main idea of the passage is that throughout our lives, we as moral people, should notice and actively fight against any evil which we encounter. Therefore, society has a moral responsibility to itself, so answer choice (B) is incorrect. The author uses the book “Pilgrim’s Process” to explain the Man with the Muck Rake and back up his main claim. Therefore, we can infer that the author believes this book is useful for studying people, so answer choice (C) is incorrect. In lines 39-49, the speaker states that Muck rakers become a force of evil, meaning they can cause harm to society. **Therefore, answer choice (D) is the correct answer.**

### Reading Passage 51

1. The main purpose of this passage is to educate readers on how children learn and adopt their gender roles. While the passage does explore some of the sources of a child’s gender identity, it does not cover all possible sources, so answer choice (A) is incorrect. The passage does not

condemn society, so answer choice (C) is incorrect. While the passage does talk about the major role that parents play in their child’s gender identity, it is not only focused on parental influence of gender roles, so answer choice (D) is incorrect. The main purpose of the passage is to describe and examine how most gender identities are formed. **Answer choice (B) is the correct answer.**

2. The first paragraph says that gender is often misunderstood as synonymous with sex. Lines 4-5 state “The two are indeed different; sex refers to biological male or female attributes.” The paragraph goes on to say that gender is an expression of behavior in a given culture associated with each sex, and that children start learning these gender identities from sources like their parents and other outside factors. Based on this, the statement sex is biological while gender is formed by outside factors is true. **Answer choice (A) is the correct answer.**
3. The second paragraph in the passage talks about how parents influence their children’s gender identities. The paragraph says that if a young girl sees her mother spending a lot of time in front of the mirror scrutinizing her physical appearance, it will teach the young girl that being feminine means obsessing over your appearance. Similarly if young children see their father not helping out around the house, they will think that household chores are a woman’s work. We can infer that when children see these behaviors from their parents, they will imitate them and this will form the basis for their gender identities. **Therefore, answer choice (D) is the correct answer.**
4. Lines 8-9 state “We begin to conceive of ourselves as gendered from a very young age.” The next sentence says it would be hard for anyone to remember a time before we understood ourselves and related to other people without the lens of gender. **From the context of the surrounding sentences we can see that the sentence is trying to say we begin to understand, or think, of ourselves as gendered from a very young age, so answer choice (C) is the correct answer.**
5. The passage starts off by talking about the concept of gender (commonly used term). It says that gender is a significant aspect of our identity but that it is commonly misunderstood. The passage goes on to explain what gender actually is and then explore how gender identities are formed from a young age. Based on this, the organization of the passage can best be described as a commonly-used term is explained and then explored. **Therefore, answer choice (A) is the correct answer.**
6. The final paragraph in the passage talks about how as children grow up, they will be exposed to more and more outside influences and further develop their own identities. The paragraph goes on to say that parents still play a very important role in children developing their gender identities because they will be the first role models of their children’s lives. Overall, the final paragraph serves to highlight the role that parents play in their children’s gender formation. **Therefore, answer choice (C) is the correct answer.**

# Practice Tests

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## Practice Test 1

### Verbal Reasoning

#### Synonyms

1. **Acclimate** means to become accustomed to a new climate or new conditions. For example, if you move from the arctic to the caribbean, you would need to **acclimate** to the new climate before you felt comfortable. This is closest in meaning to answer choice **(C) adjust**.
2. **Clandestine** means concealed or hidden. For example, a spy would probably have many **clandestine** meetings and sneak around a lot. This is closest in meaning to answer choice **(A) secret**.
3. **Gargantuan** means huge or massive. For example, the *Titanic* was a **gargantuan** cruise ship. This is closest in meaning to answer choice **(B) enormous**.
4. **Deleterious** means damaging or destructive. For example, eating junk food every day would probably be **deleterious** to your health. This is closest in meaning to answer choice **(A) harmful**.
5. **Eloquence** means fluent or persuasive speaking or writing. For example, if you hire a speechwriter, you would hope they have a certain **eloquence** to their writing. This is closest in meaning to answer choice **(D) articulateness**.
6. **Imperious** means assuming power or authority without justification. For example, an **imperious** person would probably expect others to obey their every command. This is closest in meaning to answer choice **(B) overbearing**.
7. **Humane** means having or showing compassion. For example, there are many laws that ensure the **humane** treatment of all people, no matter their race or ethnicity. This is closest in meaning to answer choice **(C) kind**.
8. **Hallowed** means holy or revered. For example, Graceland is considered **hallowed** ground for many Elvis Presley fans. This is closest in meaning to answer choice **(C) sacred**.
9. **Meticulous** means showing great attention to detail. For example, if you were **meticulous** about cleaning, your house would probably be spotless and free of mess. This is closest in meaning to answer choice **(A) precise**.
10. **Incongruous** means inappropriate or out of place. For example, a modern skyscraper would look **incongruous** in a small old fashioned town. This is closest in meaning to answer choice **(D) unsuitable**.

11. **Innovator** means a person who introduces new ideas, methods, or products. For example, Steve Jobs was an **innovator** because of all of the amazing products he helped come up with at Apple. This is closest in meaning to answer choice **(D) pioneer**.
12. **Mundane** means lacking interest or excitement. For example, going about the same everyday routine is bound to get **mundane** for most people. This is closest in meaning to answer choice **(B) ordinary**.
13. **Mollified** means appeased or pacified. For example, a crying baby would probably be **mollified** by a bottle of milk. This is closest in meaning to answer choice **(B) soothed**.
14. **Pernicious** means sinister or malevolent. For example, a disease that is very deadly and hard to treat might be described as **pernicious**. This is closest in meaning to answer choice **(C) wicked**.
15. **Pry** means to be nosy or snoop. For example, if you were suspicious about a new neighbor, you might **pry** into their past. This is closest in meaning to answer choice **(C) meddle**.
16. **Resolve** means to decide firmly on a course of action. For example, someone who wants to live a healthier life might **resolve** to stop smoking cigarettes. This is closest in meaning to answer choice **(B) decide**.
17. **Hinder** means to hamper or impede. For example, not eating a healthy diet is sure to **hinder** your weight loss goals. This is closest in meaning to answer choice **(A) delay**.
18. **Somber** means dark or dull in color or tone. For example, the mood at a funeral would probably be pretty **somber**. This is closest in meaning to answer choice **(A) grave**.
19. **Sustenance** means food and drink that is a source of strength. For example, all living things need some form of **sustenance** to survive. This is closest in meaning to answer choice **(D) nourishment**.
20. **Vermin** means small common harmful animals that are difficult to control. For example, for farmers, locusts are considered **vermin**. This is closest in meaning to answer choice **(B) pests**.

### Sentence Completion

21. **The correct answer is choice (C) prolific, which means highly productive.** This sentence is talking about an author. The blank is referring to what the author became as he grew older. The sentence tells us that as he got older the author produced an increasing number of works with each successive year, so we know that as he got older he was even more highly productive, or **prolific**.

22. **The correct answer is choice (D) forego, which means to give up or go without something.** The sentence is talking about a couple who was deep in debt. The blank is referring to what they did to their usual summer vacation plans to avoid going any deeper into debt. We know that a vacation usually costs a lot of money, so someone who was trying to avoid going deeper into debt would probably give up, or **forego**, their vacation in order to save money.
23. **The correct answer is choice (A) disheveled, which means untidy or messy in appearance.** This sentence is about a professor who is known for his careful and stylish manner of dress. The sentence tells us that the professor surprised his students when he appeared so “blank” this morning. Since his students were surprised by his appearance, we know that it must have been out of the ordinary for him, and since he was ordinarily very careful and put together, we can assume that on this day he was messy in appearance, or **disheveled**.
24. **The correct answer is choice (B) havoc, which means widespread destruction.** The blank in this sentence is referring to what was created by the collapse of the bridge. The sentence tells us that whatever was created by the collapse would cause traffic to be disrupted for at least a month. Since the traffic would be disrupted for such a long period of time, we know that the collapse of the bridge must have created widespread destruction, or **havoc**.
25. **The correct answer is choice (C) preliminary, which means early or initial.** The blank in this sentence is describing the reports regarding the motives of the crime. The sentence tells us that in the days that followed the bank theft, it became clear that these reports were almost completely inaccurate. Since it became clear that the reports were inaccurate after a couple of days, we know that the reports must have been created right away, so they were the initial, or **preliminary**, reports.
26. **The correct answer is choice (B) incessant, which means continuing without pause or interruption.** The blank in this sentence is describing the sounds coming from a construction site that caused people to file complaints. The sentence tells us that because of these complaints, the city council adopted a zoning ordinance that limited the hours during which noisy equipment could operate. Since the ordinance limited the hours in which the noisy equipment could operate, we can assume that the reason the complaints were filed was because before the ordinance, the noise was continuing without interruption, or it was **incessant**.
27. **The correct answer is choice (B) procrastinate, which means to put something off.** The blank in this sentence is referring to what Abigail would not do for once. The sentence tells us that Abigail would get the assignment turned in on time, so that means that she would not be able to put it off, or **procrastinate**, and turn it in late.
28. **The correct answer is choice (D) exhaustive, which means comprehensive or in-depth.** The blank in this sentence is describing the pitcher’s knowledge of the opposing batters. The sentence tells us that the pitcher knew how each batter had performed in his last three games. There are nine

batters on a typical baseball team, so if the pitcher knew how each one performed for their last three games, his knowledge of them must have been very in-depth, or **exhaustive**.

- 29. The correct answer is choice (A) barred, which means banned or not allowed to be or go somewhere.** The blank in this sentence is referring to what happened to Lance after he disrupted the court proceeding for a third time. The sentence says Lance was “blank” from the courtroom for the remainder of the trial. Since Lance disrupted the court proceeding multiple times, it would make sense that he would not be allowed to be in, or be **barred**, from the courtroom for the remainder of the trial so that the trial could proceed in peace.
- 30. The correct answer is choice (B) tome, which means an especially large, heavy, or scholarly book.** The blank in this sentence is describing the book the student was assigned to analyze. The sentence tells us that the student was shocked and that she could not possibly finish her assignment over the weekend. Since the sentence tells us that the student could not possibly finish analyzing the book over the weekend, we can infer that it must have been a pretty large book, or a **tome**.
- 31. The correct answer is choice (C) consensus, which means agreement.** The blank in this sentence is referring to what the negotiators were able to reach within a few short hours. Since the sentence says that they were pleased by this and a negotiator's job is to help resolve conflicts by getting people to agree, we can infer that the reason they were happy was because they were able to reach an agreement, or **consensus**, within a few hours.
- 32. The correct answer is choice (D) scrutinized, which means looked over, and innocuous, which means harmless.** Since the detective was looking for a detail in the document that might reveal a motive, the first word in the blank should mean “looked over” or “studied” the documents. Therefore, we can eliminate answer choices (A) and (B) because they do not mean “looked over.” For the second blank, “innocuous” works the best because it means harmless, so the sentence is saying that the detail was apparently harmless, but turned out to actually reveal a motive.
- 33. The correct answer is choice (D) unforeseen, which means unexpected, and flabbergasted, which means shocked.** The word “although” tells us that the first and second part of the sentence should contrast each other. Therefore, it makes sense to say that although the change in weather was not unexpected, people were still shocked because these two ideas contrast each other. Answer choice (A) is incorrect because if the change in weather was not extraordinary, it would make sense that people were nonchalant about it, so these two ideas are not contrasting. Answer choice (B) is incorrect because if the change in weather was not unprecedented (unexpected), then it would make sense that people were apathetic about it, so these two ideas are not contrasting. Answer choice (C) is incorrect because if the change in weather was not pedestrian (common), then it would make sense that people were shocked, so these two ideas are not contrasting.
- 34. The correct answer is choice (C) exacerbated, which means worsened, and compelled, which means forced.** The second part of the sentence says that drivers had to slowly exit the highway due

to the roadwork. Therefore, the word in the first blank should be negative. This eliminates answer choices (A) and (D). The words worsened and exacerbated both mean the same thing, so we need to look at the second blank to choose the correct answer. Answer choice (B) is incorrect because propelled means to push something forward which does not fit in the second blank as well as compelled which means forced.

- 35. The correct answer is choice (C) attentively, which means carefully, and dynamic, which means powerful.** The sentence says that people listened in a certain way due to the speaker's approach to the topic. Therefore, this is a cause and effect sentence completion. Answer choice (A) is incorrect because tacitly is not a word used to describe how people listen. Answer choice (B) is incorrect because a harmonious, or pleasant, speaker would not cause people to be restless. Answer choice (D) is incorrect because a comedic, or humorous, speaker would not cause people to be sullen, or gloomy. Answer choice (C) is correct because a dynamic, or powerful, speaker would cause people to listen attentively, or carefully.
- 36. The correct answer is choice (C) initial, which means first, and fruitful, which means productive or useful.** We know that the reporter made another attempt, so the word in the second blank has to mean that her first attempt did not prove to work, or be useful. While the words accurate and efficient could work in the second blank, they do not work as well as fruitful and productive: an attempt that was not accurate (correct) and an attempt that was not efficient (systematic or streamlined) do not quite mean an attempt that was not useful. We'll keep that in mind while finding a word for the first blank. The first blank is describing her attempt. The words latest, bold, and initial all fit in the first blank, but the word elementary does not because it means simple or basic. Therefore, we can cross out choice (D). Remember that we said that the words efficient and accuracy don't fit as well in the second blank as fruitful, so answer choice (C) fits in the blank the best.
- 37. The correct answer is choice (B) hypothesis, meaning assumption, and buttressed, meaning supported.** Since the researchers were pleased, we know that the sentence must have a positive meaning. We can eliminate answer choice (A) because impaired is negative. We can eliminate answer choice (C) because a collaboration is not something that is presented. Looking at answer choice (B) and (D), the words hypothesis and conclusion both work in the first blank. However, the word prefaced means introduced which is not positive, it is neutral. The word buttressed means supported which is positive. Therefore, answer choice (B) fits in the blanks the best.
- 38. The correct answer is choice (A) extraneous, which means irrelevant, and remarkable, which means amazing.** Since the editor advised the author to remove material, we know that the first blank should be negative. Therefore, we can eliminate answer choice (B) because crucial means important. The second part of the sentence says "regardless," so we know that the second part of the sentence should contrast the first part. Therefore, the word in the second blank should be positive because it does not make sense to remove material from the book that would be described

as positive on its own. Therefore, we can eliminate answer choice (C) and (D) because dismal means depressing and peculiar means odd which are not positive words.

- 39. The correct answer is choice (D) abated, meaning lessened, and devastating, meaning destroying.** It makes sense that a thunderstorm would harm beachfront properties, so we know the word in the second blank is negative. Therefore, we can eliminate answer choice (A) and (C). Answer choice (B) does not work because the word “though” tells us that the idea in the first part of the sentence should contrast the idea in the second part. The idea that the thunderstorm finally intensified is negative and the idea that the storm overwhelmed beachfront properties is negative, so these ideas are not contrasting. Therefore, we are left with choice (D): the idea that the storm abated, or lessened, is positive, and the idea that the beachfront properties were devastated, or destroyed is negative, so these ideas are contrasting.
- 40. The correct answer is choice (A) detractors, meaning critics, and sentiments, meaning opinions.** The word in the first blank describes people who pointed out an error in the survey: the number of people who responded was too small. Therefore, choices (B) and (D) do not work because admirers and designers would not point out errors. It does not make sense to put “inquiries” into the second blank because inquiries means questions. A survey would show the opinions of the general public, not the question. Therefore, the word “sentiments” fits because it means opinions.
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### Quantitative Reasoning

- 1. Answer choice (B) is the correct answer.** The product of the integers from 50 to 100 inclusive is  $50 \cdot 51 \cdot 52 \cdot \dots \cdot 98 \cdot 99 \cdot 100$ . Therefore, to find the product of the integers from 52 to 100 inclusive, we need to divide out 50 and 51 from the product of the integers from 50 to 100 inclusive to get  $\frac{z}{50 \times 51}$ .
- 2. Answer choice (A) is the correct answer.** Isolate  $b$  by first subtracting  $2a$  from both sides of the equation to get  $-b = 10 - 2a$ . Now divide both sides by  $-1$ , which flips the sign of each term, to get  $b = -10 + 2a$ . This can be rewritten as  $b = 2a - 10$ .
- 3. Answer choice (C) is the correct answer.** Simplify  $8^2$  which equals 64,  $4^3$  which equals 64, and  $4^2$  which equals 16 to get  $\frac{4(64 - 16)}{12(64 - 16)}$ . Since the factor  $(64 - 16)$  is in the numerator and denominator, they cancel out. Therefore, we get  $\frac{4}{12}$  which equals  $\frac{1}{3}$ .
- 4. Answer choice (C) is the correct answer.** If you add the same number to or subtract the same number from every number in a data set, the mean changes by the amount you added or subtracted.

Therefore, if you cut off 10 inches from each piece of wood, the average decreases by 10 inches:  
 $52 - 10 = 42$  inches.

- 5. Answer choice (D) is the correct answer.** Rewrite  $(x + y)^2$  as  $(x + y)(x + y)$  and multiply to get  $x^2 + 2xy + y^2$ . Now we know that  $(x + y)^2 = x^2 + 2xy + y^2$ . Rearrange the right side to get  $(x + y)^2 = x^2 + y^2 + 2xy$ . We know that  $x^2 + y^2 = a$  and  $2xy = b$ , so plug these into the right side of the equation to get  $(x + y)^2 = a + b$ .
- 6. Answer choice (C) is the correct answer.** The ratio of the perimeters of similar shapes is equal to the ratio of any dimension. Therefore, the ratio of the perimeters of the triangles is equal to the ratio of their side lengths, so we can set up and solve the following proportion, using  $p$  to represent the perimeter of triangle ABC:  $\frac{AB}{LM} = \frac{\text{perimeter of } ABC}{\text{perimeter of } LMJ} \rightarrow \frac{6}{9} = \frac{p}{30} \rightarrow 180 = 9p \rightarrow p = 20$  cm.
- 7. Answer choice (B) is the correct answer.** Choose numbers for  $x$  and  $y$  so that  $x$  is a factor of  $y$ : let  $x = 3$  and  $y = 9$ . Check each answer choice until you find one that is NOT true. If all answer choices are true, pick new numbers and try again. Answer choice (A) is true because 9 is a factor of 3. Answer choice (B) is NOT true because 6 is NOT a factor of 9. Answer choice (C) is true because 3 is a factor of 18. Answer choice (D) is true because 3 is a factor of 12.
- 8. Answer choice (B) is the correct answer.** Since the data is symmetric around 90, we can fill in the rest of the graph. The bar at 86 is 1 high, the bar at 88 is 3 high, the bar at 91 is 5 high, and the bar at 93 is 2 high. Now add up the number of students represented by each bar to find the total number of students:  $1 + 2 + 3 + 5 + 6 + 5 + 3 + 2 + 1 = 28$  students.
- 9. Answer choice (C) is the correct answer.** Choose volumes for Cylinder A and B so that the ratio of the volume of Cylinder A to the volume of Cylinder B is 1:4: let the volume of Cylinder A equal  $\pi$  and the volume of Cylinder B equal  $4\pi$ . Since both cylinders have the same height, let the height of both equal 1. Now write an equation for the volume of Cylinder A using the volume formula and solve for the radius:  $\pi = \pi r^2 \cdot 1 \rightarrow r^2 = 1 \rightarrow r = 1$ . Do the same for Cylinder B:  $4\pi = \pi r^2 \cdot 1 \rightarrow r^2 = 4 \rightarrow r = 2$ . Therefore, the ratio of the radius of Cylinder A to the radius of Cylinder B is 1:2.
- 10. Answer choice (D) is the correct answer.** Create a table to find when Car B will catch up with Car A using the fact that Car A travels 45 miles every hour and Car B travels 60 miles every hour. Remember that Car B is 2 hours behind Car A, so Car B doesn't start moving until 2 hours after Car A.

Time Since Car A Left	Car A Distance	Car B Distance
1 hours	45 miles	0 miles
2 hour	90 miles	0 miles

3 hours	135 miles	60 miles
4 hours	180 miles	120 miles
5 hours	225 miles	180 miles
6 hours	270 miles	240 miles
7 hours	315 miles	300 miles
8 hours	360 miles	360 miles

From the table, we can see that Car B caught up to Car A after 360 miles.

- 11. Answer choice (B) is the correct answer.** The slope of a distance vs. time graph represents the speed. Therefore, we are looking for the portion of the graph with the steepest slope (positive vs. negative slope doesn't matter because speed is always positive). The steepest portion of the graph is in between 20 and 30 minutes, so out of the answer choices, Dan was driving the fastest at 25 minutes.
- 12. Answer choice (B) is the correct answer.** There are 36 possible ways you can roll two standard dice because each die has 6 sides and  $6 \cdot 6 = 36$ . To roll a sum that is no more than 3, you can roll a 1 and a 1, a 1 and then a 2, or a 2 and then a 1. Therefore, there are 3 out of 36 ways to roll a sum of no more than 3, so the probability is  $\frac{3}{36} = \frac{1}{12}$ .
- 13. Answer choice (B) is the correct answer.** Since  $y = x^2$ ,  $y$  is positive for all values of  $x$  except 0. Therefore, the minimum value of  $y$  is 0. The maximum value of  $y$  occurs when the absolute value of  $x$  is the largest, so the maximum value of  $y$  is when  $x = 3$ :  $y = 3^2 = 9$ . Therefore,  $y$  is in between 0 and 9, so  $0 \leq y \leq 9$ .
- 14. Answer choice (B) is the correct answer.** An odd number multiplied by an odd number is *always* odd. Therefore, the numerator of the fraction in answer choice (B) is always odd because 3 and  $x$  are both odd. An odd number divided by an even number is *never* an integer, so answer choice (B) could NOT be an integer.
- 15. Answer choice (D) is the correct answer.** Use the slope formula to find the value of  $x$ :  $slope = \frac{y_2 - y_1}{x_2 - x_1}$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug in  $\frac{2}{5}$  for the slope and plug in the given coordinates:  
 $\frac{2}{5} = \frac{3 - (-1)}{x - 1}$ . Solve the equation for  $x$ :  $\frac{2}{5} = \frac{4}{x - 1} \rightarrow 2(x - 1) = 20 \rightarrow 2x - 2 = 20 \rightarrow 2x = 22 \rightarrow x = 11$ .

- 16. Answer choice (C) is the correct answer.** Since both integers are positive, the two smallest integers that have a difference of 8 are 1 and 9. The sum of 1 and 9 is 10.
- 17. Answer choice (C) is the correct answer.** Start with a square that measures 10 by 10, so the area is 100. Now decrease the side length by 10% to get a 9 by 9 square with an area of 81. The percent change from 100 to any number is just equal to the difference between the numbers. Therefore, the percent change from 100 to 81 is 19%.
- 18. Answer choice (D) is the correct answer.** To find  $h(-6)$ , plug in  $-6$  for  $x$  in the  $h(x)$  equation:  $h(-6) = (-6)^2 = 36$ . Therefore,  $h(-6) \neq -36$ , so answer choice (D) is NOT true.
- 19. Answer choice (C) is the correct answer.** Since  $3^2 = 9$ , we want to rewrite  $3^8$  as  $(3^2)^4$ . Simplify  $3^2$  to get that  $3^8 = (3^2)^4 = 9^4$ .
- 20. Answer choice (B) is the correct answer.** The formula for the area of a circle is  $A = \pi r^2$ , so the radius of a circle with an area of  $16\pi$  is 4. If we double the radius, the new radius is 8. The formula for the circumference of a circle is  $C = 2\pi r$ , so the circumference is  $2 \cdot 8\pi$  which equals  $16\pi$ .
- 21. Answer choice (B) is the correct answer.** Simplify the expression in Column A:  
 $5 - 2 \times (14 - 10) = 5 - 2 \times 4 = 5 - 8 = -3$ . Therefore, Column B is greater than Column A.
- 22. Answer choice (C) is the correct answer.** The area of a triangle is equal to the base times the height divided by two. Set up and solve the following equation to find  $x$ :  $(x \cdot 2x) \div 2 = 36 \rightarrow (2x^2) \div 2 = 36 \rightarrow x^2 = 36 \rightarrow x = 6$  in. The perimeter of a square equals four times the side length. Set up and solve the following equation to find  $y$ :  $4y = 24 \rightarrow y = 6$  in. Therefore, Column A and Column B are equal.
- 23. Answer choice (D) is the correct answer.** Rewrite the expression in Column A as  $(a + b)(a + b)$  and multiply the binomials to get  $a^2 + 2ab + b^2$ . Since we don't know the values of  $a$  and  $b$ , we cannot determine the relationship between  $a^2 + 2ab + b^2$  and  $a^2 + b^2$ . If  $a$  and  $b$  are both 0, then the two expressions are equal. However, if  $ab$  are both positive, then  $a^2 + 2ab + b^2$  is greater than  $a^2 + b^2$ .
- 24. Answer choice (B) is the correct answer.** Distribute the  $-3$  in Column A to get  $-3x - 12$ . Since  $-3x - 12$  and  $-3x + 12$  both have a  $-3x$ , we just need to compare  $-12$  and  $+12$ . Since  $+12$  is greater than  $-12$ , Column B is greater than Column A.
- 25. Answer choice (A) is the correct answer.** The ratio of the perimeters of similar shapes is equal to the ratio of any dimension. Therefore, the ratio of the perimeter of Rectangle A to the perimeter of Rectangle B is equal to the ratio of the widths, so it is 2:3. The ratio of the areas of similar shapes is equal to the ratio of any dimension square. Therefore, the ratio of the area of Rectangle A to the area of Rectangle B is  $(2:3)^2 = 4:9$ . Since ratios are like fractions, 2:3 is greater than 4:9.

