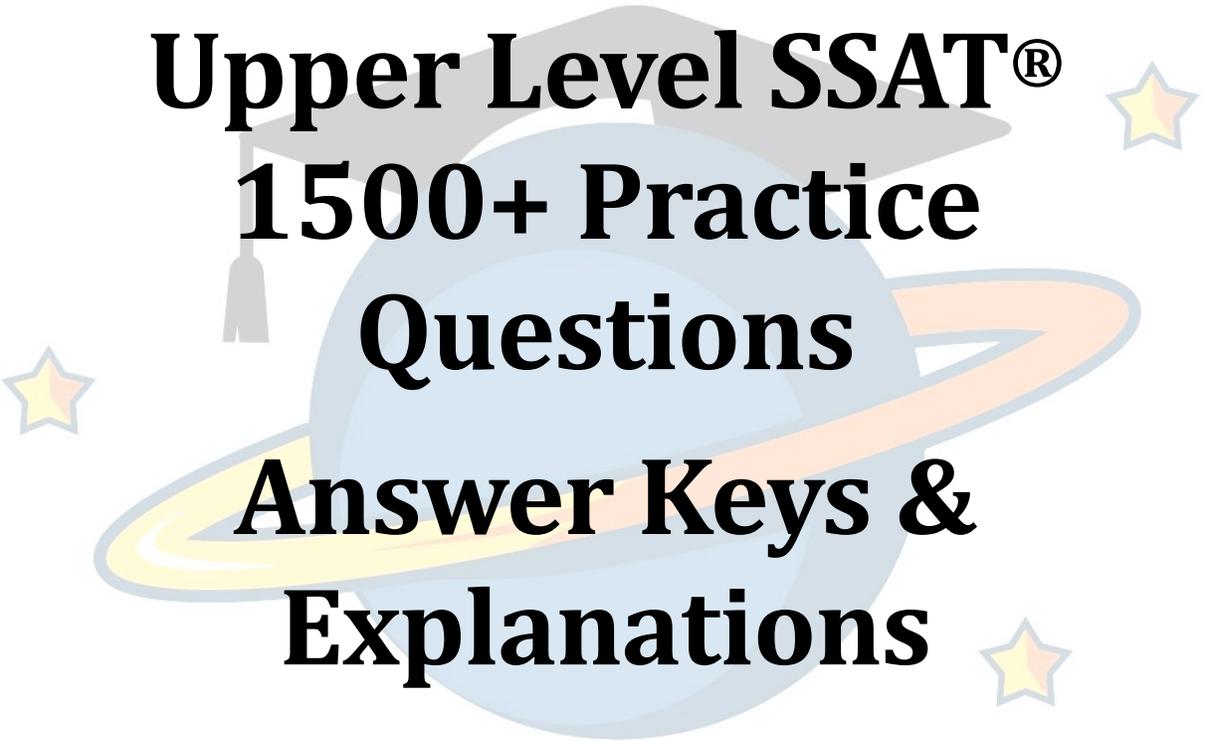


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**Upper Level SSAT®**  
**1500+ Practice**  
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**Answer Keys &**  
**Explanations**

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# Diagnostic Practice Test (Form A)