- 26. Answer choice (B) is the correct answer.** To change negative exponents into positive exponents, move the term being raised to the negative exponent to the other side of the fraction line. Therefore,  $x^{-5} = \frac{1}{x^5}$ . Since  $x$  is in between 0 and 1, raising  $x$  to the fifth power will result in a fraction that is less than 1. For example,  $\left(\frac{1}{2}\right)^5 = \frac{1}{32}$ . Dividing 1 by something less than 1 results in a number greater than 1. For example:  $1 \div \frac{1}{32} = 32$ . Therefore, Column B is greater than Column A.
- 27. Answer choice (D) is the correct answer.** The smallest possible perimeter of a rectangle that has an area of 64 is when the rectangle measures 8 by 8, so the perimeter is 32. The largest possible perimeter is when the rectangle measures 64 by 1, so the perimeter is 130. Since the perimeter of the rectangle could be equal to 32 or greater than 32, there is not enough information to compare Column A and Column B.
- 28. Answer choice (C) is the correct answer.** Consecutive integers follow a sequence where each integer is 1 more than the previous integer. For example, 4, 5, 6, 7, 8 are consecutive integers. The average of a set of consecutive integers is *always* the median, or middle. Therefore, if 15 is the average of three consecutive integers it is also the middle integer, so Column A and Column B are equal.
- 29. Answer choice (B) is the correct answer.** Since lines  $m$  and  $n$  are perpendicular, their slopes are *opposite reciprocals* (example of opposite reciprocals:  $\frac{5}{2}$  and  $-\frac{2}{5}$ ), so the slope of one of the perpendicular lines is positive and the other slope is negative. Since line  $m$  goes up to the left and down to the right, it has a negative slope. Therefore, the slope of line  $n$  is positive, so Column B is greater than Column A.
- 30. Answer choice (A) is the correct answer.** Isolate  $b$  in the given equation to get  $b = a - 8$ . Multiply both sides of the equation by 2 to get  $2b = 2a - 16$ . Therefore, Column B equals  $2a - 16$ . Since the expressions  $2a - 8$  and  $2a - 16$  both have a  $2a$ , we can just compare  $-8$  and  $-16$ . Since  $-8$  is greater than  $-16$ , Column A is greater than Column B.
- 31. Answer choice (A) is the correct answer.** Let the number of students at Riverdale High and the number of students at Sunnyside High in 1989 equal 100. Increase 100 by 10% to get 110 students at Sunnyside High in 1990. Decrease 110 by 10% to get 99 students at Sunnyside High in 1991. Therefore, the number of students at Riverdale High in 1991 (100 students) is greater than the number of students at Sunnyside High in 1991 (99 students), so Column A is greater than Column B.

- 32. Answer choice (C) is the correct answer.** Let  $x$  equal the number of apples that Leslie bought. Since she bought twice as many oranges as apples, she bought  $2x$  oranges. Write an equation setting the cost of  $x$  apples and  $2x$  oranges equal to \$18 and solve:  $1.5x + 0.75(2x) = 18 \rightarrow 1.5x + 1.5x = 18 \rightarrow 3x = 18 \rightarrow x = 6$ . Therefore, Leslie bought 6 apples and 12 oranges. The cost of 6 apples is  $1.5(6)$  which equals \$9. The cost of 12 oranges is  $0.75(12) = \$9$ , so Column A and Column B are equal. You could also realize that the price of an orange is *half* of the price of an apple, so if Leslie buys *twice* as many oranges as apples, she will spend the same amount on each fruit.
- 33. Answer choice (A) is the correct answer.** There are 5 odd numbers in between 1 and 10: 1, 3, 5, 7, 9. There are only 4 prime numbers in between 1 and 10: 2, 3, 5, 7. Therefore, the probability of drawing two odd numbers is higher than the probability of drawing two prime numbers.
- 34. Answer choice (B) is the correct answer.** To find the shaded area, we need to know the dimensions of the shaded square. Since there is a 2 inch border all around, the side length of the shaded square is 4 inches fewer than the side length of the outside square, so the side length of the shaded square is  $x - 4$ . Therefore, the area of the shaded region is  $(x - 4)^2$ . Since  $x$  is positive,  $(x - 2)$  is greater than  $(x - 4)$ , so  $(x - 2)^2$  is greater than  $(x - 4)^2$ . Column B is greater than Column A.
- 35. Answer choice (B) is the correct answer.** While we cannot determine the exact median from a histogram because a histogram does not show exact data points, we can determine a range of the possible medians. The median of a data set is the middle number when the numbers are lined up from least to greatest. The histogram represents 19 data points (add up the heights of each bar), so the median is the 10th data point which falls in the \$40,000 to \$54,000 bar. Therefore, the median is in between \$40,000 to \$54,000, so Column B is greater than Column A.
- 36. Answer choice (C) is the correct answer.** To find 50% of  $x$ , multiply  $\frac{50}{100}$  by  $x$  to get  $\frac{1}{2}x$ . To find  $x\%$  of 50, multiply  $\frac{x}{100}$  by 50 to get  $\frac{1}{2}x$ . Therefore, Column A and Column B are equal. You can also choose a few numbers for  $x$  and determine the relationship between the two columns. If  $x = 0$ , Column A and B both equal 0 because 50% of 0 = 0 and 0% of 50 = 0. If  $x = 100$ , Column A and B both equal 50 because 50% of 100 = 50 and 100% of 50 = 50.
- 37. Answer choice (C) is the correct answer.** Triangle AED and Triangle ACD both share a base AD and a height that is the length of CD. Therefore, their areas are the same.
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## Reading Comprehension

### Passage 1

1. The passage is mainly concerned with detailing and recalling the events that lead to the First World War. While the passage does talk about how the assassination of Archduke Ferdinand played a significant role in the start of the First World War, this is not the only event that the passage covers, so answer choice (A) is incorrect. While the passage does mention that the political ramifications of the First World War are still evident today, it does not go into any detail on how the war affected modern global affairs, so answer choice (C) is incorrect. While the passage says that it is vitally important to know the historical “trivia” of a century ago in order to avoid such tragedies in the future, this is just the closing sentence and not the main focus of the passage, so answer choice (D) is incorrect. The passage is primarily concerned with summarizing the circumstances leading to the First World War. **Answer choice (B) is the correct answer.**
2. The end of the third paragraph tells us that during the time before Archduke Ferdinand’s assassination, strong feelings of nationalism ran high in the small nation of Serbia. The fourth paragraph tells us that most Serbians considered themselves Slavs and many wanted to unite the Slavs in their region. This would directly threaten the Austro-Hungarian Empire so we can infer that the Austro-Hungarian powers were hostile to this idea. Archduke Ferdinand, being the heir to the Austro-Hungarian throne, represented these powers, so we can infer that this is the reason he was targeted by Serbian forces. **Answer choice (A) is the correct answer.**
3. Lines 61-64 state “The eventual loss of life was staggering, and the political ramifications are still very much evident today.” The loss of life this sentence is referring to is due to the First World War. Staggering means a large amount, so we can assume that this would have effects that would still be evident today. Another way to say that is the loss of life had political consequences that are still evident today. **Therefore, answer choice (C) is the correct answer.**
4. The passage starts off by saying that most Americans don't really know much about the origins of the First World War (a generalization). The passage goes on to discuss in more detail the historical climate and events leading up to the start of the war (historical information). The final paragraph of the passage questions if the war would have started had these events been different and if it is important to know the historical “trivia” of a century ago, and then answers these questions. Based on this, the organization of the passage can best be described as a generalization is made, relevant historical information is provided, and then questions are posed and answered. **Therefore, answer choice (C) is the correct answer.**
5. We are looking for the answer choice that the author does NOT mention contributed to the outbreak of the First World War. While talking about France, Britain, and Germany, lines 27-29 state “All of these powers competed for influence and territory in Europe as well as in Africa. These countries were all major participants in the First World War and their competition for territory contributed to the outbreak of the war, so answer choice (A) is incorrect. The reason that Archduke Ferdinand was assassinated was because of the desire of the people of Serbia, the Slavs, to unify, and the Austro-Hungarian powers being hostile to this idea, so answer choice (B) is incorrect. The passage says that Archduke Ferdinand is the name most often associated with the

start of the hostilities that would lead to the First World War, not for anything he did, but because he and his wife were assassinated by a Serbian named Gavrilo Princip, so answer choice (D) is incorrect. The only thing that the author did not mention contributed to the outbreak of the First World War is collaboration between the Serbian military and Germany. **Therefore, answer choice (C) is the correct answer.**

6. The final paragraph starts off with the question of if the war would still have started had the Archduke not been killed. Lines 66-72 state “Most historians believe that tensions were so high that war was inevitable. The origins of the ‘Great War’ had much less to do with Ferdinand than with power struggles and an overheated nationalism in a world of shifting borders.” Essentially, historians believe that the First World War would almost certainly have started even if Archduke Ferdinand had not been assassinated. **Therefore, answer choice (A) is the correct answer.**

## Passage 2

7. The first sentence in the passage states “Even if one feels utterly comfortable with ceding control of certain daily tasks to some digital contraption, one might still feel queasy at the idea of letting an algorithm be responsible for your safety as you travel near and far.” This sentence is an introduction to the main focus of the passage: autonomous vehicles. An autonomous vehicle is one that can drive itself. Driving is a daily task for many people and having a car that could drive itself would mean a person would no longer have to drive themselves. **Based on this context, we can infer the first sentence is trying to say even if one feels comfortable giving control of certain daily tasks to a digital contraption, so answer choice (C) is the correct answer.**
8. The sixth paragraph in the passage talks about autonomous vehicle’s GPS systems. The GPS system tells the vehicle where it is relative to other objects, or self-locates. Lines 57-60 state “Atmospheric conditions can mess with the data, so the system incorporates data previously collected from the same location to minimize any errors.” Atmospheric conditions is just a fancy way to say weather conditions, so a snow blizzard would be an atmospheric condition. **Based on this, we can infer that in a blizzard with high wind and heavy snow that the vehicle's ability to self-locate would be affected, so answer choice (A) is the correct answer.**
9. The fifth paragraph in the passage talks about the laser beams used in autonomous systems. Lasers are used to provide depth information but they are not foolproof on their own. Lines 49-54 state “Laser beams, however, diverge as they travel, making them less useful for long distance mapping, so the data from these sensors is combined with info from video cameras to create as accurate a map as possible.” This sentence tells us that data from video cameras can make long distance mapping more accurate. **Therefore, answer choice (C) is the correct answer.**
10. The author’s purpose in writing this passage is to educate readers on the different types of technologies and mechanics used by autonomous vehicles. While the author does talk about the future of autonomous vehicles, he/she does not talk about how or make the case that they are

continuing to improve, so answer choice (A) is incorrect. The author focuses on autonomous vehicles in the passage and not the advancements that lead to their development, so answer choice (B) is incorrect. While the author does quickly mention the technologies that help car and truck drivers self-locate, he/she is focused on technology that will help autonomous cars and not human drivers, so answer choice (C) is incorrect. The author’s main purpose in writing this passage is to provide an overview of the variety and mechanics of autonomous vehicles. **Therefore, answer choice (D) is the correct answer.**

11. Overall the author seems to be talking about the many positives of the technology that allows and will continue to allow autonomous cars to be developed. However, there are brief moments of doubt or a less than positive attitude. For example, the first paragraph ends with the author asking if autonomous vehicles will ever be able to maneuver on backroads or congested streets, to which he/she answers we shall see. The author also brings up that there have been many accidents with autonomous cars and that they are not foolproof, but he/she points out that neither are human drivers. For the most part the author’s tone could be described as positive with some doubt, or somewhat positive. **Therefore, answer choice (C) is the correct answer.**
12. Lines 71-77 state “Putting all of this together - mapping, self-location, and obstacle avoidance -- an algorithm determines a rough long-range route to a destination, and then plots short-range paths that are continually updated given the vehicles speed, traffic conditions, etc.” In other words, the algorithm makes a series of short range decisions after determining a general course. **Therefore, answer choice (A) is the correct answer.**

### Passage 3

13. This passage mainly serves to educate readers on some of the many reasons that authors do not use their real names when writing and publishing books. The passage is filled with examples of authors who have done this and explains the reasons that prompted them to do so. While the passage does mention that some authors felt their work would be more successful if they used a pen name, it does not say that using a pen name is often crucial to an author’s success, so answer choice (A) is incorrect. While the passage does give a brief history of terms that are synonymous with pen names, it does not give a chronological account of the use of pen names or give the origin of the tradition, so answer choices (C) and (D) are incorrect. The primary purpose of this passage is to explain and give examples for some of the reasons author’s use pen names. **Therefore, answer choice (B) is the correct answer.**
14. We are looking for the answer that is NOT mentioned in the passage as a reason for using a pen name. The seventh paragraph talks about more serious reasons that author’s use pen names. It states that an author might use a pen name to protect themselves after publishing a controversial work. A controversial work would probably anger some other people, so answer choice (B) is incorrect. The passage talks about how Stephen King used a pen name to write four novels because his publishers feared that many of his fans would not purchase more than one of his books per year

thus inhibiting sales, so answer choice (C) is incorrect. The final paragraph in the passage talks about a book series written by two men who used the pen name Ellery Queen. The paragraph says the brand was so successful that even after both men stopped writing, future works were still authored by “Ellery Queen”, so answer choice (D) is incorrect. The only reason for using a pen name that is not mentioned in the passage is to attempt to deceive potential buyers into thinking that a well-known author had written a book under a different name. **Therefore, answer choice (A) is the correct answer.**

15. Lines 46-50 state “Sometimes the spirit of fun informs the choice of name. Romance novelist Julie Woodcock chose to go by ‘Angela Knight’ because of the mood of chivalry and romance evoked by this name.” The second sentence is giving an example of an author who chose their name based on the mood the name evoked, Knight evoked a mood of chivalry. We can infer then that the first sentence is saying that sometimes the spirit of fun or the mood you are going for helps to make the decision on the choice of name. Therefore, the word “informs” most nearly means helps determine. **Answer choice (C) is the correct answer.**
16. Lines 26-30 state “Others have used separate names when penning books in widely differing genres. The mathematician Charles Dodgson and Lewis Carrol, who wrote *Alice in Wonderland*, were on and the same.” This sentence is saying that Charles Dodgeson was the same person as Lewis Carrol. Lewis Carrol wrote *Alice in Wonderland*, which is a fiction book, so we can assume that Dodgeson, who was a mathematician, used a pen name because the books he wrote using his real name were non-fiction mathematics based books. **Answer choice (A) is the correct answer.**
17. Lines 61-65 state “Other more serious reasons for publishing under a false name include wishing to protect oneself from reprisal, even physical harm, after publishing a controversial work.” Since the sentence is telling us this reason for using a false name is to protect oneself, we know that reprisal must be something negative. We also know that reprisal could include physical harm and that it could be the result of publishing a controversial work. Payback is closest in meaning to reprisal in this context because someone might want payback against an author who published controversial work and payback could be in the form of physical harm. **Therefore, answer choice (D) is the correct answer.**
18. Lines 13-18 state “(Curiously, this term did *not* originate with the French. They use *nom de guerre*, which literally means ‘name of war,’ but is used by native French-speakers to represent a range of false identities.” This sentence is referring to how the phrase *nom de plume* is actually not widely used in France and was created by the British. **Therefore, answer choice (C) is the correct answer.**

#### Passage 4

19. The passage is primarily concerned with the process that trees and other plants use to draw water up from their roots to their branches and leaves called transpiration. While the passage mentions

that some trees, like redwoods, can be over 300 feet tall, it does not focus on explaining how they grow this tall, so answer choice (A) is incorrect. While the passage does mention that desert plants have adapted to survive with little available water, this is just a small section at the end of the passage and not its main focus, so answer choice (C) is incorrect. The passage as a whole is focused more on the process of how trees and plants move water in general rather than detailing the specific ways the cells of these plants work, so answer choice (D) is incorrect. Overall, the passage is primarily concerned with describing the process by which trees and other plants move water from the soil into their leaves. **Therefore, answer choice (B) is the correct answer.**

20. Lines 8-12 state “The main driving factor in sending water into the roots and up is the difference in water potential between the air right around the leaves of the tree and the air more generally in the atmosphere.” Lines 15-19 state “If the water potential around the leaves is higher than the potential in the surrounding atmosphere, water vapor will travel upwards from the leaf airspace.” Based on these two sentences, we can see that in order for water to travel up through a tree, the water potential in the atmosphere around the tree must be lower than that of the air close to the leaves. **Therefore, answer choice (C) is the correct answer.**
21. Lines 28-30 state “This is how it more or less works in all plants, though in large trees, there’s an awful lot of gravity to surmount.” We know that gravity is the force created by the Earth that pulls “down” on everything on or around Earth’s surface. Therefore, the sentence is trying to say that in a large tree, in order for the water to get all the way to the top, it will have to fight, or overcome, more gravity than a smaller plant would because of how high the water will have to go. This means the word “surmount” most nearly means overcome. **Answer choice (D) is the correct answer.**
22. The final paragraph in the passage talks about how desert plants have adapted to living in such a dry environment. Lines 51-56 state “Once again, the natural world works its wonders: the leaves on these plants have little surface area and their stomata are sunken; this serves to reduce the loss of water due to transpiration so that they can conserve as much as possible.” Unlike a plant in the desert, a plant in the rainforest would have an abundance of water and would not need to conserve it as much, so we can infer that it would not need to have sunken stomata. **Answer choice (D) is the correct answer.**
23. Lines 38-42 state “The whole process is called transpiration, and while it’s highly effective, it doesn’t seem particularly efficient, as only two or three percent of the water taken in by the roots stays in the tree.” In other words, the author is saying that very little of the water that moves through a tree is actually used by the tree. **Therefore, answer choice (B) is the correct answer.**
24. We are looking for the answer choice that the author does NOT do in the passage. The main focus of the passage is on transpiration, which is the process by which trees move water from their roots up to their leaves. The first paragraph of the passage says that this process is one of the world’s many wonders but that it is easy to take for granted, or people don’t always properly appreciate how impressive it is, so answer choice (A) is incorrect. Lines 23-26 state “As water molecules

evaporate from a leaf, they pull on their neighbor molecules, and up and way they all go through a system not unlike our veins and arteries.” In that sentence the author compares how trees move water to how humans move blood through their veins, so answer choice (C) is incorrect. In the final paragraph the author talks about how desert plants have adapted to survive with little water available to them. He/she describes this adaptation as the natural world working its wonders again. This is the author professing his/her admiration for how desert plants have adapted, so answer choice (D) is incorrect. The only thing the author does not do in the passage is draw an analogy between transpiration in large trees and the overcoming of obstacles. **Therefore, answer choice (B) is the correct answer.**

### Passage 5

25. *The Return of a Forgotten Genius* does not work for the entire passage. While the passage does talk about how there has been a growing appreciation for Nikola Tesla recently and that there is a successful car company that bears his name, this is not the main focus of the passage, so answer choice (A) is incorrect. *The Man Who Surpassed Thomas Edison* does not work as a title because the passage portrays Tesla as somewhat of a second place to Thomas Edison during the time when both were alive, so answer choice (B) is incorrect. *The Scientist who Engineered the Future* is not a good title for the passage because while many of Tesla's inventions were said to be before their time, most of them were too complex or impractical to actually be adopted, so answer choice (D) is incorrect. *The Brilliant Mind of an Eccentric Original* is a good title for this passage because it encapsulates everything the passage is trying to say. The passage mainly focuses on the personality and life of Nikola Tesla, noting his eccentricity and original way of thinking. **Therefore, answer choice (C) is the correct answer.**
26. The author of the passage talks about Tesla in a mostly favorable light. He/she calls him a genius and says he showed incredible promise and work ethic. In the final sentence of the passage the author calls Tesla “one of mankind’s most imaginative minds.” It is clear that the author has some admiration for the man, but he also shows skepticism about some of his ideas. In lines 67-69 he/she writes “In his 70’s, Tesla claimed -- without proof -- to have invented a motor that ran on cosmic rays.” The author also questions some of Tesla's other more bizarre claims, such as building a machine to record thought. Overall the author's attitude towards Tesla can best be described as favorable though skeptical of some of his claims. **Answer choice (A) is the correct answer.**
27. As mentioned in the previous question's answer, the author seemed to view Teslas in a mostly favorable light but was skeptical about some of his claims. In the sixth paragraph the author points out multiple claims made by Tesla that seem too ridiculous to be true and even mentions that he did not have proof for some of them. These include claiming electric waves could enhance intelligence and claiming to have built a super weapon that would end all war. Based on this, we can infer that the author would most likely agree that not all of Tesla’s claims regarding his inventions were accurate. **Therefore, answer choice (C) is the correct answer.**

28. Lines 82-86 state “Some of this fascination is no doubt due to his eccentricity, which seems to have been an inherent part of the workings of one of mankind’s most imaginative minds.” The word “inherent” is referring to Tesla’s eccentricity. We know from the passage that Tesla was a very eccentric person, so eccentricity would most likely have been a natural part of the workings of his mind. Therefore, the word “inherent” most nearly means natural. **Answer choice (B) is the correct answer.**
29. Lines 46-49 state “Tesla’s fortunes improved after he went to work for the Westinghouse Company, where he was paid a large sum for his patent of an induction motor.” This tells us that an induction motor was one of Tesla’s most financially rewarding inventions. **Therefore, answer choice (D) is the correct answer.**
30. For this question, we are looking for the answer choice that happened first. We know from the passage that the company named for Tesla was formed after his death which would make that answer choice last in order, so answer choice (B) is incorrect. Lines 16-20 state “Eventually he went to a university in what is now the Czech Republic once he was able to quit gambling. This led to Tesla working for Consolidated Edison in New York...” Based on that, we can see that he started working for Consolidated Edison after moving to the Czech Republic, so answer choice (C) is incorrect. We can also see that he moved to the Czech Republic after he quit gambling, so answer choice (D) is incorrect. The thing that happened first on this list is Tesla quit gambling. **Therefore, answer choice (A) is the correct answer.**

### Passage 6

31. The author’s purpose for writing this passage is to talk about some of the things his friends and others assumed about his move from New York to Kansas and how those things actually played out. While the author mentions his life in New York briefly, he doesn’t talk about his life before having a family, so answer choice (A) is incorrect. While the author does mention that there is a different “style” between Kansas and New York, there really weren’t any other biases his friends had that were accurate, so answer choice (C) is incorrect. While the author does talk about the people he encountered in his new city, he doesn’t mention any surprising discoveries he made about them, so answer choice (D) is incorrect. The author’s main purpose for writing this passage is to compare some of the assumptions people made about his move to how he actually experienced it. **Therefore, answer choice (B) is the correct answer.**
32. Lines 22-26 state “Despite the impeccable logic of our decision, my East Coast friends and family expressed a certain skepticism about how well I’d adjust to life outside of the hyperactive environment that is New York.” This word “impeccable” is describing the author’s logic used in making his decision to move. The sentence says despite this logic, his friends still questioned him. Since the sentence starts off with the word despite, we know that the author is trying to say he made the decision with very sound, or perfect, logic. **The answer choice that is closest in meaning to perfect is flawless. Answer choice (C) is the correct answer.**

33. In the third paragraph of the passage, the author talks about how his East Coast friends and family were skeptical of his move to the midwest. They cited concerns like, is there enough to do in Kansas? Is there a nightlife? Is there good Thai food? The author also mentions that his friends believed that unlike him, his wife would be fine with the move because she grew up in the Midwest. Based on this, we can infer that the author believes that some of his friends from the East Coast believed he would not be content with his move to the Midwest. **Therefore, answer choice (D) is the correct answer.**
34. In the fifth paragraph, the author talks about what it is like being a father. He says that being the father of a new human keeps any boredom he may face at bay and having a family is something of an extreme sport. Lines 45-49 state “In any case, I often get the sense that I live within a family of four -- a bundle of baby boy followed his sister’s entrance by about two years -- not within the confines of any particular geographic location.” In this sentence, the author is trying to make the point that being a father and being part of a family is more significant than where he lives or if he moved to the Midwest from New York. **Therefore, answer choice (A) is the correct answer.**
35. While discussing the people in the Midwest, in lines 66-68 the author writes “People here are less on the defense in most transactions, social or otherwise.” The author isn’t using the word transaction to mean buying and selling so answer choice (A) is incorrect. The word transactions is describing social or other engagements between people, so answer choice (D) doesn't really make sense and is incorrect.. While a disagreement can be a social engagement, all social engagements are not disagreements, so answer choice (C) is incorrect. What the author is trying to say is people are less on the defense in most dealings. **Therefore, answer choice (B) is the correct answer.**
36. In the first paragraph the author talks about moving to a quiet suburb in the Midwest from the coisly center of New York City. He talks about how it still sounds funny to him to say he lives in Kansas and jokingly asks Kansas? How did that Happen? This serves to introduce the reader to the main focus of the passage (the author’s move to Kansas from New York), and does this in a lighthearted joking manner. **Therefore, answer choice (C) is the correct answer.**
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### Mathematics Achievement

1. **Answer choice (C) is the correct answer.** Turn  $\frac{5}{9}$  into a decimal by dividing the numerator by the denominator to get  $0.\overline{5}$ . Since 0.55556 is a rounded approximation of  $0.\overline{5}$ , it is not equal to  $\frac{5}{9}$ . Answer choice (A) is equal to  $\frac{5}{9}$  as we just showed. Answer choice (B) is equal to  $\frac{5}{9}$  because  $\frac{0.1}{0.18} = \frac{10}{18} = \frac{5}{9}$ . Answer choice (D) is equal to  $\frac{5}{9}$  because  $\frac{2.5}{4.5} = \frac{25}{45} = \frac{5}{9}$ .