## Section 1 – Quantitative

1. D. *Numbers – Fractions*. Convert all the fractions to have the lowest common denominator, which is 15.  $10 \frac{3}{15} + 6 \frac{5}{15} - 3 \frac{7}{15} = 13 \frac{1}{15}$ .
2. C. *Geometry & Measurements – Perimeter, Area, & Volume*. The hash marks show that the triangle is equilateral, so each side is 12. We can split any equilateral triangle down the middle into two congruent right triangles. Here, each right triangle has a base of 6 and a hypotenuse of 12. We can use the Pythagorean Theorem to find the height, which is  $6\sqrt{3}$ , so the area of the entire triangle is  $\frac{1}{2}(12)(6\sqrt{3}) = 36\sqrt{3}$ .
3. B. *Numbers – Percents*. We can find the number by applying the formula for percent:  $12 = 0.25x$ .  $x = 48$ . 70% of 48 is equal to  $0.7(48) = 33.6$ .
4. C. *Data Analysis & Probability – Reading Charts & Graphs*. The sum of the amounts of money in the account each year is  $12,000 + 10,000 + 22,000 + 21,000 + 18,000 = 83,000$ . The sum divided by the number of years is  $83,000 \div 5 = 16,600$ , which, rounded to the nearest thousand, is 17,000.
5. D. *Geometry & Measurements – Problems using Shapes & Angles*. The triangle inequality theorem states that a side of a triangle has to be less than the sum of the other two sides, or  $|a - b| < c < a + b$ . This is only correct for  $4 + 6 > 8$ ,  $6 + 8 > 4$ , and  $4 + 8 > 6$ .
6. D. *Data Analysis & Probability – Mean, Median, Mode*. Of the prices given, the mode is \$15,000. The complete number set, in ascending order, is  $\{9,000, 12,000, 13,000, 15,000, 15,000, 15,000\}$ . The numbers that are in the middle of this set are \$13,000 and \$15,000; to find the median, add these 2 numbers and divide by 2.  $\frac{13,000 + 15,000}{2} = 14,000$ .
7. E. *Algebra – Interpreting Variables*. Each month, Joe's plant grows by 13%, which means 0.13 times its height is added each month. The plant always has its original height, which is represented by 100%, or 1. Therefore, to find the plant's height after  $h$  months, multiply the height by 1.13 times itself  $h$  times.
8. E. *Algebra – Word Problems*. This scenario can be represented by the equation  $s(6 - 2) = 300$ .  $4s = 300$ , so  $x = 75$ . In context, John will have to sell no fewer than 75 sandwiches to make \$300.
9. C. *Numbers – Estimation*.  $\frac{503}{663}$  is close to  $\frac{500}{700}$ , which is 71.4% (simply divide 5 by 7). This is closest to 75%.
10. A. *Algebra – Interpreting Variables*. Simon's cards are represented by  $x$ ; since Julie has two times as many, she has  $2x$  cards.
11. B. *Algebra – Ratios & Proportions*. We will solve by using a proportion. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{chaperones}}{\text{students}}$ . Next set up your proportion:  $\frac{3}{20} = \frac{12}{x}$ . Find the cross products:  $3 \times x = 20 \times 12$ . Then, simplify:  $3x = 240$ , and solve:  $x = 80$  students. There were  $80 - 12 = 68$  more students than chaperones.
12. D. *Numbers – Unit Analysis*. There are 176 pints of rice per bag ( $22 \times 8 = 176$ ).  $176 \text{ pints} \times 35 \text{ bags} = 6,160$  pints.
13. D. *Algebra – Quadratic Equations*. For the product to be equal to 0, either  $3x$  or  $x - 5$  must be equal to 0. So, the only one of the answer choices that will work in the equation is 5.
14. A. *Algebra – Linear Equations*. Distribute 5 over  $(x + 2.4)$  which yields  $5x + 2.4 = 5x + 12$ . Subtract  $5x$  from both sides of the equation which will result in  $2.4 = 12$ . This is a false statement since  $2.4 \neq 12$ . Hence, there is no solution or 0 solutions.
15. A. *Algebra – Inequalities*. To solve the inequality, or find its possible solutions, multiply both sides of the inequality by 3.
16. A. *Geometry & Measurements – Pythagorean Theorem*. The area of each square is the length of one side squared ( $s^2$ ). Based on the information given in the problem, we know from the Pythagorean Theorem that  $a^2 + b^2 = 64 + 17$ . Therefore,  $c^2 = 81$ . Since  $c^2 = x^2$ ,  $x^2 = 81$  and  $x = 9$ .
17. E. *Numbers – Sequences, Patterns, Logic*. 100 is evenly divisible by 7 only 14 times. This means that we can get from 100 down  $14 \times 7 = 98$  places, to 2, before going negative.  $2 - 7 = -5$ .
18. B. *Algebra – Factoring*. All three terms have a common factor of  $x^2$ , so that can be factored out to yield  $x^2(x^2 - x - 6)$ . Find factors of 6 that add to 1:  $2 \times 3 = 6$  and  $2 + -3 = -1$ , so the equivalent expression is  $x^2(x + 2)(x - 3)$ . You can multiply the factors to check your answer.
19. B. *Data Analysis & Probability – Counting Principle*. Amanda and Danielle must sit next to each other in seats 1-2, 2-3, or 3-4. That is three possibilities, leaving two seats open for the other two girls. That looks like there would be six possibilities, since  $3(2)(1) = 6$ . However, Amanda and Danielle can change their positions when they are seated next to each other, so the answer is  $6(2) = 12$ .

20. B. *Algebra – Rational Expressions*. The numerators can be multiplied to yield  $2 \times 3 = 6$ . The denominators can be multiplied as well:  $(x + 3)(x + 5)$ . Use the distributive property:  $x^2 + 5x + 3x + 15 = x^2 + 8x + 15$ . So this expression is equivalent to  $\frac{6}{x^2 + 8x + 15}$ .
21. C. *Algebra – Scientific Notation*.  $8.7 \times 3 = 26.1$ , therefore  $(8.7 \times 10^3) \times 3 = 26.1 \times 10^3$ . Convert this into proper scientific notation by moving the decimal 1 place to the left, which increases the power by 1.
22. C. *Algebra – Linear Equations*. Convert the equation given into form  $y = mx + b$ . In this case, the equation becomes  $2y = -3x + 10$ . Divide both sides by 2 for  $y = -\frac{3}{2}x + 10$ . A line perpendicular to this one is the negative reciprocal, which makes the answer  $\frac{2}{3}$ .
23. B. *Data Analysis & Probability – Probability*. There are 20 candies in total in the box. The probability of selecting a cherry candy is the number of cherry candies, divided by the total ( $\frac{4}{20} = \frac{1}{5}$ ). The first candy has not been replaced, and so now there are 19 candies left in the box. The probability of selecting a green apple out of these is now  $\frac{5}{19}$ . To find the probability of these two events both occurring, multiply the two probabilities together.  $\frac{1}{5} \times \frac{5}{19} = \frac{1}{19}$ .
24. C. *Algebra – Polynomial Expressions*. Use the distributive property to multiply. Each term in the first polynomial needs to be multiplied by each term in the second, which yields:  $x^3 + 3x^2 + 2x + 5x^2 + 15x + 10$ . Then combine like terms:  $x^3 + 8x^2 + 17x + 10$ .
25. E. *Geometry & Measurements – Spatial Reasoning*. There are 4 squares each shaped by 4 triangles, and 1 outer square that is the whole figure. There is 1 large square in the center (which is filled to look like a diamond), and there are 4 smaller squares (also tilted) each shaped by 2 triangles within this large square.

## Section 2 – Reading

1. E. *Tone/Mood/Style*. The author describes a lazy afternoon spent admiring his surroundings while on a boat. He paints a tranquil scene. There is no language that would imply this the mood is annoyed. While the mood is positive, the author is too laid-back for the mood to be described as amused. Melancholy would imply sadness, which is not a feature of the poem. Restlessness would have the speaker moving around – quite the opposite of his lazy day on a boat.
2. B. *Detail*. The stream is so calm that there's not a ripple. Bubbles would produce ripples, which contradicts the initial clause in the line. We don't know the temperature, so cold is not an option. The pool is filled with water, but the fact that the author contrasts "placid" with "no ripple stirs" tells us the word has to do with movement.
3. D. *Tone/Mood/Style*. In this phrase, the sky is granted human agency, as shown by the verb "gives." This is an example of personification. Metonymy is substitution of an attribute of a thing for the thing itself – "suits" for "business executives." Simile is a comparison using "like" or "as." Parallelism has to do with sentence structure. Meter is a way of measuring syllables in poetry.
4. E. *Inference*. The natural beauty described by the author is the world's wide wealth, and it's free for the author to appreciate. We don't know how skilled the author is as a fisherman. There's nothing to suggest he will be receiving an inheritance. The sky is described as divine, but the wealth is not particularly connected to the sky, nor is the sky likened to precious gems.
5. B. *Main Idea*. The author describes his beautiful experience of nature while relaxing in a boat. The author neglects his fishing. He compares looking at nature to being wealthy, but is not primarily concerned with wealth. He is not promoting an opinion, but instead is documenting his surroundings. While he does document different types of wildlife, he is more concerned with the beauty of the wildlife and general scenery.
6. C. *Detail*. The passage states that Traylor was "aided by Shannon's professional networks," which allowed him to exhibit his art in "museums throughout the country."
7. A. *Tone/Mood/Style*. The author's tone remains light-hearted throughout the passage, and the descriptions of Traylor are full of admiration. The passage does not question, analyze, or criticize.
8. E. *Detail*. Traylor's work was initially considered to be an "exemplar," or example, of "folk art." In this context, "exemplar" most nearly means "representation."
9. B. *Inference*. The passage states that, "Now, however, the artist's works are deemed to fit squarely within the canon of contemporary, twentieth-century American art." This suggests that today's audiences admire his work and believe it to fit in the time period.

10. A. *Main Idea*. The passage covers Traylor's early life as a sharecropper and his artistic immersion later in life. While the passage does mention Shannon and some art trends, it does so in context of Traylor's life and accomplishments.
11. D. *Detail*. In context, cacophony is used to describe the harsh mixture of sounds produced by noises reflected on a city street. Racket is the word that best describes this phenomenon.
12. E. *Inference*. The author explains that softer surfaces will reflect fewer vibrations than harder ones, like stone or metal. The snow has the effect of absorbing some, but not all of the sound waves. A stone or piece of metal would probably reflect all of the ripple, while a speck of dust or small feather none. A sheet of cloth would absorb some, but not all of the ripple.
13. C. *Main Idea*. The author mentions a cold winter's day, how ripples spread across water, and how the brain process sounds, as well as the way echoes are created, in order to explain why things seem more quiet in the snow.
14. E. *Tone/Mood/Style*. The purpose of the passage is to tell more about why something happens. This is most similar to what happens in a science textbook. This is not a creative or fictional work, neither does it describe a particular event or occurrence.
15. E. *Detail*. While the reflective quality of air may contribute to noise levels, it is not addressed by the author of the passage. The author claims that the hardness of exposed surfaces, people, the presence of porous materials, and the number of reflective surfaces all contribute to noise levels.
16. E. *Detail*. The narrator describes various sights that lead the boy to "gulp" and "look brave." All of these represent novel experiences of independence and life in a big city. The boy's inexperience is revealed by these things, but is not the thing that strikes him. The author goes on later to discuss his age/perspective.
17. C. *Inference*. The narrator is overcome with emotion as he recalls his own experiences and empathizes with the boy's experiences. The narrator opens a coconut in the past, not in the present. There is no evidence that the narrator has a child. The narrator is a passenger, not the driver. The boy is said to not be crying.
18. D. *Main Idea*. The narrator describes the boy as inexperienced ("he'd set foot on London stones for the first time") and naïve ("tried to look brave"). He then mentions how "it's the young that [he pities]" because they are "set toward the road along which we have travelled, that trouble me". He mentions that he pities his own coming-of-age experience. While the flowers are a powerful symbol of innocence, this is not the main sentiment, as it is the tragedy of the loss of this innocence that is unavoidable.
19. C. *Tone/Mood/Style*. Hyperbole is the use of exaggeration, not meant to be taken literally, to emphasize a point. In this case, the narrator cannot literally give worlds, but uses the expression to emphasize how much he wanted to speak to the boy. The other answer choices contain other examples of figurative language, or are not figurative language at all.
20. E. *Inference*. The coconut story is one of youthful hope that gets dashed by reality. The young narrator hopes the coconut will be sweet, but it turns out to be sour. The fact that he remembers this 65 years later tells us that this memory has not faded, but is still as powerful as ever. This strengthens the narrator as a character, not weakens.
21. D. *Tone/Mood/Style*. The question asks how the narrator feels when he recounts his experience; it does not ask how his younger self felt at the time. While the younger self felt at one point determined and hopeful, this is not how his present self feels. The narrator feels nothing but negative emotions when he recalls this story, ruling out "optimistic," "gleeful," "satisfied," and "determined." The only choice with two negative emotions is "melancholy" and "bitter."
22. A. *Tone/Mood/Style*. The passage passionately advocates for the removal of DST while using fairly informal language throughout. The passage cannot be considered to be "passive," "ambivalent," "abstract," or "theoretical" since the author argues strongly for one point of view and uses specific examples.
23. D. *Inference*. The "tradition" and "practice" here is that of changing the time. The author argues strongly that people should no longer do so because the purpose of doing so (saving energy) has been shown to be invalid. The author relies heavily on the case study in Indiana in coming to this conclusion, and does not believe that increasing daylight is more or less important than saving energy. The author believes that what was done in the past might not be useful in the present.
24. E. *Inference*. The passage indicates that DST was used as a conservation effort during World War I, helping to conserve resources used for artificial light. Answer "C" is incorrect because there is no evidence to suggest that artificial light was used as a weapon. Electricity is a resource used to produce light, that would have been used on other things.
25. C. *Detail*. The study showed that while electricity was saved on lighting, these gains were canceled out due to the electricity used for heating and cooling.