2. **Answer choice (C) is the correct answer.** If you plug 0 in for  $x$  in both sides of the equation, you get that both sides are equal:  $-12(0) = 6(0) \rightarrow 0 = 0$ .
3. **Answer choice (C) is the correct answer.** Perform the subtraction first to get  $\sqrt{36}$  which equals 6 because  $6^2 = 36$ .
4. **Answer choice (B) is the correct answer.** Change  $\frac{30}{6000}$  into a decimal by dividing the numerator by the denominator to get 0.005. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10. The power, or exponent, tells us how many times to move the decimal point: positive means move to the right and negative means move to the left. To write 0.005 in scientific notation, change it into a decimal that is in between 1 and 10: 0.005 becomes 5. To get from 5 to 0.005, we need to move the decimal point 3 times to the left. Therefore, we can write 0.005 as  $5 \times 10^{-3}$ .
5. **Answer choice (C) is the correct answer.** To find the shaded area, we need to find the area of each small square, so we need to find the side length of each small square. Count how many side lengths are around the perimeter of the shaded region to get 16. Since the perimeter of the shaded region is 32 units, divide 32 by 16 to get a side length of 2 units. Therefore, the area of each square is  $2^2$  which is 4 units<sup>2</sup>. There are a total of 12 shaded squares, so the total shaded area equals  $4 \cdot 12 = 48$  units<sup>2</sup>.
6. **Answer choice (D) is the correct answer.** Let  $x$  equal the number of sugar cookies Pam sold. Since she sold three times as many chocolate chip cookies as sugar cookies, she sold  $3x$  chocolate chip cookies. Set the total number of sugar and chocolate chip cookies sold equal to 120 and solve for  $x$ :  $x + 3x = 120 \rightarrow 4x = 120 \rightarrow x = 30$ . Therefore, Pam sold 30 sugar cookies and 90 chocolate chip cookies.
7. **Answer choice (D) is the correct answer.** Rewrite  $(x - 9)^2$  as  $(x - 9)(x - 9)$ . Now multiply the two binomials using the box method, distributing, or foiling to get  $x^2 - 18x + 81$ .
8. **Answer choice (B) is the correct answer.** The first three flips do not affect the probability of the last three flips. Therefore, we just want to find the probability of a coin landing on heads for three flips. To find the probability of multiple events, multiply the probabilities of each event. The probability that a coin lands on heads is  $\frac{1}{2}$ , so the probability of the coin landing on heads three times =  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$ .
9. **Answer choice (D) is the correct answer.** The mode of a data set is the number that appears the most. The age that appears the most is 15, so 15 is the mode.

- 10. Answer choice (A) is the correct answer.** The greatest common factor of 16, 12, and 8 is 4 because it is the largest number that 16, 12, and 8 are all divisible by. Therefore, we can get rid of answer choices (C) and (D). To find the greatest common factor of variable expressions, take the *lowest exponent* for each variable: 2 for  $a$  and 1 for  $b$ . If a variable does not show up in each expression, it cannot be part of the greatest common factor, so  $c$  cannot be part of the greatest common factor. Therefore, our greatest common factor is  $4a^2b$ .
- 11. Answer choice (A) is the correct answer.** To make a fraction 0, the numerator must equal 0 without the denominator equaling 0. Set each factor in the numerator equal to 0 and solve. If  $x - 3 = 0$ , then  $x = 3$ . If  $x - 6 = 0$ , then  $x = 6$ . If you plug 3 into the denominator for  $x$ , it equals 0. Therefore, 3 does not make the fraction 0, so the only answer is 6.
- 12. Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up and solve an equation for Craig's test average, using  $x$  to represent the score of his final test and 93 as the average:  $93 = \frac{91 + 96 + 98 + x}{4} \rightarrow 93 = \frac{285 + x}{4} \rightarrow 372 = 285 + x \rightarrow x = 87$ .
- 13. Answer choice (D) is the correct answer.** Solve the equation by first adding  $\frac{1}{3}a$  to both sides to get  $6 = 36 + \frac{5}{6}a$ . Now subtract 36 from both sides to get  $-30 = \frac{5}{6}a$ . Divide both sides by  $\frac{5}{6}$ , which is the same as multiplying by  $\frac{6}{5}$ , to get  $a = -36$ .
- 14. Answer choice (D) is the correct answer.** Distribute the  $-2$  to get  $-5p^3q^5 + p^5q^3 - 6p^5q^3 + 8p^3q^5$ . Combine the  $p^3q^5$  terms together by adding the coefficients:  $-5p^3q^5 + 8p^3q^5 = 3p^3q^5$ . Combine the  $p^5q^3$  terms together by adding the coefficients:  $p^5q^3 - 6p^5q^3 = -5p^5q^3$ . Add the terms together to get  $3p^3q^5 - 5p^5q^3$ .
- 15. Answer choice (A) is the correct answer.** The bases of a trapezoid are parallel, so they have the same slope. If you plot the point  $(2, -4)$ , you will have a trapezoid with a short base connecting the points  $(-2, 4)$  and  $(2, 2)$  and a long base connecting the points  $(-6, 0)$  and  $(2, -4)$ . The slope between the points  $(-2, 4)$  and  $(2, 2)$  is  $-\frac{1}{2}$ , and the slope between the points  $(-6, 0)$  and  $(2, -4)$  is also  $-\frac{1}{2}$ . Therefore, the bases are parallel, making the shape a trapezoid.
- 16. Answer choice (B) is the correct answer.** Divide 4.5 by 1.8 to get 2.5. Divide  $10^4$  by  $10^{-2}$  by subtracting the exponents to get  $10^6$ . Multiply the results together to get  $2.5 \times 10^6$ .

**17. Answer choice (D) is the correct answer.** Find the slope of the line by using the formula for

$$\text{slope: } slope = \frac{y_2 - y_1}{x_2 - x_1}. \text{ Plug in the given points and solve: } slope = \frac{8 - 2}{3 - 6} = \frac{6}{-3} = -2.$$

**18. Answer choice (B) is the correct answer.** To find the mean, add up the data points and divide the sum by the number of data points. The sum of the data points equals  $10 + 25 + 5 + 30 + 10 + 20 + 5 = 105$ . Divide 105 by 7 to get a mean of 15.

**19. Answer choice (A) is the correct answer.** Isolate  $x$  in the inequality by first subtracting 6 from all three parts to get  $-12 < -3x \leq 3$ . Now divide each part by  $-3$ , remember to flip the inequality signs:  $4 > x \geq -1$  which is the same as  $-1 \leq x < 4$ . Since  $x$  can equal  $-1$ , we want a closed circle at  $-1$ . Since  $x$  cannot equal 4, we want an open circle at 4. This eliminates answer choice (B) and (D). Since  $x$  is in between  $-1$  and 4, we want a solid line in between  $-1$  and 4, so graph (A) is correct.

**20. Answer choice (B) is the correct answer.** If you plug in 1, 2, 3, 4, and 5 for  $n$  into the expression in answer choice (B), you will get the given sequence:  $5(1) - 11 = -6$ ;  $5(2) - 11 = -1$ ;  $5(3) - 11 = 4$ ;  $5(4) - 11 = 9$ ;  $5(5) - 11 = 14$ .

**21. Answer choice (B) is the correct answer.** Plot the points on a coordinate grid. The diagonal of a square connects two opposite vertices, so the diagonals of this square are the segment connecting  $(0, 0)$  and  $(3, 3)$ , and the segment connecting  $(0, 3)$  and  $(3, 0)$ . Let's use the diagonal connecting  $(0, 0)$  and  $(3, 3)$  and find the distance between the two points using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ . Plug in the points  $(0, 0)$  and  $(3, 3)$ :  $(3 - 0)^2 + (3 - 0)^2 = d^2 \rightarrow (-3)^2 + (-3)^2 = d^2 \rightarrow 9 + 9 = d^2 \rightarrow 18 = d^2 \rightarrow d = \sqrt{18} \rightarrow d = 3\sqrt{2}$  grid units.

**22. Answer choice (C) is the correct answer.** Since the left and right side of the triangle are labeled with a tick mark, they are congruent. Therefore, the two base angles of the triangle are congruent, so the bottom left angle of the triangle also measures  $40^\circ$ . The angles in a triangle add up to  $180^\circ$ , so  $40^\circ + 40^\circ + y^\circ = 180^\circ$ . Solve the equation:  $80^\circ + y^\circ = 180^\circ \rightarrow y = 100^\circ$ .

**23. Answer choice (C) is the correct answer.** To find the total number of outfits that Owen can make, multiply the number of pants he has by the number of t-shirts:  $3 \cdot 5 = 15$  outfits.

**24. Answer choice (A) is the correct answer.** First, find the slope of the line using the formula for

$$\text{slope: } slope = \frac{y_2 - y_1}{x_2 - x_1}. \text{ Plug in the given points and solve: } slope = \frac{-2 - 0}{4 - 5} = \frac{-2}{-1} = 2. \text{ Now plug the}$$

slope and the first point into *point-slope form*:  $y - y_1 = m(x - x_1) \rightarrow y - 0 = 2(x - 5)$ . Simplify to get  $y = 2x - 10$  as the equation of the line.

**25. Answer choice (B) is the correct answer.** Solve the inequality by first subtracting 4 from both sides to get  $-2|x + 3| \leq -10$ . Divide both sides by  $-2$ , remember to flip the inequality sign:  $|x + 3| \geq$

5. Set  $x + 3$  greater than or equal to 5 and less than or equal to  $-5$  and solve each inequality separately. If  $x + 3 \geq 5$ ,  $x \geq 2$ . If  $x + 3 \leq -5$ ,  $x \leq -8$ . Therefore,  $x \geq 2$  or  $x \leq -8$ .

**26. Answer choice (D) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{9 \text{ m}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ ft}}{0.305 \text{ m}}$$

Cross out the units that show up on both the top and bottoms of fractions (sec, min, and m)

and you are left with  $\frac{9 \times 60 \times 60}{0.305}$  feet per hour.

**27. Answer choice (B) is the correct answer.** On a box and whisker plot, the right side of the box represents the third quartiles. Quartiles divide a data set into quarters, so 25% of the data falls above the third quartile. Since the third quartile of this data set is 22 hours and 32 hours is the highest data point, 25% of the students spent between 22 and 32 hours on homework. Find 25% of the 400 total students:  $25\% \text{ of } 400 = 0.25 \cdot 400 = 100$  students.

**28. Answer choice (B) is the correct answer.** The only two units in the answer choices that measure weight are grams and kilograms. Grams are very small, and a car is very heavy, so it is not reasonable to measure the weight of a car in grams. Therefore, kilograms is the most reasonable unit to use.

**29. Answer choice (D) is the correct answer.** To find the shaded area, subtract the area of the white circle from the area of the outer circle. The equation for the area of a circle is  $A = \pi r^2$ , so the area of the outer circle is  $36\pi$  and the area of the white circle is  $16\pi$ . Subtract the areas to find the shaded area:  $36\pi - 16\pi = 20\pi$ . Therefore, the ratio of the shaded area to the non-shaded area equals  $20\pi:16\pi$  which can be simplified to 5:4.

**30. Answer choice (B) is the correct answer.** An irrational number is any number that cannot be written as a simple fraction. Irrational numbers are number like  $\pi$  or “ugly” roots (roots with an answer that is a non-terminating decimal). Since 13 isn’t a perfect square,  $\sqrt{13}$  is an ugly root, so it is an irrational number.

**31. Answer choice (B) is the correct answer.** Since the height equals the radius, we can replace  $r$  with  $h$  in the volume equation. We can also replace the volume, or  $V$ , with  $64\pi$  to get  $64\pi = \pi h^2 \cdot h$ . Simplify the right side of the equation and then solve:  $64\pi = \pi h^3 \rightarrow 64 = h^3 \rightarrow h = 4$  cm.

**32. Answer choice (D) is the correct answer.** Remember that  $i^2 = -1$ ,  $i^3 = -i$ , and  $i^4 = 1$ . Simplify  $i^{14}$ :  
 $i^{14} = (i^4)^3(i^2) = (1)^3(-1) = -1$ .

- 33. Answer choice (B) is the correct answer.** The stem column of a stem-and-leaf plot represents the tens digit of each number, and the leaf column represents the ones digit of each number. For example, the first row of this plot represents the number 48 and 49. The median of a set of data is the middle number when the numbers are lined up in order from least to greatest. A stem-and-leaf plot shows the numbers in order from least to greatest, so the median is 64.
- 34. Answer choice (C) is the correct angle.** The sum of the central angles of the circle graph are  $360^\circ$ , so the portion of the graph representing red takes up  $\frac{40^\circ}{360^\circ}$  or  $\frac{1}{9}$  of the circle. Therefore,  $\frac{1}{9}$  of the students chose red, so find  $\frac{1}{9}$  of 540:  $\frac{1}{9} \cdot 540 = 60$  students.
- 35. Answer choice (C) is the correct answer.** The square root of 36 is 6 because  $6^2 = 36$ , so we can eliminate answer choices (B) and (D). Rewrite  $\sqrt{a^{16}b^9}$  as  $\sqrt{a^{16}b^8 \cdot b}$ . When finding the square root of variables with even exponents, cut the exponents in half. Therefore,  $\sqrt{a^{16}b^8 \cdot b} = a^8b^4\sqrt{b}$ . Therefore,  $\sqrt{36a^{16}b^9} = 6a^8b^4\sqrt{b}$ .
- 36. Answer choice (D) is the correct answer.** Since Scott removed two brown cubes from the bucket and kept them, there are now 8 black cubes, 6 white cubes, and 8 brown cubes in the bucket (22 total cubes). We only want the probability that Tanya chooses a black or white cube, so we are not solving a compound probability problem. Since there are 8 black cubes and 6 white cubes, there are 14 ways Tanya can choose a black or white cube out of 22 total cubes. Therefore, the probability Tanya chooses a black or white cube is  $\frac{14}{22}$ .
- 37. Answer choice (A) is the correct answer.** Simplify the numerator by adding the exponents for the  $m$  terms to get  $\frac{2m^6n^3}{8m^4n^9}$ . Simplify 2 over 8 to 1 over 4, and simplify the  $m$  and  $n$  terms by subtracting the exponents for each letter to get  $\frac{1m^2n^{-6}}{4}$ . Move the  $n^{-6}$  to the bottom of the fraction and make the exponent positive to get  $\frac{m^2}{4n^6}$ .
- 38. Answer choice (A) is the correct answer.** The height to shadow ratio of the flagpole is equal to the height to shadow ratio of Annie. Therefore, we can set up and solve the following proportion using  $h$  to represent Annie's height:  $\frac{30}{20} = \frac{h}{4} \rightarrow 120 = 20h \rightarrow h = 6$  ft.
- 39. Answer choice (D) is the correct answer.** Divide both sides of the equation by  $-2$  to get

$|3 - 2x| = -9$ . The absolute value of a number can never be negative, so there are no values of  $x$  that make the equation true.

- 40. Answer choice (B) is the correct answer.** To find percent change, or percent decrease, divide the difference in the numbers by the starting number, and then multiply the result by 100. The difference between 1.80 and 1.62 is 0.18  $\rightarrow$  0.18 divided by 1.8 is 0.1  $\rightarrow$  0.1 times 100 equals 10%.
- 41. Answer choice (A) is the correct answer.** Using the top row of the matrices, set up and solve the following equation:  $7 + a = 4 \rightarrow a = -3$ .
- 42. Answer choice (C) is the correct answer.** Since the two triangles are similar, their corresponding angles are congruent. Therefore, the measure of angle S is the same as the measure of angle C. The sum of the angles in a triangle is  $180^\circ$ , so set up an equation to find the measure of angle C:  $A + B + C = 180^\circ \rightarrow 30^\circ + 30^\circ + C = 180 \rightarrow 60^\circ + C = 180^\circ \rightarrow C = 120^\circ$ .
- 43. Answer choice (B) is the correct answer.** Find the number of students who play both tennis and soccer by first adding the number of students that said they play tennis and the number of students who said they play soccer:  $160 + 120 = 280$ . Now subtract the total number of students from the result:  $280 - 240 = 40$  students who play both sports. You can verify this answer is correct by finding the total number of students who play ONLY tennis:  $160 - 40 = 120$ . Then find the number of students who play ONLY soccer:  $120 - 40 = 80$ . Add the number of students who play only tennis, the number of students who play only soccer, and the number of students who play both and verify that it adds to 240 students:  $120 + 80 + 40 = 240$ .
- 44. Answer choice (A) is the correct answer.** using SOHCAHTOA, we know that  $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ .
- Therefore,  $\sin\theta = \frac{6}{10} = \frac{3}{5}$ .
- 45. Answer choice (C) is the correct answer.** The interquartile range of a data set equals the difference between the third quartile and first quartile. The first quartile is the median of the first half of the data, and the third quartile is the median of the second half of the data. The data is already lined up in order from least to greatest, so the first quartile is the median of 54, 58, 69, 70, 70 which is 69. The third quartile is the median of 79, 80, 81, 87, 95 which is 81. Therefore, the interquartile range is  $81 - 69 = 12$ .
- 46. Answer choice (C) is the correct answer.** Imaginary numbers come from negative numbers under any even roots. Therefore, the square root of  $-8$  is an imaginary number.
- 47. Answer choice (D) is the correct answer.** Set  $3b - 24$  equal to  $b + 18$  and solve because they are vertical angles:  $3b - 24 = b + 18 \rightarrow 2b - 24 = 18 \rightarrow 2b = 42 \rightarrow b = 21$ . Now plug in 21 for  $b$  in either expression to get that the angles labeled  $3b - 24$  and  $b + 18$  both have measures of  $39^\circ$ . Since

the angle measuring  $a^\circ$  makes a straight line with the angle measuring  $b + 18^\circ$ , they add up to  $180^\circ$ . Therefore,  $a + 39 = 180$  so  $a = 141$ .

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## **Practice Test 2**

### **Verbal Reasoning**

#### **Synonyms**

1. **Immense** means extremely large or great. For example, Mount Rushmore is an **immense** sculpture on the side of a mountain. This is closest in meaning to answer choice **(C) huge**.
2. **Audacious** means showing a willingness to take bold risks. For example, Evel Knievel was very **audacious**, performing many life-threatening stunts throughout his life. This is closest in meaning to answer choice **(A) daring**.
3. **Swill** means to drink something greedily or in large quantities. For example, if you were in a rush to leave a restaurant, you might **swill** the rest of your drink before you go. This is closest in meaning to answer choice **(D) guzzle**.
4. **Glossy** means shiny and smooth. For example, marble countertops are desirable because of their **glossy** finish. This is closest in meaning to answer choice **(B) shiny**.
5. **Pulverized** means reduced to fine particles. For example, coffee beans are **pulverized** before you use them to make coffee. This is closest in meaning to answer choice **(A) crushed**.
6. **Acquiesced** means accepting something reluctantly but without protest. For example, if your boss asks you to come in to work on a Saturday and you do it reluctantly, you **acquiesced**. This is closest in meaning to answer choice **(B) complied**.
7. **Shady** means of doubtful honesty. For example, a politician who takes bribes could be described as **shady**. This is closest in meaning to answer choice **(B) disreputable**.
8. **Provocative** means causing annoyance, anger, or another strong reaction, especially on purpose. For example, writing an article bashing the President would be a **provocative** thing to do. This is closest in meaning to answer choice **(C) controversial**.
9. **Entrenched** means firmly established and unlikely to change. For example, the Harry Potter series is firmly **entrenched** in fantasy movie culture. This is closest in meaning to answer choice **(D) established**.

10. **Insidious** means proceeding in a gradual subtle way but with harmful effects. For example, cancer can be a very **insidious** disease. This is closest in meaning to answer choice (A) **sneaky**.
11. **Terse** means using few words. For example, when giving someone instructions, it's better to be **terse** than to go on and on. This is closest in meaning to answer choice (D) **concise**.
12. **Uphold** means to continue a custom or practice. For example, many families **uphold** holiday traditions that have been passed down through generations. This is closest in meaning to answer choice (D) **maintain**.
13. **Dwindle** means to diminish gradually in size, strength, or amount. For example, if you continue to spend more money than you make, your savings will **dwindle**. This is closest in meaning to answer choice (C) **fade**.
14. **Feat** means an achievement that requires great courage, strength, or skill. For example, climbing Mount Everest is a very impressive **feat**. This is closest in meaning to answer choice (C) **accomplishment**.
15. **Nick** means a small cut or notch. For example, if you're not careful when using a knife, you might end up with a **nick** on your finger. This is closest in meaning to answer choice (B) **scratch**.
16. **Craft** means to make or produce with care or skill. For example, great authors take time to carefully **craft** their stories. This is closest in meaning to answer choice (B) **manufacture**.
17. **Committed** means feeling dedication or loyalty to a cause. For example, when you make a promise to someone, you should be **committed** to seeing it through. This is closest in meaning to answer choice (A) **obligated**.
18. **Charisma** means compelling attractiveness or charm that can inspire devotion in others. For example, many famous actors have a lot of **charisma** and are very likable. This is closest in meaning to answer choice (A) **appeal**.
19. **Futile** means incapable of producing any useful result. For example, for a human being, trying to fly like a bird is **futile**. This is closest in meaning to answer choice (D) **pointless**.
20. **Creed** means a belief or aim which guides someone's actions. For example, for many people being kind and honest is their **creed**. This is closest in meaning to answer choice (C) **principle**.

### Sentence Completions

21. **The correct answer is choice (B) judicious, which means showing or done with good judgment or sense.** The blank in this sentence is describing how the couple felt about having an electrician come to their house and do the repair work. The sentence tells us that they felt this way after trying

to do the work themselves. Since they decided to have an electrician come after they tried to do it themselves, we can assume that this is because they were unsuccessful. If they were unsuccessful it was probably too hard or complicated a job and figured it would be more sensible, or **judicious**, to have a professional come to do the work.

**22. The correct answer is choice (A) weighty, which means of great seriousness or importance.**

The blank in the sentence is describing the topic that the first grade student chose to make a speech about. The sentence tells us that the subject matter of the speech was difficult and that the audience was surprised by the first graders choice. Since the subject matter was difficult and the audience was surprised, we can infer that the topic the first grader chose must have been pretty serious, or **weighty**.

**23. The correct answer is choice (B) cyclical, which means occurring in cycles; repetitive.**

The blank in this sentence is describing the nature of the politics in the state. The sentence tells us that every eight years the party in power flipped from Democrats to Republicans and then back again. This means the pattern of going back and forth between the parties was very repetitive, or **cyclical**.

**24. The correct answer is choice (D) honed, which means refined or perfected over time.**

The blank in this sentence is describing what the athlete did to her batting skills by watching recordings and making certain adjustments. Since she watched a recording of how she swung and made adjustments, we can assume that she would be improving her swing. Over time this would lead her to perfect, or **hone**, her swing.

**25. The correct answer is choice (C) mayhem, which means violent and damaging disorder or chaos.**

The blank in the sentence is describing the state of the courtroom after the jury's decision. The sentence tells us that the courtroom was in this state until the judge restored order. That means that before the judge restored order the courtroom must have been in a state of disorder, or **mayhem**.

**26. The correct answer is choice (A) feral, which means wild or untamed.**

The blank in the sentence is describing the cats in the area. The sentence tells us that the number of birds in the area had declined due to an increase in these cats, and that none of the local residents wanted to adopt them. Since the number of birds declined because of these cats, we can assume they were living out in the wild mostly, and since no one wanted to adopt them, we can assume they were probably not well behaved and untamed. An untamed and wild cat is a **feral** cat.

**27. The correct answer is choice (A) emboldened, which means given the courage or confidence to do something.**

The blank in this sentence is describing how the candidate was affected by a recent poll in her favor. If a candidate for something gets poll results in their favor, this would most likely give them confidence, or **embolden** them. This is supported by the sentence telling us that these poll results led her to challenge the senator to a debate on local TV.

- 28. The correct answer is choice (C) inequitable, which means unfair or unjust.** The blank in the sentence is describing how some of the students felt about the new system of grading. The sentence tells us that the reason the students felt this way was because the teacher held chemistry students to a different standard than the other students. Since chemistry students are being held to a different standard than other students, we can infer that the new grading system is probably unfair, or **inequitable**, to either the chemistry students or the other students.
- 29. The correct answer is choice (C) incidental, which means nonessential or unnecessary.** The blank in the sentence is describing the presence of the minor character in the book who the editor suggested should be eliminated. Since we know the character is minor, and since the editor suggested that the character is removed, we can assume that this would have no effect on the main plot. In other words, the character was nonessential, or **incidental**, to the main plot.
- 30. The correct answer (D) perjuring, which means lying under oath.** The blank in this sentence is referring to why the witness might have to make embarrassing statements while he was under oath. The clue in this sentence is the fact that the witness is under oath. The reason someone who is under oath might have to make embarrassing statements is because they were trying to avoid lying while under oath, or **perjuring** themselves.
- 31. The correct answer is choice (D) gullible, which means easily persuaded to believe something.** The blank in the sentence is describing what the saleswoman thought her client would be. The sentence tells us that the saleswoman was surprised by the sharp questions her client compelled her to answer about the product, so we know this must not have been what she was expecting. Based on that, we can infer that the saleswoman was probably expecting her client to be less questioning and more easily persuaded, or **gullible**, when being told about the product being sold.
- 32. The correct answer is choice (C) alleviate, which means to make a problem less severe, and redundant, which means unnecessary or excessive.** Since the documents are described as being needlessly stored, we can infer that they must be duplicate or **redundant** documents. Answer choices (A) and (C) both work for the second blank so we have to use the first blank to find the correct answer. The sentence tells us that the new filing system did nothing to “blank” the problem caused by these documents, and this was contrary to expectations. Most of the time when a new system is implemented, you would expect it to solve or **alleviate** an existing problem, but in this case it did not.
- 33. The correct answer is choice (A) personified, which means embodied or epitomized, and humane, which means kind or caring.** Since the sentence tells us that the new doctor delighted the patient, we know that he/she must have embodied, or **personified**, the ideal of a medical professional. Answer choices (A), (B), and (C) all work for the first blank, so we have to use the second blank to find the correct answer. Since we know that the doctor exemplified the ideal of a medical professional, we would expect him to treat his patients in not only a serious, but a kind, or **humane**, manner.

34. **The correct answer is choice (B) remedy, which means cure or treatment, and discover, which means find or unearth.** Since the sentence mentions that the plant has a disease, it would make sense for the gardener to be looking for a cure, or **remedy**, in order to save it. The sentence tells us that before this could happen, the gardener would have to do something else first. It wouldn't make sense for the gardener to have to pursue, or follow, the cause of the plant disease, so we can eliminate answer choice (D). If we think about it, before you can cure something, you first have to figure out, or **discover**, what's wrong with it, so you know what to do to fix it.
35. **The correct answer is choice (B) debunked, which means disproved or discredited, and regarding, which means concerning or with respect to.** This problem is tricky and there aren't really any clues to whether we are looking for positive or negative answer choices, so we have to just try each answer choice and see which one makes the most sense. Answer choice (A) would make the sentence, the scientist, an expert in the field, patiently decimated, or destroyed, some of the more common myths deciding the issue of climate change. That doesn't really make sense because the scientist wouldn't be deciding the issue of climate change. Answer choice (C) would make the sentence, the scientist patiently reinforced some of the more common myths explaining the issue of climate change. Since the scientist is an expert in the field, he probably wouldn't be reinforcing myths because myths are typically partially untrue, so we can cross off that answer. Answer choice (D) would make the sentence the scientist patiently described some of the more common myths opposing the issue of climate change. While the scientist might have been describing the myths, they probably wouldn't have been opposing the issue of climate change, so we can cross off answer choice (D). The only answer choice that really makes sense is choice (B), making the sentence, the scientist patiently **debunked**, or disproved, some of the more common myths **regarding**, or having to do with, the issue of climate change.
36. **The correct answer is choice (C) disseminated, which means spread or distribute, and acknowledging, which means admitting to something.** The first blank in this sentence is referring to a mailing from the mayor's office. It wouldn't really make sense to say the mayor's office conveyed or undertook a mailing, so we can eliminate answer choices (A) and (D). answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. It wouldn't really make sense for the mayor's office to release a mailing accepting the highway project would not be completed on time, so answer choice (B) is incorrect. It would, however, make sense for the mayor's office to distribute, or **disseminate**, a mailing to every household admitting, or **acknowledging**, that the highway project would not be completed on time.
37. **The correct answer is choice (B) premise, which means main topic, and adequately, which means sufficiently.** The first blank in the sentence is describing what about the student's report the professor approved. On their own all of the answer choices could work for the first blank so we have to look at the second blank to see which answer fits best. The sentence tells us that although the professor approved of the student's report, she questioned if some of the supporting details had been "blank" proven. Since the professor questioned this, we can assume that the supporting details

may not have been sufficiently, or **adequately**, proven. That leaves us with answer choices (A) and (B). It makes more sense that the professor would have approved the main point, or **premise**, of the student’s report than the interest of the student’s report.

- 38. The correct answer is choice (D) rogue, which means a dishonest person, and malefactor, which means a criminal.** The first blank is describing something the actor frequently portrayed and the sentence says he frequently portrayed this and even a petty criminal, so we can assume that the first blank is negative. Since prodigy is a positive word, we can eliminate answer choice (C). The sentence goes on to say that even though the actor frequently played this type of character, he/she stopped short of being an outright “blank”, so we know that the second blank is going to be a negative word as well and that it is going to be more intense than the first blank because it says the actor stopped short of being this. Since protagonist is not necessarily a negative word, we can eliminate answer choice (B). Charlatan means a fake, so they are the same intensity and we can eliminate answer choice (A). That leaves answer choice (D), so the sentence would say that the actor frequently played a **rogue**, or dishonest person, but stopped short of being an all out **malefactor**, or criminal. This makes sense because a dishonest person is bad but not as bad as an outright criminal.
- 39. The correct answer is choice (C) addendum, which means addition, and clarify, which means to make something less confusing.** The first blank in this sentence is referring to what the book was republished with. Since the book was originally published in the early 1900’s, it would make sense for the recently republished version to have some changes and/or an addition, or **addendum** added. The sentence also tells us that this change was added in order to “blank” potential confusing historical references. If the references were potentially confusing, then it would make sense for the newly added section to try to make those references less confusing, or **clarify** them.
- 40. The correct answer is choice (D) fixated, which means intensely focused on, and cohesion, which means unity or togetherness.** Since the sentence tells us that the coach spent hours concentrating on nothing by the players’ ability to work together as a unit, we can infer that they must have lacked unity, or **cohesion**. It would also make sense that the reason the coach decided to do this was because he was very focused, or **fixated**, on this lack of togetherness displayed by his team.
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## Quantitative Reasoning

- 1. Answer choice (D) is the correct answer.** Rewrite  $(x - 8)^2$  as  $(x - 8)(x - 8)$ , so now we have  $(x - 8)(x - 8) = x^2 - mx + 64$ . Multiply the left side:  $x^2 - 16x + 64 = x^2 - mx + 64$ . Subtract  $x^2$  and 64 from both sides of the equation to get  $-16x = -mx$ . Divide both sides by  $-x$  to get  $m = 16$ .
- 2. Answer choice (A) is the correct answer.** Multiply both sides of the original equation by 2:  $2(2x + 3y) = 2(5)$ . Simplify both sides to get  $4x + 6y = 10$

3. **Answer choice (C) is the correct answer.** If the probability of choosing a red marble is  $\frac{2}{5}$ , then the red marbles make up  $\frac{2}{5}$  of the total marbles. Find the total number of marbles by dividing the number of red marbles by  $\frac{2}{5}$ :  $8 \div \frac{2}{5} = 8 \cdot \frac{5}{2} = 20$  total marbles. Find the number of black marbles by subtracting the number of red marbles from the total:  $20 - 8 = 12$  black marbles.
4. **Answer choice (B) is the correct answer.** Let  $y$  equal the least common multiple of 6 and 8, so  $y = 24$ . 24 is a multiple of itself, so answer choice (B) is the correct answer.
5. **Answer choice (D) is the correct answer.** Let  $x$  equal the smallest integer, so the middle integer is  $x + 2$ , and the largest integer is  $x + 4$  (consecutive even integers are 2 apart). Therefore, the sum of the integers can be written as  $x + x + 2 + x + 4$ . Since the sum equals 30, set this expression equal to 30 to get  $x + x + 2 + x + 4 = 30$ .
6. **Answer choice (C) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up and solve an equation using 87 as the average and  $x$  as the score on Connor's fifth test:  $87 = \frac{85 + 89 + 76 + 90 + x}{5} \rightarrow 87 = \frac{340 + x}{5} \rightarrow 435 = 340 + x \rightarrow x = 95$ .
7. **Answer choice (C) is the correct answer.** The number of people is inversely related to the number of hours. Therefore, if we multiply the number of people by three to get from 2 people to 6 people, we need to divide the number of hours by 3:  $2\ hour \div 3 = \frac{2}{3}$  hours.
8. **Answer choice (D) is the correct answer.** If you add 4 to every number in a data set, the mean, median, and mode each change by 4. The range stays the same because the highest and lowest numbers each increase by 4, so the difference between them doesn't change. Therefore, answer choice (D) is the correct answer.
9. **Answer choice (C) is the correct answer.** Since side  $LO = \frac{4}{3}x$  and side  $WZ = x$ , side  $LO$  is  $\frac{4}{3}$  the length of side  $WZ$ . Since the rectangles are similar, their corresponding sides are proportional. Therefore, side  $ON$  is  $\frac{4}{3}$  the length of side  $YZ$  so we can set up and solve the following equation:  $\frac{4}{3}(YZ) = 12 \rightarrow YZ = 9$ .

- 10. Answer choice (C) is the correct answer.** Start with a square that has a side length of 10, so the perimeter is 40 and the area is 100. To double the perimeter, double the side length. Now we have a 20 by 20 rectangle with an area of 400. The percent increase from 100 to 400 =  $\frac{400 - 100}{100} \cdot 100 = \frac{300}{100} \cdot 100 = 300\%$ .
- 11. Answer choice (A) is the correct answer.** The sum of all integers from 1 to 50 inclusive equals  $1 + 2 + \dots + 49 + 50$ . The sum of all integers from 50 to 100 inclusive equals  $50 + 51 + \dots + 99 + 100$ . Therefore, if we add  $a + b$  we have  $1 + 2 + \dots + 49 + 50 + 50 + 51 + \dots + 99 + 100$ . This does not represent the sum of the integers from 1 to 100 inclusive because it includes two 50s. To get rid of one of the 50s, we need to subtract 50 from the sum to get  $a + b - 50$ .
- 12. Answer choice (D) is the correct answer.** Since  $y = x^4$ , the maximum value of  $y$  occurs when the absolute value of  $x$  is the greatest. Therefore, the maximum value of  $y$  occurs when  $x = -2$ , so  $y = (-2)^4 = 16$ .
- 13. Answer choice (D) is the correct answer.** Replace  $m^*$  with  $n^*$  and  $m$  with  $n$  in the original equation to get  $n^* = 2n + 6$ . Replace  $n^*$  with 10 and solve for  $n$ :  $10 = 2n + 6 \rightarrow 4 = 2n \rightarrow n = 2$ .
- 14. Answer choice (D) is the correct answer.** In order to isolate  $b$ , we need to get it out of the denominator, so multiply both sides of the equation by  $b$  to get  $\frac{10}{c} = ab$ . Now divide both sides by  $a$  to get  $b = \frac{10}{ac}$ .
- 15. Answer choice (C) is the correct answer.** Start with 100 and decrease it by 20% to get 80. Find the percent increase from 80 to 100:  $\frac{100 - 80}{80} \cdot 100 = \frac{20}{80} \cdot 100 = \frac{1}{4} \cdot 100 = 25\%$ .
- 16. Answer choice (A) is the correct answer.** Both lines are written in  $y = mx + b$  form where  $m$  represents the slope and  $b$  represents the  $y$ -intercept, so  $m$  and  $n$  are the slopes of the two lines. Since the lines are perpendicular, their slopes are *opposite reciprocals* (example:  $\frac{3}{4}$  and  $-\frac{4}{3}$ ), so  $m$  and  $n$  are opposite reciprocals. The product of opposite reciprocals is always  $-1$ , so the product of  $m$  and  $n$  is  $-1$ .
- 17. Answer choice (B) is the correct answer.** The rectangle has the greatest area when it is a square or as close to a square as possible. Therefore, the rectangle has the greatest area when it measures 6 in by 6 in. The area equals  $6 \cdot 6 = 36 \text{ in}^2$ .

- 18. Answer choice (C) is the correct answer.** Since the heart, black square, and white square are all next to each other on the cube, they cannot all be in the middle row of the net. Therefore, answer choice (A) is incorrect. The top of the heart should be facing the black square, so answer choice (B) and (D) are incorrect. We are left with answer choice (C) as the correct answer.
- 19. Answer choice (B) is the correct answer.** First subtract the number of students who chose sci-fi or comedy from the total number of students:  $720 - 180 - 240 = 300$ . Therefore, 300 students chose horror or action. Let  $x$  equal the number of students who chose horror, so the number of students who chose action is  $2x$ . Therefore,  $x + 2x = 300$ . Solve this equation:  $3x = 300 \rightarrow x = 100$ , so 100 students chose horror. Therefore, the fraction of the circle representing horror is  $\frac{100}{720} = \frac{5}{36}$ .
- The central angles of the portions of the circle graph add up to  $360^\circ$ , so find  $\frac{5}{36}$  of  $360^\circ$ :  $\frac{5}{36} \cdot 360^\circ = 50^\circ$ .
- 20. Answer choice (C) is the correct answer.** By Wednesday, Pam and her four friends have seen the picture, so  $1 + 4$  people have seen the picture. By Thursday, each of the four friends sends the picture to four people, so  $4 \cdot 4$ , or  $4^2$ , more people have seen the picture. In total,  $1 + 4 + 4^2$  people have seen the picture on Thursday. The pattern continues, so on Friday, the total number of people who have seen the picture is  $1 + 4 + 4^2 + 4^3$ . On Saturday, the total number of people who have seen the picture is  $1 + 4 + 4^2 + 4^3 + 4^4$ . On Sunday, the total number of people who have seen the picture is  $1 + 4 + 4^2 + 4^3 + 4^4 + 4^5$ .
- 21. Answer choice (B) is the correct answer.** Choose five consecutive integers: 1, 2, 3, 4, 5. Find the difference between the largest integer and the smallest integer:  $5 - 1 = 4$ . Therefore, Column B is greater than Column A.
- 22. Answer choice (B) is the correct answer.** The sum of any two sides of a triangle must be greater than the third side. Therefore, the third side of the triangle must be less than 13 cm, so the perimeter must be less than  $5 + 8 + 13 = 26$ . Column B is greater than Column A.
- 23. Answer choice (A) is the correct answer.** Find the slope of the line in Column A by isolating  $y$ :  $6x - 3y = 4 \rightarrow -3y = -6x + 4 \rightarrow y = 2x - \frac{4}{3}$ . Now the line is written in slope-intercept form,  $y = mx + b$ , where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Therefore, the slope of the line in Column A is 2. Find the slope of the line in Column B by using the formula for slope:  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$ . Plug in the given points and solve:  $\text{slope} = \frac{5 - 2}{-2 - (-4)} = \frac{3}{2}$ . Therefore, Column A is greater than Column B.
- 24. Answer choice (B) is the correct answer.** Multiply the binomials in Column A to get  $m^2 - n^2$ . Since  $m$  and  $n$  both cannot equal 0,  $m^2$  and  $n^2$  are always positive (a positive number square is

positive and a negative number square is positive). Therefore, Column B is greater than Column A because the sum of two positive numbers is always greater than the difference between the two numbers.

- 25. Answer choice (A) is the correct answer.** Let  $x$  equal the number of quarters Jacobi has, so the number of nickels he has is  $3x$ . Therefore, the value of his quarters and nickels is  $0.25x + 0.05(3x)$ . Set this equal to \$4.00 and solve for  $x$ :  $0.25x + 0.05(3x) = 4.00 \rightarrow 0.25x + 0.15x = 4.00 \rightarrow 0.40x = 4.00 \rightarrow x = 10$ . Therefore, there are 10 quarters and 30 nickels. Find the value of the nickels:  $0.05(30) = \$1.50$ . Column A is greater than Column B.
- 26. Answer choice (A) is the correct answer.** Since  $x < 0$ ,  $x$  is negative. A negative number raised to an even exponent is always positive, and a negative number raised to an odd exponent is always negative. Since a positive number is always greater than a negative number, Column A is greater than Column B.
- 27. Answer choice (C) is the correct answer.** If the perimeter of the base of Cube A is 32 ft, then the side length is 8 ft because the base is a square ( $8 + 8 + 8 + 8 = 32$ ). If the area of the base of Cube B is  $64 \text{ ft}^2$ , then the side length is also 8 ft because the base is a square ( $8^2 = 64$ ). Since the cubes have the same side length, their volumes are the same, so Column A and Column B are equal.
- 28. Answer choice (A) is the correct answer.** Isolate  $2y$  in the original equation:  $4y + 2x = 18 \rightarrow 4y = 18 - 2x \rightarrow 2y = 9 - x$ . Therefore, Column A equals  $9 - x$ . Since the expressions in Column A and Column B both have a “ $-x$ ”, we just want to compare the 9 and the 8. 9 is greater than 8, so Column A is greater than Column B.
- 29. Answer choice (A) is the correct answer.** From the diagram, we know that  $a + b = 180^\circ$  because they make a straight line. We also know that  $a = d = e$  because  $a$  and  $d$  are vertical angles and  $d$  and  $e$  are alternate interior angles. Since  $b$  is greater than  $a$ , it is also greater than  $d$  and  $e$ , so  $a + b$  is greater than  $d + e$ . If it's easier, pick numbers for the variable. Let  $a = 30^\circ$ , so  $b = 150^\circ$ ,  $d = 30^\circ$ , and  $e = 30^\circ$ . Therefore,  $a + b = 180$  and  $d + e = 60$ . Column A is greater than Column B.
- 30. Answer choice (C) is the correct answer.** To find 40% of  $a$ , multiply 0.4 by  $a$  to get  $0.4a$ . To find 20% of  $2a$ , multiply 0.2 by  $2a$  to get  $0.2(2a)$  which equals  $0.4a$ . Therefore, Column A and Column B are equal.
- 31. Answer choice (B) is the correct answer.** Since the first marble is replaced, the first marble selected does not affect the probability of the second marble selected. In each column, we are only looking for the probability of the event that comes after the word “probability.” Therefore, in Column A we are looking for the probability of the second marble being blue, and in Column B we are looking for the probability of the second marble being red. Since there are more red marbles than blue marbles, the probability of choosing a red marble is greater than the probability of choosing a blue marble, so Column B is greater than Column A.

- 32. Answer choice (A) is the correct answer.** If you add 3 to every number in a data set, the mean, median, and mode each increase by 3. The range stays the same because the highest and lowest numbers each increase by 3, so the difference between them does not change. Therefore, the change in the mean is 3 and the change in the range is 0, so Column A is greater than Column B.
- 33. Answer choice (C) is the correct answer.** To find the number of outfits Julian can make with one pair of jeans and one long sleeve shirt, multiply the number of jeans by the number of long sleeve shirts:  $6 \cdot 2 = 12$ . To find the number of outfits Julian can make with one pair of shorts and one t-shirt, multiply the number of shorts by the number of t-shirts:  $3 \cdot 4 = 12$ . Therefore, Column A and Column B are equal.
- 34. Answer choice (A) is the correct answer.** Find the area of the shaded region by subtracting the area of the white triangle from the area of the outer square. The area of the white triangle is  $\frac{1}{2}x^2$ . The area of the outer square is  $y^2$ . Therefore, the shaded area is  $y^2 - \frac{1}{2}x^2$ , so Column A is greater than Column B (because  $\frac{1}{2}x^2$  is less than  $x^2$ ).
- 35. Answer choice (D) is the correct answer.** Since we don't know the values of  $a$  and  $b$ , we cannot determine the relationship between the area of Square A and the area of Rectangle B. If  $a = 100$  and  $b = 1$ , then the area of Square A is greater than the area of Rectangle B. However, if  $a = 1$ , and  $b = 100$ , then the area of Rectangle B is greater than the area of Square A. Therefore, we cannot determine the relationship between the two columns.
- 36. Answer choice (B) is the correct answer.** There are 5 ways to roll a number that is NOT 2, but only 1 way to roll a 2. Therefore, the probability of at least one roll NOT containing a 2 is greater than the probability of at least one roll containing a 2. Column B is greater than Column A.
- 37. Answer choice (A) is the correct answer.** Let the starting price of the stock equal 100. Increase 100 by 40%:  $100 + 40\% \text{ of } 100 = 100 + 40 = 140$ . Now decrease the new price of 140 by 40%:  $140 - 40\% \text{ of } 140 = 140 - 56 = 84$ . Therefore, the price of the stock in August was 84 and the price in June was 100, so Column A is greater than Column B.
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## Reading Comprehension

### Passage 1

1. The passage starts out with the author claiming that the United States has always been a destination for people looking for a better, freer, more prosperous life (a generalization). The passage then goes on to talk specifically about Scicillians and how the ups and downs of their history as immigrants

in America (a specific case). The passage concludes by discussing how despite many of the hardships faced by Scicilians in America, eventually people became more successful and many Scicillians eventually became quite successful. This ultimately fulfilled the promise of a better life that many Scicilians had initially traveled from Scicily to America to achieve (support of author’s initial claim). Based on this, the organization of the passage can best be described as, a generalization is made, and a specific case is described that ultimately supports the author’s initial generalization. **Therefore, answer choice (B) is the correct answer.**

2. The main focus of the passage is the struggles that Scicilian immigrants faced in America during a time when they were considered a minority even amongst other immigrants. While the passage does mention how Scicillians managed to rise within American Society, this was a brief part at the end of the passage and not the primary focus, so answer choice (A) is incorrect. While the passage does mention some instances where we can infer there were biases against Scicillians present, the passage does not directly talk about these biases, so answer choice (B) is incorrect. The passage does not talk about any unique contributions made by Scicilian immigrants, so answer choice (C) is incorrect. The primary focus of the passage is the experiences of Scicilians who came to America during a time when most immigrants to the US were from Europe. **Therefore, answer choice (D) is the correct answer.**
3. Lines 2-27 state “Unfortunately, some settled Americans, regardless of their own backgrounds, also tended to view all Scicilians and Italians in a negative light.” This sentence implies that these “settled Americans” had varying backgrounds, so we can infer that they were probably immigrants as well but that they had immigrated at an earlier time than the Scicilians and were thus “settled”, or already established. **Therefore, the word settled most nearly means established, so answer choice (C) is the correct answer.**
4. Lines 16-18 state “Sicily is an island, the largest in the Mediterranean, and is part of Italy, though it has a semi-independent status.” This sentence implies that while Sicily is part of Italy, Scicilians have a status that differentiates them from other Italians. **Therefore, answer choice (C) is the correct answer.**
5. The third paragraph in the passage talks about how the tensions between Scicilians and other ethnic groups, including Irish immigrants, worsened because of the competitions for work. Based on that, we can infer that Scicilians and other immigrants were often vying for and working similar types of jobs. In the final paragraph of the passage, lines 48-53 state “Despite this horrific act, the initial difficulties faced by Scicilians -- and other immigrants -- lessened as people became more accepting of differences, and more aware of similarities between ‘us’ and ‘them.’” This sentence implies that the difficulties faced by Scicillians were similar to the difficulties faced by other immigrants. Since Scicilians and other immigrants worked similar jobs in America and faced similar difficulties, we can infer that the experience of Scicilians who came to America in the late 1800s and early 1900s was in some ways similar to the experience of other European immigrants. **Therefore, answer choice (A) is the correct answer.**

6. Lines 27-33 state “Many Scicilians came to New Orleans, knowing that there were others from their native land who had arrived before them, but not realizing how difficult it would be to make their way in a city if you did not know the language and did not have much money or a job.” This sentence tells us that Scicilians came to New Orleans because other Scicilians had moved there before them. We can infer that they did this because they felt that their lives would be made easier by making contacts with other immigrants from their native land who had made the trip and settled before them. **Therefore, answer choice (C) is the correct answer.**

## Passage 2

7. This passage is mainly concerned with the history of fireworks and how they are constructed and function. While the passage does detail some different types of fireworks, its main focus is not on the role they played in China or elsewhere, so answer choice (A) is incorrect. While the passage does mention briefly that fireworks are used today in every nation and that there are international competitions, it is more focused on the history and composition of fireworks, so answer choice (C) is incorrect. While the passage does detail the physical make-up of fireworks, it does not really talk about how the physical properties of fireworks have changed over time, so answer choice (D) is incorrect. The passage is primarily concerned with informing the reader about the basic mechanics of fireworks along with some historical information about their use. **Therefore, answer choice (B) is the correct answer.**
8. Lines 41-43 state “Phosphorus, which burns spontaneously in air, lends a glow to dark effects, and antimony glitters.” Lending a glow to darker effects is another way of saying phosphorus brightens the effect produced by certain fireworks. **Therefore, answer choice (C) is the correct answer.**
9. The first paragraph in the passage tells us that fireworks have been around as far back as the 9th century where China used them to celebrate the country's military prowess. We also learn that Europe didn't start producing fireworks until the 14th century and they didn't become popular in Europe until the 1600s. Finally, we learn that most fireworks today still originate in China. Based on these facts, we can infer that fireworks have been more central to Chinese culture than to European culture. **Therefore, answer choice (A) is the correct answer.**
10. We are looking for the answer choice which is NOT essential for the proper use of pyrotechnic stars according to the passage. Lines 30-35 state “These stars need a number of components: fuel, a compound -- often oxygen -- that supports the combustion of the fuel, color-producing chemicals, chlorine to strengthen the color of the flame, and a binder to hold the material together.” The passage does mention metal powders as well, but it states that the aerial shells of fireworks are filled with **either** metal powders or pyrotechnic stars, so metal powders are not essential for the proper use of stars. **Therefore, answer choice (A) is the correct answer.**