26. A. *Main Idea*. The author here is arguing against something that is happening around her. She is protesting the character assassinations, and chastising her peers for accepting their existence. This is not a warning, or even a valuable lesson or moral. There is no personal story here (though the author does appeal to individual experience).
27. D. *Detail*. The issue is that of character assassination of those who have different beliefs (last paragraph). Trial by jury and criminal prosecution are referred to as proper. The behavior is not called illegal – in fact, the author draws a comparison with a legal trial (by jury) and extralegal (by accusation). The author mentions the Constitution as amended, but not in the context of making amendments; only in interpreting what the amendments say.
28. B. *Detail*. The rights enumerated by the author include the right to criticize, hold unpopular beliefs, protest, and form independent thought.
29. D. *Detail*. The author never says that the respect is decreasing because parties cannot agree, or that citizens disagree with laws. There is no mention of overseas conflict, and the Constitution is not referred to as “weakening.” Instead, the author states that it is because of the actions of senators that “debase” the forum.
30. C. *Main Idea*. The author uses information to convince the reader to take action. The final line of the passage hints at this purpose. The author does not refute a counterargument, and while he does admonish certain parties, this is not the primary purpose of the passage.
31. E. *Detail*. The author explains that climate change causes a decrease in resources (food and water) and escalates violence and tensions, also leading to terrorism. This affects the United States, as do superstorms. The government’s point of view is made known. What is not is what specifically can be done to fight climate change.
32. B. *Tone/Mood/Style*. The word “yet” gives us a clue that the feels that Congress’ refusal to “act on this issue” is negative. Thus, we can rule out the positive answer choices. Since the author does not agree with Congress’ lack of action, he is likely critical of it.
33. B. *Tone/Mood/Style*. The writer is very passionate about the topic, and writes in a forceful way. He does so directly, listing his point of view and supporting it with detailed information. He does not use euphemisms (substituting words for another: for example, “downsizing” for “job cuts”). He does not use flowery or excessive language.
34. E. *Detail*. In the 4<sup>th</sup> paragraph, the author writes how the Department of Defense and Pentagon as well as CIA and Department of State recognize climate change as a serious problem. He glosses over the fact that scientists and policymakers have sounded the alarm. Congress did not declare climate change to be a national security challenge. It is climate change that worsens violence and instability, not the other way around.
35. C. *Main Idea*. The author never mentions the causes of climate change. He mentions that something can be done, so presumably, the negative consequences are not inevitable. The author does not say that the country should spend less on humanitarian aid, only that it costs more. Similarly, the author states that people are being displaced, but doesn’t state that more money should be spent. Instead, the author implies that we should address the root problem, which is climate change.
36. C. *Detail*. The following sentence give us the answer: the “object of our quest” had been forgotten, and the sudden reminder made him recall that fact.
37. B. *Detail*. From context, we can tell that the narrator’s interest is very intense, or keen. This is the opposite of dull, and not the same as neutral. The interest itself is not clever or intelligent, though that is a different meaning of the word in question.
38. E. *Tone/Mood/Style*. The passage builds in tension and excitement. While we learn about the narrator’s thoughts, the mood is not one of deep thought or foreboding or anger or wistfulness. Instead, it is one of pure excitement.
39. D. *Inference*. The metaphor tells us that Sandy is intensely looking at something and that it consumes all of her attention and energy. There’s no evidence to say that she was angry. She was not ambushed, but rather was the one doing the creeping.
40. A. *Inference*. Creeping, ambushing, and whispering are characteristics of one who wishes to remain unnoticed. This is the opposite of one who cannot contain himself, since such a person would be loud and otherwise conspicuous. We don’t know why the two characters want to find the ogres. The two do not want to avoid the ogres, since that is the stated mission of their quest.

## Section 3 – Verbal

1. E. The “a” prefix means “not” or “without,” so “atypical” means “not typical.” The word “strange” also carries the connotation of something being not normal.

2. B. A professional is someone who is very good at doing something. Said differently, the person is very skilled at doing that thing. The person may or may not be honest, and the thing being done may or may not be part of a ceremony. "Rudimentary" would be the opposite of this meaning.
3. B. To "justify" something means to support it, as in a defense. "Prop up" most closely resembles this notion of defending something. A judge decides whether something or not is justified.
4. A. To be "vehement" is to be impassioned. "Passionate" best captures this meaning.
5. C. "Technique" describes a specific manner of doing something. While "tool" is too specific, "method" also denotes a specific approach to completing a task.
6. D. A "nuisance" is something that is annoying. A "misbehaving child" is an *example* of a nuisance, whereas "irritating circumstance" is an actual definition.
7. A. Something that is "authentic" is real, or the opposite of artificial. "Genuine" also means real. An autograph may be genuine, or it may be forged.
8. B. "Literal" is used to describe things as they come in their precise, original, most basic form. "Exact," which means accurate or precise, is the best answer.
9. B. To "predict" an event is to attempt to anticipate a future outcome. When we "forecast" something, we are similarly trying to determine a future event. This meaning is often used when talking about the weather, as in a "weather forecast." Note the prefixes "pre-" and "fore" both describe things that come before. In this case, a "prediction" is made before something is known.
10. D. When something varies, it is different than the norm. "Difference" is thus the best synonym for "variation." "Peculiarity" may seem right, but something that is peculiar is not necessarily different.
11. B. To "abdicate" is to relinquish one's control. "Give up" captures the notion of releasing one's hold over something.
12. C. "Diplomacy" describes the art of dealing with others sensitively. It is often used to describe the attempt by different nations to find common ground. "Tactful behavior," or smart, thoughtful behavior, best captures this meaning. One may receive immunity if one is a diplomat, but this isn't the same thing as the noun "diplomacy."
13. D. Philanthropy is the act of helping those who are less fortunate, usually through donations. Note that "anthro" is a root word that pertains to people, which may help in this case. "Philanthropic" is thus best paired with "helpful."
14. A. To "usurp" is to take away forcefully. To seize something is to forcibly take something away, so "seize from" is our best answer.
15. B. A "quarantine" is often used to separate something for the surrounding environment. "Isolate" also denotes this kind of separation from others.
16. E. "Intermittent" means infrequent. Taken another way, "intermittent" means happening without much regularity, so "irregular" is the best answer. "Inter-" means "between," and something intermittent happens in between other things.
17. A. "Reparation" derives from repair, which is to fix. "Amends" are helpful actions meant to compensate for an injury, making this word a synonym for "reparation."
18. D. We usually use the word "embargo" when describing prohibitions on certain goods and services. To "restrict" is to block, thus making it a match with "embargo."
19. B. A "reprieve" is a postponement or cancellation of a negative experience. "Rest" similarly implies a moment of calm from trying circumstances.
20. C. "Erratic" describes behavior that is irregular and/or unpredictable. "Fitful" also denotes this type of irregularity.
21. E. The prefix "an-" means "not" (think "anti" or "antagonist"). These have negative connotations, which would eliminate the first several choices.
22. B. To laud something is to applaud or celebrate it. Something "laudable" can thus also be described as "praiseworthy."
23. A. An "astute" observation or comment is marked by its clever, or smart insights. "Intelligent," which means quick understanding, is the best answer.
24. A. "Belie" has the word "lie" in it, which means to make a false statement, or to be in opposition to the truth. Using this information, we can deduce that "contradict" is our best answer.
25. C. Someone who is "diffident" is marked by their shyness. To be "reserved" is to be quiet and withdrawn, making it the ideal synonym.
26. C. Someone who is facetious is thought of as foolish or silly, which is the opposite of someone thoughtful or productive. The word has a slightly negative connotation, but not as negative as "atrocious." It does not have quite the positive connotation as "prodigious."