11. Lines 2-6 state “As far back as the 9th century, the Chinese military used rocket-propelled devices in warfare, and presented elaborate firework displays to celebrate the country’s military prowess.” The word “prowess” is a characteristic of the Chinese military that they wanted to celebrate, so we can assume that it is a positive attribute. The answer choice with the most positive connotation is expertise. **Therefore, answer choice (C) is the correct answer.**
12. The final sentence in the passage states “Less popular, though, to some people, even more interesting than these enormous aerial displays, are ground fireworks, which can outline familiar shapes such as flags and can create various rotating, spinning, three-dimensional effects that are viewed at relatively close distances.” Since the sentence tells us that ground fireworks can be viewed at relatively close distances, and we know that aerial fireworks shoot high up into the air, we can infer that ground fireworks can be watched more closely than aerial fireworks. **Therefore, answer choice (D) is the correct answer.**

### Passage 3

13. The main purpose of the passage is to educate the reader on the history and creation of audiobooks. The passage discusses the first audio recordings all the way up to modern audiobooks and gives examples of how they were used at different times. While the passage does explain that audiobooks can serve some unique functions, it does not say that no other form of media can serve these functions, so answer choice (A) is incorrect. While the passage does discuss many of the advantages of using audiobooks, it does not really mention any disadvantages, so answer choice (B) is incorrect. While the passage does indicate that the use of audiobooks has changed over the years, this is not the main focus of the passage as a whole, so answer choice (D) is incorrect. Overall, the primary purpose of the passage is to briefly discuss the appeal, history, and use of audiobooks. **Therefore, answer choice (C) is the correct answer.**
14. Lines 23-27 state “The use of audio effects can background music can even give listeners the sense that they are in a movie theater, while still engaging their imagination for the visuals.” The sentence is trying to say that some audiobooks can give listeners the sense that they are in a movie theater through the use of unique music and sound effects. We know that a movie theater also includes visuals and so we can infer that audiobooks still rely on, or use, the reader's imagination for the visual aspect. Another way to say audiobooks use the reader's imagination is they involve the reader's imagination, so the word “engaging” most nearly means involving. **Therefore, answer choice (C) is the correct answer.**
15. The passage begins by telling the reader that millions of people listen to audiobooks every day. They listen to them while driving, while doing chores, and while exercising. The passage goes on to say that audiobooks have many advantages. Lines 9-12 state “Besides allowing the listener to multitask, audiobooks can be enjoyed by several people at once, making them useful to have on family road trips.” If someone was reading a book instead of listening to an audiobook, these

benefits would not exist, so we can infer that the author believes that listening to an audiobook is an experience that offers unique benefits. **Therefore, answer choice (B) is the correct answer.**

16. The fifth paragraph in the passage discusses the current increase in popularity of audiobooks. An example of this popularity is given in lines 72-74 which state “Some well-known authors have written books with the intent of their work *first* being released as an audiobook.” That sentence tells us that some authors write their books with the express intention of them being published as audiobooks, so we know that they have audiobooks in mind when they write them. **Therefore, answer choice (A) is the correct answer.**
17. Throughout the passage the author talks about the benefits of audiobooks. He/she talks about the advantages that are unique to audiobooks such as being able to multitask and have multiple people listen to the same book at once. He cites that audiobooks can be used as a teaching tool and as an aid to people with impaired vision or other disabilities. Overall the author seems to really understand and appreciate many of the specific uses of audiobooks, so his/her tone regarding the use of audiobooks can best be described as appreciative. **Therefore, answer choice (C) is the correct answer.**
18. We are looking for the answer choice that is NOT mentioned as a reason for the use of audiobooks. The first sentence in the passage states “Millions of people listen to audiobooks every day, some while driving of course, but many while engaged in other activities such as chores, gardening, or exercising.” This clearly illustrates that listeners can perform other activities while listening to an audiobook, so answer choice (B) is incorrect. Lines 15-20 state “Additionally, the voice or voices heard on audiobooks are typically those of skilled performers, sometimes well-known actors, so that the listener has an experience not unlike that of a play.” Having an experience not unlike that of a play while listening to an audiobook means that audiobooks can be enjoyed as performances, so answer choice (C) is incorrect. Lines 13-15 state “Some people use them to learn a language, perhaps following along with an ordinary book at the same time.” This means they can help in learning a new language, so answer choice (D) is incorrect. The only thing the passage does not mention as a reason for the use of audiobooks is that listeners can easily skip around to different parts of the book. **Therefore, answer choice (A) is incorrect.**

#### Passage 4

19. The primary purpose of the passage is to educate the reader on the function and importance of sleep. While the passage does mention that proper sleep is as crucial to reaching one’s potential as diet and exercise, this is a one sentence at the end of the passage and not the main focus, so answer choice (B) is incorrect. While the passage does touch on how the human body uses sleep to restore itself, this is more of a brief overview rather than a detailed analysis, so answer choice (C) is incorrect. While the passage mentions that people need different amounts of sleep at different stages of life, it does not go over the functions of sleep at different stages of life, so answer choice

(D) is incorrect. The primary purpose of the passage is to describe some of the biological aspects of sleep and to emphasize its importance. **Therefore, answer choice (A) is the correct answer.**

20. Lines 23-26 state “During sleep, our circadian clocks put our bodies into an *anabolic state*, meaning that we use this time to construct molecules from smaller units.” Based on that sentence, we can see that we go into an anabolic state because of our circadian clock, but what controls our circadian clock. Lines 8-12 state “To begin, people have a system of chemicals and chemical pathways that function as a ‘clock,’ giving us a sense of regularity that is synchronized with Earth’s 24-hour day.” Our circadian clock is caused by chemicals and chemical pathways and the anabolic state we are in during sleep is caused by our circadian clock, so we can reason that we go into an anabolic state because of a system of chemicals and chemical pathways. **Therefore answer choice (A) is the correct answer.**
21. Lines 16-20 state “This *circadian clock*, as it is known, is reset when the environment changes significantly, as when one travels to a different time zone, though of course this does not happen overnight.” Since the circadian clock can reset or change when someone travels to a different time zone, we can infer that this happens because when you are in a different time zone, the sun rises and sets at different times and your body adjusts. Since your circadian clock seems to be connected to the sun and daylight, we can infer that an individual's circadian clock can be altered by a seasonal change in the number of hours of daylight. **Therefore, answer choice (B) is the correct answer.**
22. Lines 46-50 state “Interestingly, people are not particularly accurate appraisers of how much they’ve slept. Individuals who believe that they’ve only gotten about 4 hours of sleep in some cases have gotten twice that number.” These sentences are trying to say that people are not very good at estimating, or judging, how much sleep they’ve gotten, so the word appraisers most nearly means judges. **Therefore, answer choice (C) is the correct answer.**
23. The passage starts off by saying that sleep is a curious phenomenon (topic). The passage then goes on to give some background information on the function of sleep and how important it is for our bodies to get sufficient sleep in order to rebuild (technical information). The final paragraph of the passage starts with the sentence “There is still much that is unknown about sleep, including how exactly it helps the body grow and heal and why some people have difficulty getting proper sleep.” The final sentence then compares sleep to nutrition and exercise (acknowledgement of limitations of knowledge and comparison to other related topics). Based on this, the organization of the passage can best be described as, a topic is introduced, followed by technical information and ending with an acknowledgment of the limitation of the knowledge on the topic and a comparison with other related topics. **Therefore, answer choice (C) is the correct answer.**
24. Lines 54-57 state “In addition, the function of dreams and the mechanisms that produce them have produced countless hypotheses.” Since there are countless hypotheses, or educated guesses, on the

function and origin of dreams, we can infer that this is a topic that there is not universal agreement. **Therefore, answer choice (D) is the correct answer.**

### Passage 5

25. We are looking for the answer that is NOT given in the passage as a reason for England sending convicts to Australia. Lines 8-10 state “The jails were so overcrowded that some prisoners were placed on ships that had been used in the Seven Years’ War.” The passage goes on to say that officials looking for new ways to handle the growing prison population started transporting them to distant locations. At first they sent them to the American colonies, but lines 16-18 tell us that the American Revolution stopped that and so Australia was chosen. Lines 21-24 tell us that setting up a penal colony on the east coast of Australia also served the purpose of limiting the ability of the French empire to expand in the region. The reasons listed by the passage for the English sending prisoners to Australia were that the prisons were overcrowded in England, they couldn’t send them to America after the American Revolution, and sending them to Australia helped them slow French expansionist goals. The only answer not mentioned in the passage as a reason England sent prisoners to Australia is support for the native Australians. **Therefore, answer choice (D) is the correct answer.**
26. The fifth paragraph in the passage talks about what the convicts who were sent to Australia did when their sentences were up. Some went back to England, but the passage tells us that most chose to stay. Lines 51-54 state “Most chose to stay, though the social stigma associated with their past made it difficult for some, though not all, to rise in society.” Since the sentence tells us that it was difficult for some ex-convicts to rise in society but not all, we can infer that some of the former British convicts were able to improve their social status in Australia after they had served their sentence. **Therefore, answer choice (A) is the correct answer.**
27. The passage primarily serves to educate the reader on the history and details of how British convicts were transported to Australia. While the passage does focus on the transport of convicts, it is specifically focused on transporting British convicts to Australia and not convict transport in general, so answer choice (A) is incorrect. The author does not comment on whether he/she thinks the transportation of convicts is fair or unfair, so answer choice (B) is incorrect. While the passage does describe one way in which 18th century Britain chose to deal with the problem of overcrowded jails, the overcrowding of the jails is not the focus of the passage, so answer choice (D) is incorrect. The passage mainly serves to provide historical context and relevant details regarding the transportation of British convicts to Australia. **Therefore, answer choice (C) is the correct answer.**
28. Lines 34-38 state “Many of the approximately 162,000 men and women who were sent to Australia as convicts during this period had been found guilty of petty crimes, though a fair number were political prisoners.” This sentence is saying that a lot of the convicts sent to Australia committed petty, or small, crimes. The word “though” tells us that whatever comes after is going to be in

contrast to what came before. The sentence goes on to say “though” a fair number were political prisoners. If many of the convicts had committed petty crimes, the contrast of that would be that a relatively large, or considerable, number of them were political prisoners, so the word “fair” most nearly means considerable. **Therefore, answer choice (B) is the correct answer.**

29. The final paragraph in the passage talks about how the stigma of having a convict in your lineage lessened over time. Lines 58-60 state “Books and silent movies often featured the character of a transported convict in their storylines.” That sentence serves to reinforce the idea that the way in which these convicts were viewed changed over time. **Therefore, answer choice (C) is the correct answer.**
30. The fourth paragraph in the passage tells us that life was very difficult for the first convicts to arrive in Australia. Lines 39-43 state “They had been given only enough food to keep them alive until they could grow their own, but there weren’t enough skilled farmers or livestock for this purpose.” Based on that sentence, we can see that the British did not provide the first convicts transported to Australia with the proper means to survive, or provide for themselves, like skilled farmers or livestock. **Therefore, answer choice (D) is the correct answer.**

### Passage 6

31. The main idea of the passage is that many people enjoy having their other senses, besides just hearing, engaged while listening to music. While the passage does say that part of the appeal of analog record players is that they engage more senses than just listening, the passage covers a more broad array of topics than just this, so answer choice (A) is incorrect. While the passage does say that for many people, visuals help them to appreciate music more, it also says there are other ways that people's senses can be engaged while listening, so answer choice (C) is incorrect. While the passage does say that classical music performances that have an interesting visual tend to sell more tickets, this is not the main focus but rather is used to support the passage’s main idea, so answer choice (D) is incorrect. The main idea of the passage is that for many people, the experience of music involves more than just listening. **Therefore, answer choice (B) is the correct answer.**
32. The second paragraph in the passage talks about people needing to engage multiple senses when listening to music. The paragraph says this might explain the era of music videos, but that this is not limited to just the pop world. It says that visually spectacular opera productions are still popular as are classical concerts with expressive conductors or performers. The end of the paragraph talks about how performances in smaller spaces have become increasingly popular. Lines 40-42 state “Audiences and performers appreciate the heightened sense of connection in these spaces.” Based on this, we can infer that these smaller concerts are succeeding because listeners feel more of their senses engaged than when they are in a larger, more traditional, concert space. **Therefore, answer choice (A) is the correct answer.**

33. The first paragraph in the passage talks about the differences between analog and digital music. The passage states that many people who say they prefer analog music say that it has a warmer quality than that of digital music. The author does note, however, that digital music has distinct advantages saying in lines 6-8 “...though the quieter ‘noise floor’ and wider dynamic range of digital audio can’t be denied...” We can see that the author believes that digital sound offers certain clear advantages. **Therefore, answer choice (D) is the correct answer.**
34. Lines 34-40 state “And while sales to large classical concert halls have been declining for some time, a new market has sprung up that caters to people who want to hear these performances in smaller, less fussy spaces, not unlike where one might hear a jazz or cabaret performance.” This sentence is explaining why smaller concert venues have become popular. The word “fussy” is used to describe how these smaller spaces are different and more appealing than larger concert halls. If we think about a large classical music concert we probably imagine a lot of people dressed in fancy clothes listening to fancy music. The image that the passage paints of these smaller concert venues is of a small jazz club or cabaret theater where everything is less uptight and formal. We can assume then, that the word “fussy” as used in the passage is closest in meaning to formal. **Therefore, answer choice (C) is the correct answer.**
35. The final paragraph in the passage talks about how newer more sophisticated music usually needs to be listened to, and listened to again, without distraction. This implies that this new more sophisticated music is best appreciated by just listening to it without any other senses being engaged. Lines 48-50 state “The market for music of this sort, whatever the genre, will probably remain relatively small...” If the author is telling us that the market for this music will remain small, that means that it has to be relatively small right now, or said another way, doesn’t reach a wide audience. **Therefore, answer choice (B) is the correct answer.**
36. In the first paragraph, while discussing the differences between analog and digital music, the author says that he/she believes that part of the attraction of old record players is that its three-dimensional existence engages more than just our sense of hearing. Lines 12-17 state “YOU have the pleasure of placing the record on the turntable, putting the needle down carefully, and then waiting a few moments in anticipation as the sound of the needle in the groove announces in hushed excitement ‘Music is about to happen!’” Basically, the author believes that many people like analog records better because of all the mechanical features involved in playing a record that engage multiple senses. **Therefore, answer choice (C) is the correct answer.**
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## Mathematics Achievement

1. **Answer choice (B) is the correct answer.** The sum of the angles in a quadrilateral is  $360^\circ$ , so we can set up and solve the following equation:  $100 + 90 + 2x + x + 38 = 360 \rightarrow 228 + 3x = 360 \rightarrow 3x = 132 \rightarrow x = 44$ . Now plug in  $x$  to each missing angle and find the smallest angle. The angle

measuring  $2x$  has a measure of  $2(44) = 88^\circ$ . The angle measuring  $x + 38$  has a measure of  $44 + 38 = 82^\circ$ . Therefore, the smallest angle measures  $82^\circ$ .

2. **Answer choice (A) is the correct answer.** We want to figure out which answer choice is equal to  $c$ , so we can plug  $\frac{3}{4}$  into each answer choice for  $d$  and see which one equals 12, since the problem told us that  $d = \frac{3}{4}$  and  $c = 12$ . Answer choice (A) is correct because  $16\left(\frac{3}{4}\right) = 12$ . Answer choice (B) is incorrect because  $9\left(\frac{3}{4}\right) = \frac{27}{4}$ . Answer choice (C) is incorrect because  $\frac{4}{3}\left(\frac{3}{4}\right) = 1$ . Answer choice (D) is incorrect because  $\frac{3}{4} \div 16 = \frac{3}{64}$ .
3. **Answer choice (B) is the correct answer.** Simplify  $3(4\sqrt{5})$  by multiplying the numbers outside of the root to get  $12\sqrt{5}$ . Now we have  $2\sqrt{5} + 12\sqrt{5}$ , so we can combine the two terms together by adding the numbers outside of the root to get  $14\sqrt{5}$ .
4. **Answer choice (C) is the correct answer.** There are 14 shaded grid squares, so multiply the number of shaded grid squares by the area of each grid square:  $14 \cdot 3 = 42 \text{ cm}^2$ .
5. **Answer choice (B) is the correct answer.** Write  $5.6 \times 10^4$  in standard form by moving the decimal point 4 times to the right to get 56,000. Write  $2.3 \times 10^6$  in standard form by moving the decimal point 6 times to the right to get 2,300,000. Add 56,000 and 2,300,000 to get 2,356,000. Change 2,356,000 into scientific notation to get  $2.356 \times 10^6$ .
6. **Answer choice (C) is the correct answer.** Let  $x$  represent the number of miles Shayna swam. Since Yuki can swim three times as fast, she will swim three times as far as Shayna in the same amount of time, so Yuki swam  $3x$  miles. Set their total miles equal to 24 and solve:  $x + 3x = 24 \rightarrow 4x = 24 \rightarrow x = 6$  miles. Therefore, Shayna swam 6 miles and Yuki swam 18 miles.
7. **Answer choice (B) is the correct answer.** Multiply the polynomials by multiplying each term in the first set of parentheses by each term in the second set of parentheses to get  $x^3 - 2x^2 - 3x + x^2 - 2x - 3$ . Combine like terms to get  $x^3 - x^2 - 5x - 3$ .
8. **Answer choice (A) is the correct answer.** There are 10 candies to start with, and 4 blue candies. So the probability of choosing a blue candy for the first pieces is  $\frac{4}{10}$  or  $\frac{2}{5}$ . Since the first candy is not replaced, there are only 9 pieces of candy left, and 6 pieces that are NOT blue (1 green and 5 pink). So the probability of choosing a second piece that is NOT blue is  $\frac{6}{9}$  or  $\frac{2}{3}$ . Multiply the probabilities of each event together:  $\frac{2}{5} \cdot \frac{2}{3} = \frac{4}{15}$ .

- 9. Answer choice (B) is the correct answer.** The least common multiple of  $4x^2$  and  $6x^3y$  is  $12x^3y$  (take the highest exponent for each variable). The greatest common factor of  $4x^2$  and  $6x^3y$  is  $2x^2$  (take the lowest exponent for each variable and don't include a variable if it doesn't show up in both expressions). Therefore,  $\frac{a}{b} = \frac{12x^3y}{2x^2} = 6xy$
- 10. Answer choice (B) is the correct answer.** The median of a set of numbers is the middle number when the data is lined up from least to greatest. If you add up all of the numbers in the right column of the table, you get that there are a total of 78 data points. Therefore, the median is going to be the average of the 39th and 40th data point. If you wrote out the data points from this chart, you'd have 0, 0, 0, 1, 1, 1, 1, 1 ... etc. Therefore, the 39th and 40th data points are both 3, so the median is 3 cars.
- 11. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Set up and solve an equation for Desi's test average, using  $x$  to represent her score on the final (which is counted twice) and 91 as the average:  $91 = \frac{356 + 2x}{6} \rightarrow 546 = 356 + 2x \rightarrow 190 = 2x \rightarrow x = 95$ .
- 12. Answer choice (D) is the correct answer.** Isolate the  $y$  by dividing both sides by 4 to get  $y = \frac{7}{4}x + 2$ . Now the equation is written in  $y = mx + b$  form where  $m$  represents the slope of the line and  $b$  represents the  $y$ -intercept. Therefore, the slope of the line  $y = \frac{7}{4}x + 2$  is  $\frac{7}{4}$ .
- 13. Answer choice (D) is the correct answer.** Use the segment in between the points  $(-3, -3)$  and  $(-3, 4)$  as the base of the triangle. The length of this segment is 7 grid units. Use the distance from that segment to the point  $(5, 2)$  as the height. The length of the height is 8 grid units. Find the area by multiplying the base times the height and dividing by 2:  $A = (7 \cdot 8) \div 2 = 56 \div 2 = 28$  units<sup>2</sup>.
- 14. Answer choice (D) is the correct answer.** In order to make a fraction equal 0, the numerator must equal 0 without the denominator equaling 0. Set the numerator equal to 0 and solve for  $x$ :  $x^2 + 4 = 0 \rightarrow x^2 = -4 \rightarrow x = \pm\sqrt{-4}$ . Since the square root of a negative number is not a real number, there are no real values of  $x$  that make the equation true.
- 15. Answer choice (D) is the correct answer.** Plug in \$105 for  $p$  and solve the equation for  $c$ :  $105 = 1.5c - 30 \rightarrow 135 = 1.5c \rightarrow c = 90$  cups.
- 16. Answer choice (A) is the correct answer.** Distribute the 2 and  $-3y$  to get  $8x^5y - 10xy^5 - 12x^5y + 3xy^5$ . Combine the  $x^5y$  terms by adding the coefficients:  $8x^5y - 12x^5y = -4x^5y$ . Combine the  $xy^5$  terms by adding the coefficients:  $-10xy^5 + 3xy^5 = -7xy^5$ . Add the terms together to get  $-4x^5y - 7xy^5$ .

- 17. Answer choice (C) is the correct answer.** The stem column of a stem-and-leaf plot represents the tens digit of each number, and the leaf column represents the ones digit of each number. For example, the first row of this plot represents the number 63, 64, and 67. The mode of a set of data is the number that appears the most, so the mode of this data set is 73. The median of a set of data is the middle number when the numbers are lined up in order from least to greatest. A stem-and-leaf plot shows the numbers in order from least to greatest, so the median is 85. To find the mean of the median and the mode, add the values and divide by 2:  $(73 + 85) \div 2 = 158 \div 2 = 79$ .
- 18. Answer choice (B) is the correct answer.** Multiply 1.2 by 1.1 to get 1.32. Multiply  $10^5$  by  $10^{-8}$  by adding the exponents to get  $10^{-3}$ . Multiply the two results together to get  $1.32 \times 10^{-3}$ .
- 19. Answer choice (C) is the correct answer.** The third term is when  $n = 3$ , so plug in 3 for  $n$  in the given expression:  $\frac{1}{2}(4)^3 = \frac{1}{2}(64) = 32$ .
- 20. Answer choice (B) is the correct answer.** Find the radius by finding the distance between the center of the circle and the point given that lies on the circle using the distance formula:  $(x_2 - x_1)^2 + (y_2 - y_1)^2 = d^2$ . Plug in the given points:  $(1 - 4)^2 + (3 - 7)^2 = d^2 \rightarrow (-3)^2 + (-4)^2 = d^2 \rightarrow 9 + 16 = d^2 \rightarrow 25 = d^2 \rightarrow d = 5$  grid units. Therefore, the radius is 5 grid units and the diameter is twice the radius, so the diameter is 10 grid units.
- 21. Answer choice (A) is the correct answer.** To find where two lines cross, set them equal to each other and solve for  $x$ :  $3x - 4 = -3x + 2 \rightarrow 6x - 4 = 2 \rightarrow 6x = 6 \rightarrow x = 1$ . Since there is only one answer choice that has an  $x$ -coordinate of 1, we do not need to solve for the  $y$ -coordinate. Answer choice (A) is correct.
- 22. Answer choice (D) is the correct answer.** 20% is equal to  $\frac{20}{100}$  which equals  $\frac{1}{5}$ , so  $\frac{1}{5}$  of Larry's non-fiction books are biographies. Find  $\frac{1}{5}$  of  $\frac{4}{5}$  by multiplying the fractions:  $\frac{1}{5} \cdot \frac{4}{5} = \frac{4}{25}$ .
- 23. Answer choice (B) is the correct answer.** The middle of the shaded line is  $-1$ , and both endpoints are 5 units away from  $-1$ . Therefore, the number line represents all numbers *less than or equal to* 5 units away from  $-1$ . This means that the difference between any number that is a solution and  $-1$  must be *less than or equal to*  $-1$ . We can write this as  $|x - (-1)| \leq 5$  which simplifies to  $|x + 1| \leq 5$ .
- 24. Answer choice (B) is the correct answer.** The range of a data set is the difference between the highest and lowest values. On a box and whisker plot, the highest value is represented by the rightmost line, and lowest value is represented by the leftmost line. Therefore, the highest value is 84 and the lowest value is 58, and the difference is  $84 - 58 = 26$ .

**25. Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{15 \text{ yd}}{1 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}}$$

Cross out the units that show up on both the top and bottom of fractions (sec, min, yd, and ft) and you are left with  $15 \times 60 \times 60 \times 3 \times 12$  inches per hour which can be rewritten as  $15 \times 3 \times 12 \times 60 \times 60$  inches per hour.

**26. Answer choice (B) is the correct answer.** Find the slope of the line through the two given points

using the slope formula:  $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 8}{1 - (-3)} = \frac{-8}{4} = -2$ . The slopes of parallel lines are the

same, so the slope of a line parallel to the line passing through the given points is also  $-2$ . The answer choices are written in  $y = mx + b$  form where  $m$  represents the slope and  $b$  represents the  $y$ -intercept, so answer choice (B) is the only answer that has a slope of  $-2$ .

**27. Answer choice (D) is the correct answer.** Since Alexa wants to know the average number of children that all of the teachers at her school have, we want the most broad data sample. A random sample of all of the teachers at the school is the most broad (least specific) data sample.

**28. Answer choice (A) is the correct answer.** To find the shaded area, subtract the area of the white square from the area of the outer circle. The area of a circle equals  $\pi r^2$ , so the area of the outer circle equals  $16\pi$ . Therefore, we can cross out answer choices (C) and (D) because they don't have a  $16\pi$ . To find the area of the square, we need to find the side length. Draw a diameter of the circle that is also a diagonal of the square. Now we have a right triangle with the two sides of the square as the legs and the diameter as the hypotenuse which is 8 mm. Find the side length of the square by using the pythagorean theorem and  $x$  to represent the side length of the square:  $a^2 + b^2 = c^2 \rightarrow x^2 + x^2 = 8^2 \rightarrow 2x^2 = 64 \rightarrow x^2 = 32 \rightarrow x = \sqrt{32}$ . Find the area of the square by squaring the side length:  $(\sqrt{32})^2 = 32$ . Therefore, the area of the shaded region equals  $16\pi - 32$ .