27. A. "Remuneration" is money that is paid for a service. "Compensation" is also money given to someone for a rendered service, so "fair compensation" would mean money commensurate with the service provided.
28. B. "Blatant" means being clear or explicit. "Obvious" also means being evident or easily recognized and is thus the best choice.
29. C. "Blithe" has the word "lithe" in it, which means flexible. "Agile," however, is not a perfect synonym. "Carefree" is a better synonym because it captures the untroubled nature of someone who is flexible.
30. C. Someone who is "obstreperous" resists control or acts in a disorderly manner. "Disruptive" also means unruly or unable to be regulated.
31. B. Gaunt is the opposite of plump, so this is an antonym analogy. Abundant, which means plentiful, is the opposite of scarce, which means limited.
32. E. Plastic is associated with wraps (think "plastic wrap"), so this is an association analogy. Glass is associated with ceilings (consider the phrase "glass ceiling").
33. D. A spark causes an inferno, so this is a cause/effect analogy. A boat creates a wake in the water.
34. E. Innovate (to improve something) is the opposite of copy (to duplicate exactly), so this is an antonym analogy. To refute, which means to deny, is the opposite of confirm.
35. A. An illness is caused by a virus, so this is a cause/effect analogy. A fan causes a breeze.
36. A. A student learns a lesson, so this is a defining analogy. A dog learns a trick, which fits the defining analogy structure.
37. A. A doctor uses a scalpel (a surgical tool), so this is an individual/object analogy. A lumberjack uses a chainsaw. Note that we may not know what a phlebotomist is, but we know that the suffix "-ist" means "person," whereas the stem question describes the relationship between a person and object.
38. E. Furious is a more extreme degree of angry, so this is a degree/intensity analogy. Elated, which means extremely joyful, is a stronger form of happy.
39. A. Forth and back are associated (think "back and forth"), so this is an association analogy. Fro is associated with "to" when we consider the phrase "to and fro."
40. B. Genocide, which is murder on a wide scale, is a more extreme version of murder, so this is a degree/intensity analogy. Obliterate is a more extreme version of remove.
41. A. The function of a balloon is to float, so this is a function/object analogy. A vehicle's primary function is to transport. A sailboat is piloted by a sailor. Notice that police and crime are both nouns.
42. A. An accountant uses a calculator, so this is an individual/object analogy. Telemarketers use phones to conduct business.
43. D. A bed is used for sleep, so this is a function/object analogy. A newspaper is used to inform readers of happenings around the world.
44. C. One grows a beard, so this is a noun/verb analogy. You draw a picture. Notice that buoys do float, but that the order is reverse when compared with the question stem.
45. E. An usher takes a ticket, so this is a defining analogy. Cashiers also "take" money.
46. C. An orator is one who speaks, so this is a noun/verb analogy. A maligner is one who makes damaging comments, or who slanders others.
47. E. Forgotten is the past participle of forget, so this is a tense analogy. Given is the past participle of give. Other answers are incorrect because they have a past tense relationship, not a past participle relationship.
48. B. A shingle makes up a roof, so this is a whole/part analogy, where the order of the word pair matters. An episode makes up a show.
49. D. Lettuce makes up a salad, so this is a part/whole analogy, where the order of the word pair matters. Many crumbs make up a loaf bread. A peel, while part of a banana, does not *make up* the banana.
50. C. A wrench is used on a pipe, so this is a purpose/object relationship. A quill is used *on* parchment. A plunger is used *to unclog*, not *on an unclog* (notice that we are seeking a noun-to-noun relationship, not a noun-to-verb relationship).
51. E. A number is part of an equation, so this is a whole/part analogy. The numerator is part of a fraction.
52. C. Palpable is similar in meaning to apparent, so this is a synonym analogy. Dubious is synonymous with doubtful.
53. D. A locomotive is a type of vehicle, so this is a type/kind analogy. Influenza is a type of malady.
54. A. Shampoo is used to clean the hair, so this is a purpose/object analogy. Soap is used to clean the body.
55. D. Translucent, meaning "clear", is the opposite of opaque, meaning "muddy" or "obscure", so this is an antonym analogy. Wonderful is opposite in meaning to unconscionable, which means "horrifying."
56. C. An undertaker, or funeral director, handles caskets in a funeral, so this is an individual/object analogy. An executioner handles guillotines, which are used in executions.