**29. Answer choice (B) is the correct answer.** A pencil is not very long, so it would only be a fraction of a kilometer in length. Therefore, it is not reasonable to measure the length of a pencil in kilometers.

**30. Answer choice (C) is the correct answer.** Imaginary numbers come from negatives under square, or any even, roots, so  $\sqrt{-5}$  is an imaginary number.

**31. Answer choice (B) is the correct answer.** Isolate the  $w$  in the given equation by dividing both sides by  $lh$  to get  $w = \frac{V}{lh}$ . Plug in 72 for the volume, or  $V$ , to get  $w = \frac{72}{lh}$ .

- 32. Answer choice (D) is the correct answer.** To find the expected value, multiply each number in the left column by each corresponding probability in the right column and add the results:  $1(0.2) + 2(0.4) + 3(0.3) + 4(0.1) \rightarrow 0.2 + 0.8 + 0.9 + 0.4 \rightarrow 2.3$ .
- 33. Answer choice (D) is the correct answer.** A circle has  $360^\circ$ , and it makes one rotation every hour. There are 60 minutes in one hour, so the hand of the clock travels  $6^\circ$  every minute ( $360^\circ$  divided by 60 minutes =  $6^\circ$  per minute). 50 minutes pass from 4:10 to 5:00, so multiply 50 by  $6^\circ$  to get  $300^\circ$ .
- 34. Answer choice (C) is the correct answer.** The sum of the angles in a triangle is  $180^\circ$ , so set up the equation  $5x + 3x + x = 180^\circ$ , where  $5x$ ,  $3x$ , and  $x$  represent the measure of the largest, middle, and smallest angles respectively. Solve the equation:  $9x = 180^\circ \rightarrow x = 20^\circ$ . Therefore, the largest angle equals  $5 \cdot 20^\circ = 100^\circ$ .
- 35. Answer choice (A) is the correct answer.** Raising something to the one-half is the same as taking the square root. Therefore,  $(36x)^{\frac{1}{2}} = \sqrt{36x}$ . The square root of 36 is 6 because  $6^2 = 36$ , so  $\sqrt{36x} = 6\sqrt{x}$ .
- 36. Answer choice (B) is the correct answer.** If 9 triangles represent  $360 \text{ units}^2$ , then each triangle represents  $40 \text{ units}^2$  ( $360$  divided by  $9$  equals  $40$ ). Therefore, to find the number of triangles that represents  $160 \text{ units}^2$ , divide  $160$  by  $40$  to get  $4$  triangles.
- 37. Answer choice (D) is the correct answer.** Find the total number of outfits Edward can create by multiplying the number of options he has for pants, shirts, and shoes:  $5 \cdot 3 \cdot 2 = 30$  total options. He only has one way to choose his favorite pants, shirt, and shoes, so he has  $29$  ways to NOT choose his favorite pants, shirt, and shoes. Therefore, the probability is  $\frac{29}{30}$ .
- 38. Answer choice (D) is the correct answer.** Solve the equation by first subtracting  $18$  from both sides, then dividing by  $2$ , and then taking the square root:  $2x^2 + 18 = 0 \rightarrow 2x^2 = -18 \rightarrow x^2 = -9 \rightarrow x = \pm\sqrt{-9} \rightarrow x = \pm 3i$ . Remember that when you take the square root of both sides of an equation, you need a  $\pm$  sign. Also remember that the square root of a negative number is an imaginary number.
- 39. Answer choice (B) is the correct answer.** Let  $x = 100$ , so the original price of the computer was  $\$100$ . The sale price was  $0.85(100) = \$85$ . The percent change from  $100$  to another number is equal to the difference between the two numbers. Therefore the percent change, or percent discount, from  $\$100$  to  $\$85 = 15\%$ .
- 40. Answer choice (B) is the correct answer.** Find the length of  $AC$  using the equation for the area of a triangle:  $A = \frac{1}{2}bh$ . Plug in  $54$  for the area and  $12$  for the base and solve for  $h$ :  $54 = \frac{1}{2}(12)h \rightarrow 54 = 6h \rightarrow h = 9$  m. Find side  $AB$  using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow 9^2 + 12^2 = (AB)^2$

$\rightarrow 81 + 144 = (AB)^2 \rightarrow 225 = (AB)^2 \rightarrow AB = 15$ . Since the two triangles are congruent, their perimeters are the same. Therefore, the perimeter of triangle DEF equals the perimeter of triangle ABC which equals  $9 + 12 + 15 = 36$  m.

- 41. Answer choice (D) is the correct answer.** When  $t = 0$ , the height of the ball equals 20. You can verify this by plugging in 0 for  $t$ :  $h = -16(0)^2 + 4(0) + 20 \rightarrow h = 0 + 0 + 20 \rightarrow h = 20$ . Therefore, the 20 represents the height of the ball when the time is 0 which is before the ball was thrown.
- 42. Answer choice (A) is the correct answer.** Find the diameter of the cylinder by finding one third of the height:  $\frac{1}{3} \cdot 12 = 4$  cm. Therefore, the radius of the cylinder is 2 cm. Plug 12 in for  $h$  and 2 in for  $r$  in the surface area equation and simplify:  $SA = 2\pi(2)^2 + \pi(2)(12) \rightarrow SA = 8\pi + 24\pi \rightarrow SA = 32\pi$ .
- 43. Answer choice (D) is the correct answer.** A rational number is any number that can be written as a simple fraction. Rational numbers include whole numbers, integers, fractions, terminating decimals, and repeating decimals. Answer choice (D) results in a rational number because  $\frac{\sqrt{18}}{\sqrt{2}} = \sqrt{\frac{18}{2}} = \sqrt{9} = 3$ .
- 44. Answer choice (B) is the correct answer.** When multiplying a constant by a matrix, multiply each term in the matrix by the constant. Therefore, the top row equals  $-2(-4)$ ,  $-2(0)$ ,  $-2(2)$  which equals 8, 0,  $-4$ . The bottom row equals  $-2(1)$ ,  $-2(3)$ ,  $-2(-1)$  which equals  $-2$ ,  $-6$ , 2.
- 45. Answer choice (D) is the correct answer.** We are given the measure of angle M and the side opposite of angle M. We are looking for side LM which is the side adjacent to angle M. Therefore, using SOHCAHTOA, we know we should use tangent because  $\tan = \frac{\text{opposite}}{\text{adjacent}}$ . Set up an equation for the tangent of angle M:  $\tan(40^\circ) = \frac{6}{LM}$ . Isolate LM by first multiplying both sides by LM to get  $LM \cdot \tan(40^\circ) = 6$ . Now divide both sides by  $\tan(40^\circ)$  to get  $LM = \frac{6}{\tan(40^\circ)}$ .
- 46. Answer choice (B) is the correct answer.** The  $y$ -coordinates go up by 4 as the  $x$ -coordinates go up by 2. Therefore, since slope is *rise over run*, the slope of the function is  $\frac{4}{2} = 2$ . The  $y$ -intercept of a linear function is when  $x$  equals 0, so the  $y$ -intercept of the given function is 1. Write the equation in  $y = mx + b$  form where  $m$  represents the slope and  $b$  represents the  $y$ -intercept. Plug in 2 for  $m$  and 1 for  $b$  to get  $y = 2x + 1$ .
- 47. Answer choice (C) is the correct answer.** The top angle of the triangle is vertical to the angle measuring  $100^\circ$ , so it also measures  $100^\circ$ . Since the left and right side of the triangle are congruent,

the bottom angles of the triangle are congruent. The angles in a triangle add up to  $180^\circ$ , so the bottom two angles each have measures of  $40^\circ$  ( $100^\circ + 40^\circ + 40^\circ = 180^\circ$ ). The angle measuring  $a^\circ$  makes a straight line with the bottom left angle in the triangle, so the two angles add to  $180^\circ$ . Therefore,  $a + 40 = 180^\circ$ , so  $a = 140^\circ$ .

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### **Practice Test 3**

#### **Verbal Reasoning**

##### **Synonyms**

1. **Opportune** means fitting or favorable. For example, with all the advancements in computer technology, right now would be an **opportune** time to learn how to code. This is closest in meaning to answer choice **(C) appropriate**.
2. **Vile** means extremely unpleasant. For example, expired milk will probably have a **vile** smell. This is closest in meaning to answer choice **(A) dreadful**.
3. **Purge** means to clear out or get rid of something or someone. For example, many people follow a cleansing diet to help **purge** toxins from their system. This is closest in meaning to answer choice **(A) remove**.
4. **Sycophant** means a person who tries to please someone in order to gain a personal advantage. For example, if you are always kissing up to your teacher, your classmates might describe you as a **sycophant**. This is closest in meaning to answer choice **(A) flatterer**.
5. **Unearth** means to discover something hidden by investigating or searching. For example, detectives will try to **unearth** any relevant information about a suspect in order to help them with an investigation. This is closest in meaning to answer choice **(C) uncover**.
6. **Pugnacious** means eager or quick to argue or fight. For example, a **pugnacious** child will constantly talk back to his parents when they tell him to do something. This is closest in meaning to answer choice **(D) confrontational**.
7. **Treatise** means a written work or argument on a particular subject that includes a discussion of facts and conclusions reached. For example, your professor might ask you to write a **treatise** on a given subject instead of a final exam. This is closest in meaning to answer choice **(A) essay**.
8. **Aghast** means filled with horror or shock. For example, you would probably be **aghast** to find out your house had been broken into. This is closest in meaning to answer choice **(B) shocked**.

9. **Pertain** means to be related or applicable. For example, if you attend extra help, your questions should **pertain** to the subject you are studying. This is closest in meaning to answer choice **(B) relate**.
10. **Cunning** means tricky, crafty, or deceptive. For example, a **cunning** thief can still get away with a crime despite all of the advanced security systems in place. This is closest in meaning to answer choice **(C) sly**.
11. **Adept** means very skilled or proficient at something. For example, Michael Phelps is a very **adept** swimmer, having won multiple Olympic gold medals. This is closest in meaning to answer choice **(D) skilled**.
12. **Flamboyant** means tending to attract attention due to their confidence and/or stylishness. For example, a house with huge, intricately designed white pillars all along the front might be described as **flamboyant**. This is closest in meaning to answer choice **(A) showy**.
13. **Circumscribe** means to restrict something within limits. For example, HIPAA laws are designed to **circumscribe** access to patients' health records. This is closest in meaning to answer choice **(B) limit**.
14. **Appalling** means shocking or horrific. For example, many people find the living conditions in third world countries to be **appalling**. This is closest in meaning to answer choice **(C) atrocious**.
15. **Affix** means to stick or fasten something to something else. For example, in order to **affix** a stamp to an envelope you have to lick the back of it first. This is closest in meaning to answer choice **(D) attach**.
16. **Flair** means a special or instinctive ability for doing something well. For example, many comedians have a **flair** for impressions and can make themselves sound like someone else. This is closest in meaning to answer choice **(B) knack**.
17. **Agitate** means to stir or disturb something, especially a liquid. For example, in order to combine oil and vinegar you have to **agitate** the mixture. This is closest in meaning to answer choice **(A) churn**.
18. **Degenerated** means declined physically, mentally, or morally. For example, the reason an older person might have trouble walking could be because their muscles have **degenerated** over time. This is closest in meaning to answer choice **(B) deteriorated**.
19. **Impish** means inclined to do naughty things for fun. For example, on mischief night many children become quite **impish** and “decorate” the neighborhood with toilet paper. This is closest in meaning to answer choice **(D) mischievous**.

20. **Unacquainted** means having no experience or familiarity with something. For example, when you visit a foreign country you might be **unacquainted** with the local customs. This is closest in meaning to answer choice **(A) ignorant**.

### Sentence Completions

21. **The correct answer is choice (D) brevity, which means shortness of time.** The sentence starts out by telling us that the senator had a reputation for long-windedness, or taking a long time to say something. The blank in the sentence is describing the senator's remarks that took the audience by surprise. Since the senator was known for his long-windedness, we can infer that the audience was surprised by the shortness, or **brevity**, of his remarks on this day.
22. **The correct answer is choice (A) fortuitous, which means fortunate or lucky.** The blank in this sentence is referring to the timing of the picnic. The sentence tells us that guests arrived for the picnic just minutes after the rain had stopped. Most people wouldn't want it to be raining when their picnic starts, so the fact that the rain stopped just in time was very lucky, or **fortuitous**.
23. **The correct answer is choice (B) understated, which means toned-down or restrained.** The blank in this sentence is describing the woman's manner. The second half of the sentence says that the meaning of her words was powerful and crystal-clear, so we would normally assume that her manner would be powerful as well. The word "but" in the middle of the sentence tells us that the woman's manner is going to be in contrast to how her words are described, so we can infer that her manner was restrained, or **understated**.
24. **The correct answer is choice (A) raucous, which means disorderly or rambunctious.** The sentence starts off by saying that the get-together was supposed to be relaxed, which implies that in reality it was not relaxed. The second part of the sentence tells us that several of the adults left early without making sure that someone would be there to keep things under control. Based on these two things, we can assume that the get-together did not turn out to be relaxed, but instead it became quite disorderly, or **raucous**.
25. **The correct answer is choice (B) trailblazer, which means a pioneer or innovator.** The blank in this sentence is describing what the teacher did not consider herself to be. The word "but" in the middle of this sentence tells us that even though the teacher did not consider herself to be this, she probably was because other people thought of her this way. The second part of this sentence says that other people viewed the teacher's approach as startlingly new and highly influential. Someone who approaches something in a new or innovative way would usually be called a **trailblazer**.
26. **The correct answer is choice (C) dichotomy, which means a contrast between two things that are opposed to each other.** The blank in this sentence is referring to the difference between the two candidates. The second part of the sentence tells us that the candidates had sharply differing

ways in which they responded to the latest economic forecast. Since the two candidates responded to the same thing so differently, this means that there was a stark contrast, or **dichotomy**, between them.

27. **The correct answer is choice (B) forthcoming, which means open or transparent.** The blank in this sentence is referring to what the employees wished upper management to be more of in regards to changes. The second part of this sentence tells us they wished this so they would not be surprised by any big changes. Since the employees didn't want to be surprised by big changes, it would make sense that they wished for upper management to be more open, or **forthcoming**, about any changes so that the employees could be prepared.
28. **The correct answer is choice (D) modified, which means to make partial or minor changes to something to make it less extreme.** The blank in this sentence is referring to what the union representatives did to their position regarding overtime pay in order to reach an agreement. When two sides are negotiating, in order for them to reach an agreement, a compromise must be made. When people compromise they tend to make slight changes to, or **modify**, their position so that the other side will accept it.
29. **The correct answer is choice (C) redoubled, which means deepened or strengthened.** The blank in this sentence is referring to what Scott did to his commitment to making a return trip abroad. The first part of the sentence says that he did this when he thought fondly of his first trip. If someone thinks fondly about something, this would most likely make them want to do that thing again. This means it would make sense that Scott thinking fondly about his previous trip would cause him to deepen, or **redouble**, his commitment to make another trip with his family.
30. **The correct answer is choice (A) fashion, which means build or construct.** This sentence is talking about Marie and what she was able to do. The sentence tells us that Marie used a cardboard box and some crafts to “blank” a model of her plans for the scenery. A cardboard box and some crafts are things that people might use to build, or **fashion**, something from scratch.
31. **The correct answer is choice (B) tenaciously, which means persistently or in a very determined way.** The blank in this sentence is describing how the team held on and managed to win the game despite being down by a large margin. If a team is losing by a large margin and they come back to win in the final minutes, they would have to have fought pretty hard and held on very persistently, or **tenaciously**, in order to do so.
32. **The correct answer is choice (A) intermittently, which means at irregular or random times, and exasperating, which means irritating or frustrating.** This sentence is describing how the principal's announcements throughout the class day affected the students who were trying to finish their project. If the principal's announcements sounded ceaselessly, or without end, throughout the day, it wouldn't make sense for that to amuse, or entertain, the students trying to complete their project, so answer choice (B) is incorrect. If the principal's announcements sounded powerfully

throughout the day it wouldn't make sense for that to enable the students trying to complete their project, so answer choice (C) is incorrect. If the principal's announcements sounded unobtrusively, or discreetly, throughout the day, it wouldn't make sense for that to frustrate the students trying to complete their project, so answer choice (D) is incorrect. It would make sense that if the principal's announcements were sounding randomly, or **intermittently**, throughout the day that that would irritate, or **exasperate**, the students trying to finish their project because it would probably distract them and make it harder to focus.

- 33. The correct answer is choice (D) allot, which means allocate or distribute, and compile, which means to produce something, especially a list, by assembling information collected from other sources.** This sentence is describing a manager and what he had to do to “blank” enough funds for the annual bonuses. It wouldn't make sense for the manager to have to remove a list of employees who had been with the company for two years in order to generate enough funds for bonuses, so answer choice (A) is incorrect. It wouldn't make sense for the manager to have to edit, or change, a list of employees who had been with the company for two years in order to distribute, or give out, enough funds for bonuses, so answer choice (B) is incorrect. It wouldn't make sense for the manager to have to terminate, or end, a list of employees who had been with the company for two years in order to collect enough funds for bonuses, so answer choice (C) is incorrect. It would, however, make sense for the manager to have to create, or **compile**, a list of employees who had been with the company for two years in order to allocate, or **allot**, enough funds for bonuses.
- 34. The correct answer is choice (C) colleague, which means co-worker, and unfathomable, which means baffling or incomprehensible.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is describing a mathematician's work that is also described as intricate. If someone's work is intricate, that most likely implies that it was complicated, especially in the case of a mathematician, so we can eliminate oversimplified as an answer choice. The clue in this sentence to the right answer is the word “though” at the start of the sentence. That word signifies that the first half of the sentence is going to contrast in some way with the second. The first part of the sentence tells us that the other mathematicians respected the woman but a few found her work not just intricate but “blank”. That tells us that not only is the word we are looking for probably not something typically associated with respecting someone's work, but that it is more than intricate or complicated. If a mathematician's work is overly complicated it might be baffling, or **unfathomable**, to people around her, which is not something you would usually say about someone's work who you respect. . Despite this fact, the sentence is trying to say that the other mathematicians still respected their co-worker, or **colleague**.
- 35. The correct answer is choice (B) endure, which means go through or undergo, and demanding, which means challenging or rigorous.** The first blank in the sentence is describing what people wishing to become rescue swimmers in the Coast Guard must do. The Coast Guard is a branch of the US military that acts as maritime security. They go out on search and rescue missions to find people who are lost at sea. We can assume that in order to become a rescue swimmer for the Coast Guard, you would have to go through some pretty intense training because

people’s lives will be on the line in your job. Since this training is probably very tough, it makes sense that people who wanted to become rescue swimmers would have to survive, or **endure**, this training. Answer choices (B) and (C) both work for the first blank, so we have to use the second blank to find the correct answer. The second blank is describing this training that people must undergo. As we have already discussed, we can assume this training is very intensive, or **demanding**, and not captivating, or attractive.

- 36. The correct answer is choice (A) contemplative, which means thoughtful or reflective, and leisurely, which means unhurried or relaxed.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank in the sentence is describing how Henry went about reviewing the events of the day. Since the sentence tells us he now had the opportunity to relax, we know that he must have been able to unhurriedly, or **leisurely**, review the events of the day. Answer choices (A) and (C) both work for the second blank, so we have to use the first blank to do the correct answer. The first blank is describing the mood that Henry now found himself in. Since we know that Henry was reviewing, or thinking about, the events of the day, it would make sense that he would be in a thoughtful, or **contemplative**, mood.
- 37. The correct answer is choice (D), tirade, which means a long angry speech of criticism, and qualified, which means to modify or make something less harsh.** The first blank in this sentence is referring to what the mayor had earlier launched against his opponent. The word before the blank is devastating, so we know the blank is going to be a negative word. Praise is a positive word, so we can eliminate choice (C). It would make sense for the mayor to have launched a devastating **tirade**, or angry speech, at his opponent. Answer choices (A), (B), and (D) all work for the first blank, so we have to use the second blank to find the correct answer. The second blank is referring to what the mayor did to his negative remarks to soften his image during the debate. It wouldn’t make sense for the mayor to bolster, or strengthen, his negative remarks if his goal was to soften his image, so answer choice (A) is incorrect. Similarly, it wouldn’t make sense for the mayor to question his negative remarks, so answer choice (B) is incorrect. It would, however, make sense for the mayor to modify, or **qualify**, his negative remarks in order to soften his image.
- 38. The correct answer is choice (C) atypical, which means unusual, and expected, which means likely or anticipated.** The word “while” at the start of this sentence is a clue that the two ideas in the sentence are going to be in contrast with each other. The second blank is describing how the child’s disobedient behavior seemed to his/her parents. Since the sentence tells us that the child had recently faced a trauma, and we can assume his/her parents knew about this, it would make sense for his/her disobedient behavior to seem **expected**, to his/her parents. Since we know the ideas in the sentence are going to be in contrast, we know the way the child’s behavior seemed to his/her teachers must be in contrast with it seeming likely to his/her parents. The child’s behavior seeming unusual, or **atypical**, to his teachers is in contrast to it seemed likely to his/her parents.
- 39. The correct answer is choice (C) eradication, which means the destruction or elimination of something, and vermin, which means wild animals or insects that are believed to be harmful**

**to crops.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank in this sentence is referring to the pests that had damaged the region's flora. A pest that damages a region's flora, or plant life, is very similar to the definition of the word **vermin**. Since the pests wouldn't go away on their own and they were so damaging to the region, it makes sense that the priority of the people living there would be to completely eliminate, or **eradicate**, them.

- 40. The correct answer is choice (D) reassess, which means reconsider or reevaluate, and impediments, which means obstacles.** For this sentence we can start with the second blank to find the correct answer more easily. The second blank is referring to what some of the recent graduates ran into while trying to find employment in the student's current field of study. If we think about running into something, we usually think of something hard or something that is in our way. It doesn't really make sense to say someone ran into opportunities or advances, so we can eliminate answer choices (A) and (B). It makes a lot more sense to say someone ran into a series of obstacles, or **impediments**. Answer choices (C) and (D) both work for the second blank, so we have to use the first blank to find the correct answer. The first blank refers to what the student began to do to her decision after she had talked to these recent graduates who had struggled to find employment in her field of study. It wouldn't make sense for the student to esteem, or praise, her decision if the recent graduates were having difficulty finding employment, so answer choice (C) is incorrect. It would, however, make sense for the student to reconsider, or **reassess**, her decision after talking with recent graduates who were having trouble finding employment in her field of study.
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### Quantitative Reasoning

- 1. Answer choice (A) is the correct answer.** Factor a 17 out from the expression to get  $17(489 + 511)$ . Add 489 and 511 to get 1000. Now we have  $17(1000)$  which equals 17,000.
- 2. Answer choice (C) is the correct answer.** Let  $a$  equal the smallest factor of 9 that isn't 1, so  $a = 3$ . Let  $b$  equal the smallest factor of 25 that isn't 1, so  $b = 5$ . Therefore,  $ab = 3 \cdot 5 = 15$ . The least possible value that 15 can be a factor of is 15.
- 3. Answer choice (C) is the correct answer.** Consecutive integers follow a sequence where each integer is 1 more than the previous integer. For example, 4, 5, 6, 7, 8 are consecutive integers. The average of a set of consecutive integers is *always* the median, or middle. Therefore, if 10 is the average of five consecutive integers it is also the middle integer.
- 4. Answer choice (C) is the correct answer.** Let the original dimensions of the square be 10 by 10, so the original area is 100. To increase the perimeter by 30%, we need to increase each side by 30%. Increase 10 by 30% to get new side lengths of 13. The new area is 169. The percent increase from 100 to 169 is 69%.