57. D. Protract, which means “to lengthen”, is similar in meaning to extend, so this is a synonym analogy. Surrender is synonymous with succumb, which means “to give up.”
58. D. A crop is the result of farming and is often used with the word “bumper” to describe a big harvest (a “bumper crop”). Condiments are used on buns, but only “hotdog bun” creates a commonly used phrase like the question stem.
59. C. An enormous number of threads make up a cloth, so this is a part/whole analogy. A large number of cells makes up an organ. Note that magazine and page are not in the proper order; a magazine is the whole, while the pages are the part. The best choice preserves the order from the question stem.
60. C. Obey is the infinitive form of the word obeys, which is in the present tense, so this is a tense analogy. Invent is the infinitive form of the word invents, which is in the present tense.

## Section 4 – Quantitative

1. C. *Numbers – Percents*. The pants begin at 100%. If the pants are discounted 30%, they cost 70% of the original price. When they go on sale further, then they are 70% of 70% of the original price. So, the pants now cost 49% of the original price.
2. A. *Algebra – Word Problems*. The time, in seconds, after the ball was launched is the value of  $x$  at the maximum height, or the value of  $x$  at the vertex of the parabola that represents the function. Recall that a quadratic function has the format  $ax^2 + bx + c$ . The value of  $x$  at the vertex of the parabola is equal to  $-\frac{b}{2a}$ , or in this case  $-\frac{6}{2(-3)} = 1$ .
3. B. *Geometry & Measurements – Perimeter, Area, & Volume*. If the area of the circle is  $16\pi$ , then its radius must be 4 and its diameter must be 8, so its circumference is  $8\pi$ .
4. E. *Numbers – Integers*.  $-64 - 18 = -82$ , and  $-82 - 80 = -162$ .
5. A. *Algebra – Common Factor*. The GCF of 48, 24, and 30 is 6. The GCF of  $m^4$ ,  $m^8$ , and  $m^6$  is  $m^4$ . Therefore, the GCF for all three expressions is  $6m^4$ .
6. D. *Numbers – Place Value*. The largest odd number that can be formed from these digits is 86,207. 2 is in the hundreds place of this number.
7. B. *Algebra – Exponential Expressions*. It is helpful to split this problem into how many bacteria there are after each hour. We start with  $10^3$  bacteria. EACH of these  $10^3$  bacteria produces  $10^2$  bacteria by itself in an hour. So after an hour, we have  $(10^3)(10^2) = 10^{3+2} = 10^5$  bacteria. The second hour then starts with  $10^5$  bacteria, and each produces  $10^2$ :  $(10^5)(10^2) = 10^7$ . Finally, in the third hour we have  $(10^7)(10^2) = 10^9$ .
8. A. *Numbers – Time Money Concepts*. At \$10/hour, it will take Ali 30 hours to earn \$300. (If  $x$  represents the number of hours, then  $10x = 300$ , and  $x = 30$ .) At \$15/hour, it will take Ali 20 hours to earn \$300. (If  $y$  represents the number of hours, then  $15y = 300$  and  $y = 20$ .) Therefore, it will take 10 hours less to earn \$300 ( $30 - 20 = 10$ ).
9. E. *Algebra – Linear Equations*. Use any two points to find the slope by substituting into  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . For example, using the points  $(-1, 4)$  and  $(1, -2)$  yields  $m = \frac{-2 - 4}{1 - (-1)} = \frac{-6}{2} = -3$ . Substitute  $m$  into  $y = mx + b$  which yields  $y = -3x + b$ . Use any point to find  $b$  by substituting in  $x$  and  $y$ . For example, using the point  $(-1, 4)$  yields  $4 = -3(-1) + b$  and results in  $b = 1$ . Substitute  $b$  into the equation which results in  $y = -3x + 1$ .
10. D. *Numbers – Basic Number Theory*.  $2a + 2b$  because  $2a + 2b = 2(a + b)$ , whose factors are 2 and  $a + b$ .
11. E. *Algebra – Quadratic Equations*. If you picture the arc of the ball as the curve of a parabola on a graph, and the ground as the  $x$ -axis, then the place on the graph where the ball hits the ground is the intercept with the  $x$ -axis. The parabola intercepts the  $x$ -axis when  $y = 0$ , so we can find the answer by using the equation  $0 = -x^2 + 5x + 6$  or  $x^2 - 5x - 6 = 0$ . This can be factored as  $(x + 1)(x - 6) = 0$ , so the possible solutions are  $-1$  and  $6$ . Since the intercept at  $-1$  represents 1 second before the ball was thrown, only  $6$  makes sense in context. Notice that we can eliminate both  $-1$  and  $-6$  immediately for this reason. Therefore, the time from when Jill throws the baseball to when it hits the ground is 6 seconds.
12. B. *Numbers – Computational Clue*. Two bins will hold one basketball each, and the rest will hold different numbers, starting at two.  $1 + 1 + 2 + 3 + 4 + 5 + 6 + 7 = 29$ .
13. A. *Data Analysis & Probability – Mean, Median, Mode*. We do not need to know the weights of the individual animals to find the average of all 8. Since the average weight of all 5 cats is 9 ounces, this means the cats weigh 45 ounces all together ( $5 \times 9 = 45$ ). Similarly, the weight of the dogs all together is 75 ounces ( $3 \times 25 = 75$ ). The cats and dogs therefore weigh 120 ounces in total ( $45 + 75 = 120$ ). To find the average, divide 120 by the 8 animals.  $120 \div 8 = 15$ .
14. C. *Algebra – Equations Based on Word Problems*. One of many ways to solve this question is to distribute  $d$  across  $n$  and  $-1$ ; then subtract  $a_1$  from both sides. Add  $d$  to both sides to isolate  $dn$ ; then divide by  $d$ .

15. B. *Geometry & Measurements – Problems using Shapes & Angles.* If the triangle is isosceles and the sum of the angle measures in a triangle is  $180^\circ$ , then the base angles are each  $36^\circ$ . B is a line segment, so  $36 + 2x + 52 = 180$ . Simplifying yields  $x = 46$ .
16. B. *Algebra – Radical Expressions.* Because  $\sqrt{x} = x^{\frac{1}{2}}$ , we can find the value of the innermost term by dividing the exponent by 2. So,  $\sqrt{x^{16}} = x^8$ . The same can be applied to the outermost radical.  $\sqrt{x^8} = x^4$ .
17. D. *Geometry & Measurements – Transformations.*  $(x - 5, y + 4) = (0, 0)$ , so  $x = 5$  and  $y = -4$ .
18. E. *Algebra – Word Problems.* This scenario can be represented by the equation  $s(12 - 8) = 500$ , where  $s =$  the number of scarves. This means Maria earns \$4 per scarf.  $4s = 500$ , and  $s = 125$ . Therefore, Maria needs to sell 125 scarves to earn \$500.
19. A. *Algebra – Inequalities.* Isolate  $nx$  by subtracting 8 from each side.  $nx \leq -20$ . Substituting  $-5$  for  $n$  yields  $-5x \leq -20$ . When we divide by  $-5$ , we must remember to flip the inequality sign, which leaves us with  $x \geq 4$ .
20. D. *Data Analysis & Probability – Set Theory.* The correct answer is  $\{6, 9, 15, 21\}$ . To find the intersection of two or more sets, determine which numbers the sets have in common. Here, sets C, D, and E all contain the numbers 6, 9, 15, and 21, so this is the intersection of these three sets.
21. D. *Algebra – Interpreting Variables.* Since the area of the rectangle is 48, it must be true that the length times width equals 48. Given the parameters, we cannot prove that any of the other choices must be true. For example,  $2L + 2W$  gives us the perimeter of the rectangle, though a rectangle with an area of 48 can have many different possible perimeters (consider a rectangle  $2 \times 24$  vs one that is  $4 \times 12$ ).
22. A. *Algebra – Ratios & Proportions.* We will solve by using a proportion. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{height}}{\text{shadow length}}$ . Next set up your proportion:  $\frac{5.5}{11} = \frac{x}{35}$ . We can cross multiply, or we can see that the numerators are half the denominators:  $x$  is therefore  $35 \div 2 = 17\frac{1}{2}$  feet.
23. D. *Algebra – Word Problems.* Together, Tom and Bette can assemble a total of 8 cars in an hour. This means it will take them  $30 \div 8 = 3.75$  hours to assemble 30 cards, which is 3 hours and 0.75 hours, which is  $0.75 \times 60$  minutes = 45 minutes.
24. B. *Data Analysis & Probability – Mean, Median, Mode.* The mode is the number that appears most frequently. The only number to appear more than once is 5.
25. C. *Algebra – Word Problems.* If the velocity of the plane traveling against the wind is  $x$ , then  $4x = 2,000$ . If the velocity of the plane traveling with the wind is  $y$ , then  $6y = 3,600$ . So,  $x = 500$  and  $y = 600$ . So, the velocity without the help of the wind is  $v - w = 500$  and with is  $v + w = 600$ .

## Section 5 – “Experimental”

1. A. *Detail.* The author does not refer to a literal new body of water, or the particular hazards. He does allude to the amount of knowledge to be gained, but he uses the imagery of the sea in order to convey that there is a new and unknown place to explore.
2. D. *Detail.* Here the author is describing a place of war. While war could be waged on an ocean, the author is talking about space (certainly not a playhouse or cinema or hall). Thus, the best word to replace “theater” is “realm.”
3. D. *Inference.* The author states that the benefits of space exploration should be shared with everyone, not kept in secret. We can infer that he is speaking altruistically. The other choices represent selfishness or other traits not exemplified by the passage (for example, timidity or risk aversion).
4. C. *Detail.* The author says that we seek to “solve these mysteries,” which is akin to satisfying curiosity. He explicitly states that he wishes to pursue “new knowledge to be gained” and that doing so will is not easy, but hard. Doing so “will serve to organize and measure the best of our energies and skills,” akin to stating that people must band together and cooperate. The author writes how he will not attempt to gain an advantage in future conflicts.
5. D. *Tone/Mood/Style.* The author’s last paragraph is inspirational. He uses repetition (“we choose...we choose”; “because...because...because”) to emphasize his point. He is not antagonizing anyone or delivering a warning. He is not using rude language, and is optimistic, not pessimistic.
6. D. Something that is “likely” is possible. “Highly probable” means expected, or very much possible.
7. A. To “bolster” means to strengthen. To “build up” denotes a certain toughening or fortification.
8. C. The prefix “mal-” means “bad” so we can assume that “malignant” has a negative charge; it means evil or cruel. “Hurtful” is the best synonym, as the others are neutral to positive.
9. A. This is a synonym analogy, since insensitive and numb are used to describe how something is difficult to notice or feel. Similarly, unwavering and constant are both used to mean steady or unchanging.