5. **Answer choice (B) is the correct answer.** Megan can run at a speed of  $8\pi$  miles per hour, so in one hour, she will run  $8\pi$  miles. Therefore, since she ran 8 laps in 1 hour, then 8 laps equals  $8\pi$  miles. Find the distance of one lap by dividing  $8\pi$  miles by 8 to get  $\pi$  miles per lap. The distance it takes to run one lap equals the circumference of the track, so the circumference is  $\pi$  miles. The equation for the circumference of a circle is  $C = 2\pi r$ . Set the circumference equal to  $\pi$  and solve for the radius:  $\pi = 2\pi r \rightarrow r = \frac{1}{2}$  mile.
6. **Answer choice (A) is the correct answer.** Find  $4\#1$  by replacing  $a$  with 4 and  $b$  with 1 in the original equation:  $4\#1 = 2(4) + 1 = 8 + 1 = 9$ .
7. **Answer choice (D) is the correct answer.** The value of one quarter is 0.25 dollars, the value of one dime is 0.1 dollars, and the value of one penny is 0.01 dollars. Find the total value of the coins by multiplying the number of each coin by the value of one of those coins and finding the sum:  $0.25q + 0.1(d + 5) + 0.01(8)$ . Simplify the expression:  $0.25q + 0.1d + 0.5 + 0.08 = 0.25q + 0.1d + 0.58$ .
8. **Answer choice (B) is the correct answer.** Since  $5^2 = 25$ , we can rewrite  $25^5$  using  $5^2$ :  $25^5 = (5^2)^5$ . Simplify the expression by multiplying the exponents to get that  $25^5 = 5^{10}$ .
9. **Answer choice (C) is the correct answer.** Let's say that Train A passes the station every 2 hours and Train B passes the station every 3 hours. Therefore, at 5:00 Train A will pass Markway Station, at 6:00 Train B will pass, at 7:00 Train A will pass, and at 9:00 Train A and B will pass. 9:00 is 6 hours after 3:00, and 6 hours is the least common multiple of 2 hours and 3 hours. Therefore, we need to know the least common multiple of  $x$  and  $y$  to determine when both trains pass Markway Station.
10. **Answer choice (A) is the correct answer.** Isolate  $b$  in the inequality  $-2 < b + 1 < 2$  by subtracting 1 from all three parts to get  $-3 < b < 1$ . Now find the range of values of  $a$ . The lower endpoint for the values of  $a$  is when  $b$  is the smallest, so the lower endpoint for the values of  $a$  equals  $3(-3) - 2 = -11$ . The higher endpoint for the values of  $a$  is when  $b$  is the greatest, so the higher endpoint of the values of  $a$  equals  $3(1) - 2 = 1$ . Therefore,  $-11 < a < 1$ , so  $a$  cannot equal 1.
11. **Answer choice (C) is the correct answer.** Find the volume of the small cube by cubing the side length:  $3^3 = 27 \text{ cm}^3$ . The area of the base of the larger cube is 36  $\text{cm}^2$ , so the side length is 6  $\text{cm}$ . Find the volume of the larger cube by cubing the side length:  $6^3 = 216 \text{ cm}^3$ . Find the number of small cubes that can fit inside the large cube by dividing the volume of the large cube by the volume of the small cube:  $216 \div 27 = 8$ .
12. **Answer choice (C) is the correct answer.** The smallest possible perimeter is when the dimensions of the rectangle are 6 in by 6 in. Therefore, the perimeter is  $6 + 6 + 6 + 6 = 24$  in.

- 13. Answer choice (A) is the correct answer.** There are more even products than odd products if you multiply two numbers in between 1 and 6. This is because an even number times anything is *always* an even number, but an odd number times anything is *not always* an odd number. Therefore, there is a higher probability of getting an even product, so Donna has a greater probability of receiving a point.
- 14. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, if the average decreased by 1.2, the sum decreased by 12 because  $(1.2\ average\ decrease) \cdot (10\ runners) = 12$ .
- 15. Answer choice (A) is the correct answer.** The temperature of the soup starts at 100° F, so answer choice (C) is incorrect. Since the soup sits in a fridge that is 40° F, the temperature cannot go below 40° F. Therefore, graphs (B) and (D) are incorrect. We are left with graph (A) as the correct answer.
- 16. Answer choice (D) is the correct answer.** The ratio of the smallest to largest number is 4:6 or 2:3. Set up and solve the following proportion using  $x$  to represent the larger number:
- $$\frac{2}{3} = \frac{60}{x} \rightarrow 2x = 180 \rightarrow x = 90.$$
- 17. Answer choice (B) is the correct answer.** Find  $h\left(\frac{1}{2}\right)$  by plugging in  $\frac{1}{2}$  for  $x$  in the  $h(x)$  equation:  $h\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$ . Find  $h\left(\frac{2}{3}\right)$  by plugging in  $\frac{2}{3}$  for  $x$  in the  $h(x)$  equation:  $h\left(\frac{2}{3}\right) = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$ . Find  $k\left(\frac{1}{2}\right)$  by plugging in  $\frac{1}{2}$  for  $x$  in the  $k(x)$  equation ( $k(x) = \frac{1}{x}$  which equals  $1 \div x$ ):  $k\left(\frac{1}{2}\right) = 1 \div \frac{1}{2} = 1 \cdot \frac{2}{1} = 2$ . Find  $k\left(\frac{2}{3}\right)$  by plugging in  $\frac{2}{3}$  for  $x$  in the  $k(x)$  equation ( $k(x) = \frac{1}{x}$  which equals  $1 \div x$ ):  $k\left(\frac{2}{3}\right) = 1 \div \frac{2}{3} = 1 \cdot \frac{3}{2} = 1.5$ . Therefore,  $h\left(\frac{1}{2}\right) < h\left(\frac{2}{3}\right) < k\left(\frac{2}{3}\right) < k\left(\frac{1}{2}\right)$ .
- 18. Answer choice (D) is the correct answer.** To find the volume of a triangular prism, multiply the area of the triangular base by the distance between the two triangular bases. On the grid, we can tell that the triangular bases each have a height of 4 cm and a base of 3 cm, so their area equals  $6\text{ cm}^2$  (area of triangle =  $(base \cdot height) \div 2$ ). The distance between the two bases is the longer side of the middle rectangle, which is 9 cm. Multiply 6 by 9 to get a volume of  $54\text{ cm}^3$ .
- 19. Answer choice (D) is the correct answer.** Since a histogram does not show us exact data points, we cannot find the range of the data.

- 20. Answer choice (C) is the correct answer.** From the graph, we can see that Steven was riding at a constant speed of 200 meters per minute during the last 2 minutes of his trip. Multiply his speed by the time to find his total distance:  $200 \cdot 2 = 400$  meters.
- 21. Answer choice (C) is the correct answer.** Find the value of Column A by plugging in 3 for  $y$  and solving for  $x$ :  $x = 4(3) - 8 = 4$ . Find the value of Column B by plugging in 8 for  $x$  and solving for  $y$ :  $8 = 4y - 8 \rightarrow 16 = 4y \rightarrow y = 4$ . Therefore, Column A and Column B are equal.
- 22. Answer choice (B) is the correct answer.** Find the area of Rectangle A by multiplying the dimensions:  $(x + 4)(x + 6) = x^2 + 10x + 24$ . Find the area of Rectangle B by multiplying the dimensions:  $(x + 3)(x + 8) = x^2 + 11x + 24$ . Since  $x$  is greater than 0, Column B is greater than Column A because  $11x$  is greater than  $10x$ .
- 23. Answer choice (B) is the correct answer.** The greatest possible area of a rectangle with a perimeter of 40 in is when the rectangle measures 10 in by 10 in, so the greatest area is  $100 \text{ in}^2$ . The smallest possible area of a rectangle with a perimeter of 40 is when the rectangle measures 19 in by 1 in, so the smallest area is  $19 \text{ in}^2$ . Since  $105 \text{ in}^2$  is greater than the greatest possible area of the rectangle, Column B is greater than Column A.
- 24. Answer choice (B) is the correct answer.** Find the measure of each exterior angle of a regular hexagon by dividing the sum of the exterior angles by 6:  $360^\circ \div 6 = 60^\circ$ . Find the measure of each exterior angle of a regular pentagon by dividing the sum of the exterior angles by 5:  $360^\circ \div 5 = 72^\circ$ . Therefore, Column B is greater than Column A.
- 25. Answer choice (A) is the correct answer.** Remember that the absolute value of any non-zero number is always positive. Simplify the expression in Column B:  $8 - 2|4 - 7| \rightarrow 8 - 2|-3| \rightarrow 8 - 2|3| \rightarrow 8 - 6 \rightarrow 2$ . Therefore, Column A is greater than Column B.
- 26. Answer choice (C) is the correct answer.** The volume of a cube equals the side length cubed. Therefore, to find the side length of a cube with a volume of  $64 \text{ cm}^3$ , take the cube root of 64 which is 4 cm. The surface area of a cube equals the sum of the area of all six sides. Find the area of one side of the cube by dividing  $96 \text{ cm}^2$  by 6 to get  $16 \text{ cm}^2$ . Since each side is a square, find the square root of 16 to get that the side length of Cube B is 4 cm. Therefore, Column A and Column B are equal.
- 27. Answer choice (A) is the correct answer.** When you raise a negative number to an even power, the answer is always positive. Therefore, Column A is always positive. Column B is always negative because the negative is not being raised to the exponent, so it is applied after the exponent is simplified. Since a positive number is always greater than a negative number, Column A is greater than Column B.

- 28. Answer choice (D) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of the numbers is  $3 \cdot 20 = 60$ . We cannot determine what the largest of the three numbers is by just knowing the average and the sum. Therefore, we cannot determine the relationship between Column A and Column B.
- 29. Answer choice (A) is the correct answer.** The two labeled angles are congruent because they are vertical angles, so  $b - 18 = a$ . Isolate  $b$  to get  $b = a + 18$ . Since  $a + 18$  is greater than  $a - 18$ , Column A is greater than Column B.
- 30. Answer choice (D) is the correct answer.** Distribute the 5 in Column A to get  $5x + 15$ . Distribute the 3 in Column B to get  $3x + 15$ . Since the two expressions both have a + 15, we just want to compare  $5x$  and  $3x$ . Since we don't know what  $x$  is, we cannot determine the relationship between  $5x$  and  $3x$ . If  $x = 0$ , the two quantities are equal. If  $x = 1$ ,  $5x$  is greater than  $3x$ . If  $x = -1$ ,  $3x$  is greater than  $5x$ .
- 31. Answer choice (B) is the correct answer.** The situation in Column A is more restrictive than the situation in Column B. In Column B, we need to choose *at least* 1 non-blue marble, so we can choose 1 non-blue marble or 2 non-blue marbles. In Column A, we can only choose 2 non-blue marbles. Therefore, the probability in Column B is greater than the probability in Column A.
- 32. Answer choice (B) is the correct answer.** Let the original dimensions of Rectangle A equal 10 by 10, so the area is 100. Increase one side by 10% and decrease one side by 20% to get dimensions of 11 by 8, so the new area of Rectangle A is 88. The percent change from 100 to 88 is 12%, so Column A equals 12%. Let the original dimensions of Rectangle B equal 10 by 10, so the area is 100. Increase one side by 20% and decrease one side by 30% to get dimensions of 12 by 7, so the new area of Rectangle A is 84. The percent change from 100 to 84 is 16%, so Column B equals 16%. Therefore, Column B is greater than Column A.
- 33. Answer choice (A) is the correct answer.** Since Samatha has the same number of nickels and quarters, let  $x$  equal the number of nickels and the number of quarters she has. Set the total value of her quarters and nickels equal to \$3.00 and solve  $0.25x + 0.05x = 3.00 \rightarrow 0.3x = 3.00 \rightarrow x = 10$ . Therefore, Samantha has 10 quarters and 10 nickels. Find the value of her quarters:  $10(0.25) = \$2.50$ . Therefore, Column A is greater than Column B.
- 34. Answer choice (B) is the correct answer.** Since the width of the shaded border is 1 inch all around, the dimensions of the white rectangle are  $x - 2$  and  $2x - 2$ . Therefore, the area of the white region is  $(x - 2)(2x - 2)$ . Since  $x - 2$  is smaller than  $x - 1$ , and  $2x - 2$  is smaller than  $2x - 1$ ,  $(x - 2)(2x - 2)$  is smaller than  $(x - 1)(2x - 1)$ . Therefore, Column B is greater than Column A.

- 35. Answer choice (D) is the correct answer.** Since we do not know the values of  $x$  and  $y$ , we cannot compare the area of Triangle A to the area of Triangle B.
- 36. Answer choice (D) is the correct answer.** While we cannot determine the exact range of the values in a data set from a histogram, we can determine a range of values for the range. Using the graph, we can see that the lowest possible minimum value of our data is 25, and the highest possible maximum value of our data is 99. Therefore, the largest possible range is  $99 - 25 = 74$ . The highest possible minimum value of our data is 39, and the lowest possible maximum value of our data is 85. Therefore, the smallest possible range is  $85 - 39 = 46$ . Therefore, our range is between \$46,000 and \$74,000 inclusive. Since Column B could be greater than or equal to the range, depending on what the range is, we cannot determine the relationship between Column A and Column B.
- 37. Answer choice (C) is the correct answer.** In both columns, we only want to find the probability of the event that comes after the word “probability”. The first roll does not affect our probability. Therefore, for Column A we want the probability that the second roll is a 3, and for Column B we want the probability that the second roll is a 4. Since there is only one 3 and one 4 on a six sided die, the probabilities are both equal to 1 out of 6, so Column A and Column B are equal.
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## Reading Comprehension

### Passage 1

1. The main purpose of the passage is to educate readers and give them some information on the motion of the Earth. While the passage does talk about the speed at which the Earth moves through space, it does not really compare that speed to other objects moving through space, so answer choice (B) is incorrect. While the passage does mention that there is no one number that summarizes all the data on the different speeds at which the Earth is moving through space, it isn't focused on proving this and it only mentions this once, so answer choice (C) is incorrect. While the passage does talk about the speed at which the Earth and Solar System are moving through space, it does not talk about the forces that are causing this, so answer choice (D) is incorrect. The primary purpose of the passage is to provide some data and context regarding the motion of the Earth. **Therefore, answer choice (A) is the correct answer.**
2. Lines 57-59 state “There is no one number that summarizes all this data, but a relatively recent discovery does make matters a bit more intelligible.” This first part of this sentence is saying there is no number that can summarize all the speeds of movement acting on the Earth. The word “but” in the middle of the sentence tells us that whatever comes after it is going to be in contrast to whatever was before it, so we know the word “intelligible” is describing something that must be similar to summarizing all the data. When information is summarized it makes a large amount of

data more understandable, so we can infer that the word “intelligible” most nearly means understandable. **Answer choice (D) is the correct answer.**

3. The third paragraph in the passage talks about the rotational speeds affecting the Earth. It states that the Earth rotates once around its axis in about 24 hours, also known as the *sidereal period*. Lines 26-28 state “That means if you’re standing still right on the equator, you’re rotating at about 1000 miles per hour.” The sentence mentions the fact that you have to be standing right on the equator to be moving at 1000 miles per hour, so we can assume that this is important. This implies that where you are located on the Earth determines the rotational speeds you experience on Earth. **Therefore, answer choice (A) is the correct answer.**
4. The sixth paragraph in the passage talks about something called the Great Attractor. The paragraph tells us that the Great Attractor is a region of space about 150 million light-years away. Lines 52-56 state “Our galaxy and the others close by are moving towards the Great Attractor, which has a mass 100 quadrillion times greater than our sun, at a speed of over 2 million miles per hour.” Since the Great Attractor is affecting not only our whole galaxy, but galaxies close by as well, we know that many solar systems, and in turn the planets in those solar systems, are being affected by it. **Therefore, answer choice (D) is the correct answer.**
5. According to the passage the speeds of each of the answer choices are as follows: Earth’s speed around the sun is 67,000 miles per hour (lines 29-33), our sun’s speed as it moves towards the Great attractor is 2 million miles per hour (lines 52-56), the Solar System’s speed around the center of the Milky Way Galaxy is 490,000 miles per hour (lines 44-47), and Earth’s rotational speed at the equator is 1000 miles per hour (lines 26-28). As we can see the greatest speed is that of our sun moving towards the Great Attractor at 2 million miles per hour. **Therefore, answer choice (B) is the correct answer.**
6. The overall focus of the passage is on educating the reader about the different speeds that are affecting the Earth. The passage provides a lot of information and does so in an understandable way. The author does not really make any jokes or talk in a humorous way, but the information is still approachable. The author uses contractions and first person pronouns such as we and us to keep the passage feeling more conversational and less formal. Overall the tone of the passage can best be described as serious but informal. **Answer choice (C) is the correct answer.**

## Passage 2

7. The author’s primary purpose in writing this passage is to briefly educate the reader on Basque culture and history. While the author does mention the recent resurgence of interest in Basque culture in the US, this is only mentioned briefly and is not the main focus of the passage, so answer choice (A) is incorrect. The author does not structure the passage chronologically, so answer choice (C) is incorrect. While the author does point out differences within Basque culture and some differences between Basques and other Europeans, the passage does not focus on these differences,

so answer choice (D) is incorrect. Overall the author’s main purpose for writing this passage is to provide an introduction to Basque culture both within and outside of the US. **Therefore, answer choice (B) is the correct answer.**

8. The quote the question is referring to states “While their neighbors have long since resigned all their pretensions into the hands of kings and priests, these extraordinary people have preserved their ancient language, genius, laws, government, and manners, without innovation, longer than any other nation of Europe.” President Adams is clearly impressed with the Basque people calling them “extraordinary” and praising their preservation of their cultural identity, so we can infer that the author quoted Adams to illustrate how impressed he was. **Answer choice (A) is the correct answer.**
9. Lines 20-25 state “Like all ethnic groups, Basques -- and Basque Americans -- are not monolithic. Though some people prefer to be thought of simply as ‘Basque,’ others consider themselves *Spanish* or *French* Basque.” The word “monolithic” is referring to what Basques are not as an ethnic group. The second sentence says that some Basques consider themselves French while others Spanish, so we can reason that monolithic must refer to an ethnic group all being characterized as one thing or the same. **Another way of saying the same is identical, so answer choice (D) is the correct answer.**
10. The second paragraph talks about how some Basques think of themselves as belonging to a distinct *nation*. Lines 37-40 state “In fact, the term *Basque nation* was commonly used until the Spanish Constitution of 1812 forbade the use of the term.” Based on that sentence, we can infer that at one time, Spain discouraged the feelings of Basque independence because they forbade the use of the term Basque nation. **Therefore, answer choice (D) is the correct answer.**
11. Lines 28-33 state “There is, however, a distinct Basque language, one that has ancient origins, perhaps dating back to the Stone Age. This language, unrelated to any other, is key in Basque cultural identity...” Since the Basque language has ancient origins and is unrelated to any other language, it must have origins that differ from those of other European languages. **Therefore, answer choice (B) is the correct answer.**
12. Lines 16-19 state “You’ll also find Basque family names in Texas, especially along the border with Mexico, as many Hispanics are descended from Basques.” Since the sentence says that many Hispanics are descended from Basques and you can find Basque family names in Texas along the Mexican border, we can infer that there are many families that descended from Basques living in Mexico, a country with many Hispanics, and some of them have crossed over to live in Texas. **Therefore, answer choice (C) is the correct answer.**

### Passage 3

13. The third and fourth paragraphs in the passage talk about the use of *constrained writing* by authors. Lines 38-44 state “Authors of fiction can also engage in stunt literature, though the term has a pejorative quality that is perhaps unfair to serious-minded writers who simply wish to experiment as a way of developing their craft, as opposed to simply providing a ‘hook’ for promotional purposes.” The next sentence says that some of these experiments take the form of *constrained writing*. We can see that the author is trying to make a distinction between using stunt writing purely to garner more promotion for their book and serious writers who experiment with things like constrained writing to develop their craft. The author then goes on to give some examples of authors who have done this and describes some of their work as “impressive”, and speaks with an overall tone of respect and admiration. From this, we can infer that the author believes that constrained writing can be used to produce serious works or fiction. **Therefore, answer choice (C) is the correct answer.**
14. The second paragraph in the passage talks about *immersion journalism*, which is a style of journalism where the author takes part in the proceedings about which he or she is writing. The passage mentions that *gonzo journalism* is an extreme version of this demonstrated in a 1967 book about the Hell’s Angels motorcycle gang that was written by Hunter S. Thompson. Describing this book, lines 26-31 state “It’s safe to say that the line between fact and fiction is intentionally stretched in works of this sort, thought in the service -- some would say -- of reporting a *larger* truth than the facts alone would provide.” The next few lines go on to talk about another work of immersion journalism that seemed to have a more apparent regard for the facts. This implies that books containing gonzo journalism are less concerned with the traditional reporting of actual events when compared to other forms of immersion journalism. **Therefore, answer choice (B) is the correct answer.**
15. The main purpose of the passage is to educate the reader about the concept of stunt writing and provide examples of different ways authors do this. The passage does not comment on whether stunt writing does or does not guarantee good quality in a book, so answer choice (B) is incorrect. While the passage does mention some recent developments in stunt writing using new technologies, this is a small part of the final paragraph and not the main focus, so answer choice (C) is incorrect. Answer choice (D) is incorrect because the passage tells us that immersion journalism is a form of stunt writing, so it wouldn’t make sense to compare the two. Overall the primary purpose of the passage is to present an overview of the meaning of stunt writing along with several examples. **Therefore, answer choice (A) is the correct answer.**
16. Lines 38-44 state “Authors of fiction can also engage in stunt literature, though the term has a pejorative quality that is perhaps unfair to serious-minded writers who simply wish to experiment as a way of developing their craft, as opposed to simply providing a ‘hook’ for promotional purposes.” The sentence says that the “pejorative” quality of stunt literature is unfair to serious-minded writers, which implies that a pejorative quality is a negative quality. **Disapproving** is the only answer choice with a negative connotation. **Answer choice (A) is the correct answer.**

17. The third paragraph in the passage talks about the use of constrained writing by author Walter Abish. The paragraph tells us that in the first chapter of his book, Abish only uses words that start with the letter A. He then allows words to start with A and B in the second chapter, adding one letter of the alphabet each chapter until chapter 26. Lines 55-58 state “The author, Walter Abish, reverses this process in the second half of the book, in which chapter 27 contains no z’s chapter 28 has no z’s or y’s etc.” We can reason then that the last chapter would contain words only starting with the letter A, just like the first chapter. **Therefore, answer choice (C) is the correct answer.**
18. This passage starts off with a paragraph that sets up the reader for the main idea of the passage (introductory paragraph). The main topic (stunt writing) is introduced in the second paragraph and the author goes on to give examples of this technique and how it is used by different writers. The author then concluded with his opinions on the topic in the final paragraph. Based on this, the organization of the pasag can best be described as “an introductory paragraph leads to a discussion of the main topic, after which the author gives an opinion relevant to the topic.” **Therefore, answer choice (D) is the correct answer.**

#### Passage 4

19. *The History of the Paralympics* only works for the first paragraph and even then it doesn’t encompass everything the paragraph is talking about. The passage as a whole covers many more topics than just the history of the Paralympic Games, so answer choice (A) is incorrect. *Disabled Athletic Organizations* implies that the passage is focused on the organizations themselves when in reality the passage is focused on the ways that disabled athletes can compete, so answer choice (C) is incorrect. *Competition at All Levels* is too broad of a title for this passage. It does not give any indication to the reader that this passage will focus on disabled athletes competing and not just competition in general, so answer choice (D) is incorrect. *Sports Without Limits* captures the main idea of this passage, that just because these athletes may be physically limited does not mean they can’t compete in many different sports without limits. The primary focus of this passage is disabled athletes and the organizations which provide them the opportunity to compete in sports like everyone else. **Therefore, answer choice (B) is the correct answer.**
20. Throughout the passage the author talks about different adapted sports and the organizations that host events for diabled athletes. The author does not get overly emotional in any way about these athletes or organizations yet still the passage has an overall positive feel to it. This is due to the authors inclusion of the benefits these adapted sports have on the athletes that participate in them. Overall the tone of this passage can best be described as moderate and positive. **Answer choice (A) is the correct answer.**
21. In the second paragraph of the passage the author talks about adapted sports and how the term typically refers to a sport that is based on an existing one, such as sitting volleyball. However this is not always the case, lines 31-36 state “In some cases the adaptation involves not only a change in rules but also a change in the ultimate goal of the activity; winning is emphasized less than

exercise, fun, and social engagement.” This sentence implies that there are some adapted sports that are not as strictly based on a sport played by non-disabled people as something like sitting volleyball. **Therefore, answer choice (B) is the correct answer.**

22. The final paragraph in the passage talks about how there are some sports where disabled individuals are capable of competing with fully abled athletes. The paragraph also mentions that there have been controversies such as when a participant has a prosthetic that could actually provide some type of advantage. Lines 74-78 state “How to resolve issues of this sort will, no doubt, become more difficult and plentiful as improvements are made -- and for that, one can only be grateful -- for people with a wide range of capabilities.” The fact that this sentence says issues surrounding disabled athletes competing with fully abled athletes will become more difficult and plentiful implies that disabled and fully abled athletes will increasingly compete against each other in the years ahead. **Therefore, answer choice (D) is the correct answer.**
23. Lines 12-18 state “The 1948 event was not the first time disabled athletes performed in a public setting. The Silent Games -- later known as the Deaflympics -- began in Paris in 1924, and there were even earlier competitions of this sort, though none that have carried on to the present day.” Since the sentence says there were competitions like the Deaflympics earlier than 1924, we know that sporting events for disabled people began prior to 1924. **Therefore, answer choice (A) is the correct answer.**
24. Lines 45-51 state “People with intellectual disabilities have a number of opportunities for competition that provides them with more than an afternoon of recreation; these events can be stimulating in ways that can lead to an abiding improvement in the participants quality of life.” The word “abiding” in this sentence is describing the improvements that people with intellectual disabilities can experience from events created for them to compete. Since the sentence says these events can provide more than an afternoon of recreation and then says they can lead to abiding improvements, we can infer that abiding must mean longer than an afternoon. Another way to say this is these events can provide long-term improvements. **Answer choice (C) is the correct answer.**

### Passage 5

25. The passage starts off with an introduction paragraph that discusses the benefits that music education has on students. The next paragraph poses the argument that jazz in particular should be the focus of this music education (statement of purpose). The passage goes on to present supporting reasons for this argument such as the improvisation of jazz will be very rewarding for students once they learn to understand it and that learning to play with other musicians will develop their musical coordination (supporting reasons). Based on this, the best way to describe the organization of the passage is, an introduction is followed by a statement of purpose and then supporting reasons for the author’s views. **Therefore, answer choice (C) is the correct answer.**

26. The main idea of the passage is that jazz should be an important, if not the most important, part of students' music education. While the passage does mention that music education has many benefits that stretch outside of music, it never argues that the best way to educate students in general is to increase their knowledge of jazz, therefore answer choice (A) is incorrect. While we can infer that the author believes an education in jazz will provide students with benefits that can be applied to musical knowledge in general, the passage never directly focuses on this point, so answer choice (B) is incorrect. While the passage does focus on American students, this probably has to do more with the fact that the author is most likely American and that jazz is an American art form rather than an indication that jazz is more appropriate for American students versus other nationalities, therefore answer choice (D) is incorrect. The main idea of the passage is that American students would be well served by an emphasis on instruction in jazz appreciation and performance. **Therefore, answer choice (C) is the correct answer.**
27. Lines 18-20 state “Why jazz in particular? There are so many reasons, but let's start with the natural draw that jazz has with school-age children.” The word “draw” is referring to a reason that jazz would be a good choice with school-aged children so we can infer that it implies something positive or else the author would not use this as an argument for jazz. After this sentence the passage goes on to describe the characteristics of jazz that help it hook young people. Since the author believes jazz will hook young people and we know that he is talking about a positive aspect of jazz, we can infer that the word “draw” most nearly means attract. **Therefore, answer choice (D) is the correct answer.**
28. Lines 37-42 state “At the heart of jazz is improvisation. It's tough enough to get unamateur musicians to play notes *as written*; is it practical to expect them to come up with their own and have it sound less-than-awful?” The passage answers this question by saying not at first but there is no better way to train young ears than by giving them the opportunity to listen and find their own way into the musical texture. The passage goes on to ask what better and more rewarding way is there to absorb the notation of scales and other musical theory than through improvisation. These questions and answers imply that learning to improvise is most likely harder for students than just simply learning to read the music, but that learning music theory in this way is much more rewarding. **Therefore, answer choice (B) is the correct answer.**
29. Lines 29-34 state “Some jazz is reflective and thorny, and some students will respond to that, but the infectious swing of Count Basie's band and the funky vitality of Weather Report will likely gain more traction with the toe-tapping, singing qualities of the music.” We can assume the two musicians/bands mentioned in this sentence are the more “rhythmically energetic” forms of jazz based on the fact they are described as infectious, funky, and having toe-tapping qualities. We can also assume that the reflective and thorny jazz is less rhythmically energetic and the sentence implies that while some students will respond to this type of jazz, it is probably going to be a smaller number of students. **Therefore, answer choice (A) is the correct answer.**

30. We are looking for the answer choice that is NOT mentioned in the passage as a benefit of teaching students to play and appreciate jazz. Lines 64-67 state “Conversely, if you start to take it up a notch, to be -- if only for a little while -- the leader -- what a feeling when they do the same. This implies that taking the role of a leader is a benefit of jazz music, therefore answer choice (A) is incorrect. While discussing improvisation the passage says that it will give students an opportunity to listen to others and find their own way into the music. The passage also says that jazz requires an especially well-developed sense of coordination with one’s fellow musicians. Both of these statements point to the fact that in order to play jazz one would have to develop a greater sensitivity to others, therefore answer choice (C) is incorrect. Lines 73-75 state “And then there’s all that American *history* that students can learn through their study of the development of jazz.”, so answer choice (D) is incorrect. The only thing the passage does not mention as a benefit of teaching students to play and appreciate jazz music is, students will become more comfortable performing for others. **Therefore, answer choice (B) is the correct answer.**

### Passage 6

31. The primary purpose of the passage is to educate readers on the history of a secret society known as the Illuminati. While the passage does say that people today are fascinated with an understanding of the Illuminati that is different from what the group actually was, this is only mentioned briefly and not the focus of the passage, so answer choice (A) is incorrect. While the passage does show that when they were formed, the Illuminati were less influential than some people think today, the passage only focuses on the Illuminati and not other groups, so answer choice (C) is incorrect. While the passage does give a summary of the history and expansion of the Illuminati, it does not mention that they briefly controlled the inner workings of European governmental affairs, so answer choice (D) is incorrect. The main purpose of the passage is to describe the history of a secretive society that has often been described inaccurately. **Therefore, answer choice (B) is the correct answer.**
32. Lines 55-59 state “When Bavaria’s monarch, Charles Theodore was pressured by leaders of the church to bring back a more oppressive regime, this led to a swelling of the Illuminati’s ranks.” We can infer from this sentence that the reason the Illuminati’s ranks grew after Charles Theodore was pressured by the church was because the Illuminati, and the new members joining, were opposed to the actions taken by Thoeodore in response to this pressure. **Therefore, answer choice (D) is the correct answer.**
33. Lines 70-78 state “It’s unlikely that anyone today would even know the name ‘Illuminati,’ let alone ascribe all sorts of nefarious actions to the group in not for two men -- Augustin Barruel and John Robinson -- who, starting in 1797, published books that made unsubstantiated claims that the Illuminati did not die out and that the members were involved in global conspiracies.” This sentence is trying to say that the reason people ascribe all sorts of nefarious actions to the illuminati is because two men wrote a book that claimed that the Illuminati were involved in global conspiracies. If someone read that the Illuminati were involved in global conspiracies, it would

make sense for them to attribute, or assign, these nefarious actions with the Illuminati. **Therefore, assign is closest in meaning to the word “ascribe”, so answer choice (D) is the correct answer.**

34. The fifth paragraph in the passage discusses how much was made of the different membership “grades” in the Illuminati and that the “Most Supreme Superiors” were at the highest degree of membership. Lines 49-52 state “This was primarily for show, however, and Weishaupt eventually had to admit to some of the higher-ups that the “Supreme Superiors” did not even exist.” Since the passage tells us that the Supreme Superiors didn’t even exist and were only for show, we can infer that they were a fictional group invented to add to the Illuminati’s aura of mystery. **Therefore, answer choice (A) is the correct answer.**
35. The final paragraph in the passage talks about how most people wouldn’t even know the name Illuminati if it were not for two men. Lines 70-78 state “It’s unlikely that anyone today would even know the name ‘Illuminati,’ let alone ascribe all sorts of nefarious actions to the group in not for two men -- Augustin Barruel and John Robinson -- who, starting in 1797, published books that made unsubstantiated claims that the Illuminati did not die out and that the members were involved in global conspiracies.” This tells us that Augustin Barruel and John Robinson were primarily responsible for the mistaken view of the Illuminati that exists today. **Therefore, answer choice (C) is the correct answer.**
36. We are looking for the answer that was Not practiced by the Illuminati. Lines 39-44 state “As befitted a *secret society*, there were rituals and passwords and secret signs. There was even espionage, though this was directed at the Illuminati members themselves, with the spies reporting back to Weishaupt about each other’s activities.” The only thing that is not mentioned as a practice of the Illuminati in those sentences is open membership. **Therefore, answer choice (C) is the correct answer.**
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### Mathematics Achievement

1. **Answer choice (D) is the correct answer.** Factor out a 2 to get  $2(3a^3 - a^2 + 2)$ .
2. **Answer choice (B) is the correct answer.** Consecutive angles (right next to each other) in a parallelogram are supplementary which means they add up to  $180^\circ$ . Therefore, the measure of angle C equals  $180^\circ$  minus the measure of angle B:  $180^\circ - 105^\circ = 75^\circ$ .
3. **Answer choice (A) is the correct answer.** Use dimensional analysis as shown below:

$$\frac{15 \text{ pages}}{30 \text{ min}} \times \frac{1 \text{ book}}{150 \text{ pages}} \times \frac{60 \text{ min}}{1 \text{ hr}}$$

Cross out the units that show up on both the top and bottom of fractions (pages and min)

and you are left with  $\frac{15 \times 60}{30 \times 150}$  books per hour.

4. **Answer choice (A) is the correct answer.** The least common multiple of 6, 8, and 12 is 24 because 24 is divisible by 6, 8 and 12. Therefore, we can cross out choices (C) and (D). To find the least common multiple of variables, take the highest exponent for each variable: 4 for  $x$ , 5 for  $y$ , and 3 for  $z$ . Therefore, the LCM of the three terms is  $24x^4y^5z^3$ .
5. **Answer choice (D) is the correct answer.** You can simplify  $\frac{0.45}{0.3}$  by first moving the decimal point in each number to the right two times to get  $\frac{45}{30}$ . Divide the top and bottom by 15 to get  $\frac{3}{2}$  which equals 1.5, not 15. Answer choice (A) equals 15 because  $15\%$  of  $100 = 0.15 \cdot 100 = 15$ . Answer choice (B) equals 15 because  $50\%$  of  $30 = 0.5 \cdot 30 = 15$ . Answer choice (C) equals 15 because  $1.5 \div 0.1 = 15 \div 1 = 15$ .
6. **Answer choice (C) is the correct answer.** Profit = revenue – costs. Since Suzy sells each cup for \$1.50, the revenue, or money, she makes after selling  $c$  cups is  $1.50c$ . Since she paid \$35 to buy supplies, we need to subtract this from the money she makes from selling  $c$  cups to find her total profit:  $P = 1.5c - 35$ .
7. **Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of the ages of the five boys =  $8 \cdot 5 = 40$ , and the sum of the ages of the three girls =  $16 \cdot 3 = 48$ . Find the average of all 8 children by dividing the sum of their ages by 8:  $average = \frac{40 + 48}{8} = \frac{88}{8} = 11$ .
8. **Answer choice (C) is the correct answer.** To find the mean, or average, we need to divide the sum of the data points by the number of data points. If we wrote out the data points, we would have ten 0s, ten 1s, ten 2s, thirty 3s, and twenty 2s. Therefore, we have 80 total data points ( $10 + 10 + 10 + 30 + 20 = 80$ ). To find the sum of the data points, we can multiply each number in the “Number of Sports” column by the corresponding number of students and find the sum:  $0 \cdot 10 + 1 \cdot 10 + 2 \cdot 10 + 3 \cdot 30 + 4 \cdot 20 = 0 + 10 + 20 + 90 + 80 = 200$ . Divide 200 by 80 to get 2.5.
9. **Answer choice (D) is the correct answer.** If you know how to factor the given expression, you can solve the problem that way. However, if you don’t know how to factor, you can multiply out each answer choice until you find one that is equivalent to  $3a^2 - 10a - 8$ . Answer choice (A) equals  $3a^2 - 5a - 8$ , so it is incorrect. Answer choice (B) equals  $a^2 - 10a - 24$ , so it is incorrect. Answer

choice (C) equals  $3a^2 + 10a - 8$ , so it is incorrect. Answer choice (D) equals  $3a^2 - 10a - 8$ , so it is correct.

- 10. Answer choice (D) is the correct answer.** Since Lily is choosing numbers in between 0 and 9 inclusive, she has 10 numbers to choose from for the first digit of her combination. Since she cannot repeat numbers, she only has the remaining 9 numbers to choose from for the second digit of her combination. For the third digit, she only has the remaining 8 numbers to choose from. Multiply the number of options Lily has for each digit together to get that there are a total of  $10 \cdot 9 \cdot 8$  different combinations.
- 11. Answer choice (A) is the correct answer.** The  $x$ -intercepts of the graph are  $-2$  and  $4$ , so the factors of the equation are  $(x + 2)$  and  $(x - 4)$ . This eliminates answer choices (B) and (D). Since the graph *opens downwards*, the number in front should be *negative*, so this eliminates answer choice (C). We are left with answer choice (A) as the correct answer.
- 12. Answer choice (A) is the correct answer.** To find the probability of compound events, multiply the probabilities of each event. The probability of flipping a heads is  $\frac{1}{2}$  and the probability of flipping a tails is  $\frac{1}{2}$ . Therefore, the probability of flipping two heads and one tails =  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$ .
- 13. Answer choice (C) is the correct answer.** The center of the circle is the midpoint of the diameter. Therefore, find the center of the circle by finding the midpoint of the two given points. To find the midpoint, use the formula:  $midpoint = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ , where  $(x_1, y_1)$  represents the coordinates of the first point and  $(x_2, y_2)$  represents the coordinates of the second point. Plug the given points into the formula and simplify:  $\left( \frac{5 + (-7)}{2}, \frac{8 + 3}{2} \right) \rightarrow \left( \frac{-2}{2}, \frac{11}{2} \right) \rightarrow (-1, 5.5)$ .
- 14. Answer choice (A) is the correct answer.** We want the coordinates of point B, so first, reflect point B,  $(7, 2)$ , across the  $y$ -axis. When you reflect a point across the  $y$ -axis, the sign of the  $x$ -coordinate changes. Therefore,  $(7, 2)$  becomes  $(-7, 2)$ . Now translate the new coordinates of point B down 4 units by subtracting 4 from the  $y$ -coordinate to get  $(-7, -2)$ .
- 15. Answer choice (B) is the correct answer.** Since Partha drives east for 30 minutes, or half an hour, at a speed of 60 mph, he drives 30 miles east (half of  $60 = 30$ ). Since he drives south for 2 hours at a speed of 20 mph, he drives 40 miles south ( $2 \cdot 20 = 40$ ). If you draw Partha's path on a piece of paper and connect his starting and ending points, you will have a right triangle with legs measuring 30 miles and 40 miles. Find the hypotenuse, which represents the distance Partha is from his house,

by using the pythagorean theorem:  $a^2 + b^2 = c^2 \rightarrow 30^2 + 40^2 = c^2 \rightarrow 900 + 1600 = c^2 \rightarrow 2500 = c^2 \rightarrow c = 50$  miles.

- 16. Answer choice (A) is the correct answer.** The speed of a motorcycle is found by dividing the distance by the time. Therefore, we need to find a unit that measures distance per time. Answer choice (A) and (B) both measure distance per time (kilometers and inches measure distance and hours and days measure time). A motorcycle would probably travel hundreds of thousands, if not millions, of inches in a day. So it doesn't make sense to measure the speed of a motorcycle in inches per day. Therefore, kilometers per hour is the most reasonable unit to use.
- 17. Answer choice (B) is the correct answer.** To find the shaded area, we need to subtract the area of the circle from the area of the square. The equation for the area of a circle is  $A = \pi r^2$ . Plug in  $16\pi$  for  $A$  and solve for the radius of the circle:  $16\pi = \pi r^2 \rightarrow r^2 = 16 \rightarrow r = 4$ . Therefore, the radius of the circle is 4 and the diameter is 8. The diameter of the circle equals the side length of the square, so the area of the square =  $8^2 = 64$ . Therefore, the area of the shaded region =  $64 - 16\pi$ .
- 18. Answer choice (B) is the correct answer.** In order for the equation to be true, A must equal 8 and B must equal 8. Therefore,  $B - A = 8 - 8 = 0$ .
- 19. Answer choice (A) is the correct answer.** Simplify each term separately:  $2\sqrt{18} = 2\sqrt{9 \cdot 2} = 2 \cdot 3 \cdot \sqrt{2} = 6\sqrt{2}$  and  $3\sqrt{8} = 3\sqrt{4 \cdot 2} = 3 \cdot 2 \cdot \sqrt{2} = 6\sqrt{2}$ . Add the terms together:  $6\sqrt{2} + 6\sqrt{2} = 12\sqrt{2}$ .
- 20. Answer choice (C) is the correct answer.** To find the probability of compound events, multiply the probabilities of each event. The probability of choosing the first black marble is  $\frac{4}{6}$  which equals  $\frac{2}{3}$ . Since the first marble is replaced after it is chosen, the probability of choosing the second black marble is also  $\frac{2}{3}$ . Therefore, the probability of choosing two black marbles =  $\frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$ .
- 21. Answer choice (D) is the correct answer.** Choose numbers for  $x$  and  $y$  that fit the requirement. Let  $y = 100$ . Since  $x$  is 50% more than  $y$ ,  $x = 150$ . Now check each answer choice until you find one that is true. Answer choice (A) is incorrect because 50% less than  $x = x - 50\%$  of  $x = 150 - 75 = 75$ , which does not equal  $y$ . Answer choice (B) is incorrect because 100 is not one-half of 150 (half of 150 is 75). Answer choice (C) is incorrect because 100 is not one-third of 150 (one-third of 150 is 50). Answer choice (D) is correct because 100 is two-thirds of 150.
- 22. Answer choice (D) is the correct answer.** Imaginary numbers come from negatives under square, or any even, roots, so they cannot be the result when dividing two irrational numbers. You can get an integer or rational number when dividing two irrational numbers because  $\pi \div \pi = 1$  which is

rational and an integer. You can get an irrational number when dividing two irrational numbers because  $\sqrt{10} \div \sqrt{5} = \sqrt{2}$  which is irrational.

- 23. Answer choice (C) is the correct answer.** Solve the equation by first multiplying both sides by 2 to get  $n + 12 = 6 - 2n$ . Now add  $2n$  to both sides to get  $3n + 12 = 6$ . Subtract 12 from both sides to get  $3n = -6$ . Divide both sides by 3 to get  $n = -2$ .
- 24. Answer choice (C) is the correct answer.** The interquartile range of a set of data is the difference between quartile 1, Q1, and quartile 3, Q3. On a box and whisker plot, the left edge of the box represents Q1 and the right edge represents Q3. Therefore, Q1 equals 80 and Q3 equals 92. Find the interquartile range by subtracting Q1 from Q3:  $92 - 80 = 12$ .
- 25. Answer choice (D) is the correct answer.** The outlier of the data set is 70 because it is significantly larger than the other data points. If we remove 70, the mode of the data set is still 40 (the mode of a data set is the number that appears the most). Therefore, the mode changes the least.
- 26. Answer choice (C) is the correct answer.** Since the three angles form a straight line, they add up to  $180^\circ$ . Therefore  $x + y + 65 = 180$ . Subtract 65 from both sides to get  $x + y = 115$ .
- 27. Answer choice (B) is the correct answer.** The average of a set of numbers equals the sum of the numbers divided by the number of terms:  $average = \frac{sum}{number\ of\ terms}$ . Rearrange the equation to get  $sum = (average) \cdot (number\ of\ terms)$ . Therefore, the sum of the 6 items =  $6 \cdot 19 = 114$ . Find the sum of the shirt and backpack by subtracting the cost of the other four items from the total sum:  $\$114 - \$14 - \$35 - \$7 - \$12 = \$46$ .
- 28. Answer choice (D) is the correct answer.** To make a fraction 0, the numerator must equal 0 without the denominator equaling 0. If we set the numerator equal to 0, we get  $x + 3 = 0$ . Solve this equation to get  $x = -3$ . However, if you plug  $-3$  into the denominator, it also equals 0:  $9 - (-3)^2 = 9 - 9 = 0$ . Therefore,  $-3$  does not make the equation true, so there are no values of  $x$  that make the equation true.
- 29. Answer choice (A) is the correct answer.** First divide 1.5 by 3 to get 0.5. Then divide  $10^{-5}$  by  $10^3$  by subtracting the exponents to get  $10^{-8}$ . Multiply the two results together to get  $0.5 \times 10^{-8}$ . This is not in scientific notation because 0.5 is not in between 1 and 10, so change  $0.5 \times 10^{-8}$  into scientific notation to get  $5 \times 10^{-9}$ .
- 30. Answer choice (A) is the correct answer.** The  $\sqrt{16} = 4$  because  $4^2 = 16$ . Therefore, we can cross out answer choices (C) and (D). To find the square root of variables raised to even exponents, cut the exponents in half. Therefore,  $\sqrt{x^{64} y^{36}} = x^{32} y^{18}$ . Multiply the two results together to get an answer of  $4x^{32} y^{18}$ .

- 31. Answer choice (C) is the correct answer.** The fraction of people who chose comedy is  $\frac{12}{60}$  which equals  $\frac{1}{5}$ . The central angles of the portions of a circle graph add up to  $360^\circ$ , so find  $\frac{1}{5}$  of  $360^\circ$ :  $\frac{1}{5} \cdot 360^\circ = 72^\circ$ .
- 32. Answer choice (B) is the correct answer.** Let  $x$  represent the number of gift bags Liam can make in one minute. Since Aidan can make gift bags 3 times as fast as Liam, Aidan can make  $3x$  gift bags in one minute. Set the number of gift bags Liam and Aidan can make in one minute equal to 24 and solve for  $x$ :  $x + 3x = 24 \rightarrow 4x = 24 \rightarrow x = 6$ . Therefore, Liam can make 6 gift bags in one minute, so he can make 12 gift bags in two minutes.
- 33. Answer choice (C) is the correct answer.** Find the height of the orange after 1 second by plugging in 1 for  $t$  in the original equation and simplifying:  $h = -16(1)^2 + 20(1) + 5 \rightarrow h = -16 + 20 + 5 \rightarrow h = 9$  ft.
- 34. Answer choice (B) is the correct answer.** Since the hexagon is regular, all of the sides are congruent. Set the two given side lengths equal to each other and solve for  $x$ :  $3x = 5x - 4 \rightarrow -2x = -4 \rightarrow x = 2$ .
- 35. Answer choice (B) is the correct answer.** To subtract two vectors, subtract the components of the vectors:  $\langle 2, -7 \rangle - \langle 5, -3 \rangle = \langle 2 - 5, -7 - (-3) \rangle = \langle -3, -4 \rangle$ .
- 36. Answer choice (B) is the correct answer.** In order for both sides of the equation to be equal,  $z$  must be 4. If you plug in 4 for  $z$ , you get  $4x + 8y = 4x + 2(4)y$ . Simplify the right sides to get  $4x + 8y = 4x + 8y$ .
- 37. Answer choice (B) is the correct answer.** The average of two numbers equals the sum divided by two. Therefore, the average of the bases of the trapezoid equals  $\frac{b_1 + b_2}{2}$ , so we can plug in 6 for  $\frac{b_1 + b_2}{2}$  in the original equation and 2 for the height to find the area of the trapezoid:  $A = h \left( \frac{b_1 + b_2}{2} \right) \rightarrow A = 2 \cdot 6 = 12$  square feet.
- 38. Answer choice (D) is the correct answer.** The fact that Luna hit an even number does not affect our probability. We only want to find the probability that Chris hit an even number. There are 4

even numbers out of 8 total numbers on the dartboard, so the probability that Chris hit an even number equals  $\frac{4}{8}$  which equals  $\frac{1}{2}$ .

- 39. Answer choice (A) is the correct answer.** Solve the inequality by first dividing both sides by  $\frac{2}{3}$  which is the same as multiplying both sides by  $\frac{3}{2}$  to get  $|x + 2| < 9$ . Now set  $x + 2$  less than 9 and greater than  $-9$  and solve each inequality. If  $x + 2 < 9$ , then  $x < 7$ . If  $x + 2 > -9$ , then  $x > -11$ . Therefore,  $-11 < x < 7$ .
- 40. Answer choice (A) is the correct answer.** Since lines  $m$  and  $n$  are parallel, they have the same slope. Find the slope of line  $n$  by using the slope formula and the points  $(1, -1)$  and  $(0, 2)$  from the graph:  $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-1)}{0 - 1} = \frac{3}{-1} = -3$ .
- 41. Answer choice (B) is the correct answer.** Plug in  $9\pi$  for  $V$  and 2 for  $r$  in the original equation and solve for  $h$ :  $9\pi = \frac{1}{3}\pi(3^2)h \rightarrow 9\pi = 3\pi h \rightarrow h = 3$  in.
- 42. Answer choice (C) is the correct answer.** Multiply  $(4 + i)(4 - i)$  to get  $16 - i^2$ . Since  $i^2 = -1$ , plug in  $-1$  for  $i^2$  and simplify:  $16 - (-1) = 16 + 1 = 17$ .
- 43. Answer choice (B) is the correct answer.** Using SOHCAHTOA, we know that  $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ . Therefore,  $\cos(C) = \frac{BC}{AC}$ . Plug in  $\frac{5}{13}$  for  $\cos(C)$  and 5 for BC and solve for AC:  $\frac{5}{13} = \frac{5}{AC} \rightarrow 65 = 5(AC) \rightarrow AC = 13$ . Find  $AB$  using the pythagorean theorem:  $a^2 + b^2 + c^2 \rightarrow (AB)^2 + 5^2 = 13^2 \rightarrow (AB)^2 + 25 = 169 \rightarrow (AB)^2 = 144 \rightarrow AB = 12$ .
- 44. Answer choice (C) is the correct answer.** There are 7 shaded grid squares, so multiply the area of one grid square by 7 to find the shaded area:  $4 \cdot 7 = 28 \text{ mm}^2$ .
- 45. Answer choice (A) is the correct answer.** Isolate the  $x$  in the given inequality by first subtracting 4 from all three parts to get  $-6 < -x \leq 3$ . Now divide each part by  $-1$ , remembering to flip the inequality signs, to get  $6 > x \geq -3$  or  $-3 \leq x < 6$ . To graph this inequality, we want a closed circle at  $-3$  because  $x$  can equal  $-3$  and an open circle at 6 because  $x$  cannot equal 6. Since  $x$  is in between  $-3$  and 6, we want a line connecting the dots at  $-3$  and 6. Therefore, graph (A) is the correct answer.
- 46. Answer choice (C) is the correct answer.** Triangle CED is similar to triangle CBA because their corresponding angles are congruent. Therefore, we can set up the proportion  $\frac{DC}{AC} = \frac{EC}{BC}$ . Since AD

equals 5 and DC equals 10, AC equals 15. Plug in 10 for DC, 15 for AC, and 12 for EC and solve the proportion for BC:  $\frac{10}{15} = \frac{12}{BC} \rightarrow 180 = 10(BC) \rightarrow BC = 18$  in.

**47. Answer choice (B) is the correct answer.** Using the best fit line, the total cost of taking 20 classes is \$550. Find the average cost of each class by dividing \$550 by 20 to get \$27.50.