10. C. This is an antonym analogy, since something that is orderly (organized) is the opposite of something cluttered (messy). Similarly, someone who is empathetic is one who feels sympathy or understands how someone else feels, while someone callous is someone who does not (or does not care).
11. E. This is a type/kind analogy, since a mouse is a type of mammal, and a snake is a type of reptile. A snake slithers, but this is a noun/verb relationship.
12. E. This is a purpose/object analogy, since the purpose of calories is to provide people with energy and a the purpose of a textbook is to provide people with knowledge.
13. B. *Numbers – Percents*. Break the question down into pieces. First, find 20% of 200. This is  $0.2 \times 200 = 40$ . Then, take 20% of that. This is  $0.2 \times 40 = 8$ .
14. B. *Numbers – Decimals*. Remember PEMDAS: first, simplify inside parenthesis. This is  $0.25 - 0.75 = -0.5$ . If we raise this to the third power, we know several things. First, the answer must be negative, since a negative raised to an odd power will always be negative (it's like multiplying a negative number by itself three times – you'll always get a negative number). Second, since we are multiplying a decimal by itself, it should get smaller and smaller, not bigger. Therefore, we can solve this without doing any math.
15. B. *Geometry & Measurements – Area, Perimeter, Volume*. We know the formula for the area of a circle is  $A = \pi r^2$ , where  $r$  is the radius. Simply substitute:  $36\pi = \pi r^2$ . Divide both sides by  $\pi$  to get  $36 = r^2$ . Take the square root for  $r = 6$ . Note that the question asks for the diameter, not the radius. This is  $2r$ , or 12.
16. D. *Geometry & Measurements – Slope*. Rewrite the equation in standard form. This becomes  $2y = x + 6$ . Divide both sides by 2 for  $y = \frac{1}{2}x + 3$ . The  $y$ -intercept is 3.

## Quantitative Reasoning & Mathematics Achievement

### Number Concepts & Operations

#### Integers

1. D.  $-27 + 39 = 12$ . Then,  $12 - 12 = 0$ . Finally,  $0 + 45 = 45$ .
2. C. Adding a negative number is the same as subtracting a positive number. Therefore,  $(-25) + (-50)$  is the same as  $(-25) - (50) = -75$ . Finally,  $-75 + 82 = 7$ .
3. B.  $(-44) + (-76)$  is the same as  $(-44) - (76) = -120$ . Finally,  $-120 + 100 = -20$ .
4. D. Subtracting a negative number is the same as adding a positive number. Therefore,  $(-35) - (-40)$  is the same as  $(-35) + (40) = 5$ . Finally,  $5 + 20 = 25$ .
5. E. Notice that we are multiplying two negatives. This means that we must end up with a positive number, ruling out all negative choices. We can see quickly that the product must be greater than 700, since  $-70 \times -100 = 700$ . This leaves only the last choice.
6. A. Notice that we are dividing a positive number by a negative number. This will always result in a negative number. We know that  $5 \times 5 = 25$ , so the answer must be  $-25$ .
7. E. Multiplying two negatives gives us a positive. Multiplying this positive by another positive gives us a positive. Therefore, the result is going to be a positive number, ruling out all negative answer choices. We don't need to multiply all remaining numbers – we need only to multiply the ones places to see that the answer cannot end in 5 (because  $6 \times 5 \times 4 = 120$ , which ends in 0).
8. B. We can eliminate all positive answer choices because when we multiply or divide a negative and positive number, we get a negative number. Notice that we cannot simply divide all three numbers by 10, since we must observe order of operations.

#### Decimals

1. D. 0.2 is equivalent to  $\frac{2}{10}$ , or  $\frac{1}{5}$ .  $\frac{1}{5}$  of 50 equals 10.
2. B. An easy way to multiply decimals is to ignore the decimal points. Multiply 5 and 4 to get 20. To convert back into a decimal, move the decimal back 2 places since the factors have a total of 2 decimal places.
3. D. When multiplying a decimal by a factor of 10, move the decimal point an equal number of places as the factor (here, 3 places). Therefore,  $0.09 \times 1000 = 90$ .
4. D. The quotient of two numbers is found by dividing the first number by the second number. An easy way to divide decimals is to turn everything the divisor into a whole number. Multiply 7.2 by 10 to get 72 and multiply 0.3 by 10 to get 3. Divide 72 by 3 to get 24.
5. B. The quotient of two numbers is found by dividing the first number by the second number. An easy way to divide decimals is to first turn everything into whole numbers. Multiply 5.12 by 100 to get 512 and multiply 0.2 by 100 to get 20. Divide 512 by 20 to get 25.6.
6. A. There's no need to simplify this expression. Notice that the product of the two numbers inside the parenthesis will have two places after the decimal point. Then, notice what happens if you multiply two

decimals in their hundredths; you end up with a decimal to the ten thousandths (four decimal places). Only one such number is given. Or, simplify: remember PEMDAS. First, multiply inside parentheses. Remember, a trick to multiply decimals is to multiply them as whole numbers, then shift the decimal place to the left as many times as you did to make whole numbers from the decimals. In this case,  $6 \times 4 = 24$ , and since we had to shift the decimals over a total of two times, we would get 0.24. Then, simplify the exponent  $0.24^2$  for 0.0576.

7. E. First, simplify within the parenthesis for 0.55. Then, multiply:  $0.55 \times 0.55 = 0.3025$ .
8. D. First, simplify within the parenthesis for 0.16. Then, multiply:  $0.16 \times 0.16 = 0.0256$ .
9. D. If the card is worth 0.45 times more, then the cost of the card is equal to  $5 + (0.45)(5) = \$7.25$ .
10. E. 11.56 is 0.15 times less than his previous time, so if the original time is  $t$ ,  $11.56 = t - 0.15t$  or  $0.85t = 11.56$ .  $t = 13.6$  seconds.

## Fractions

1. D. The product of all of these expressions is 2, except  $10 \times \frac{3}{5}$ , which equals  $\frac{30}{5}$ , or 6.
2. E. First convert all of the fractions to have the lowest common denominator, which is 12; then add.  $2\frac{8}{12} + 1\frac{6}{12} + 1\frac{9}{12} = 4\frac{23}{12} = 5\frac{11}{12}$ .
3. D. When raising a fraction to any power, raise the numerator and denominator to that power.  $5^2 = 25$ , and  $8^2 = 64$ ; therefore,  $(\frac{5}{8})^2 = \frac{25}{64}$ . When dividing fractions, we simply multiply by the reciprocal. So,  $\frac{1}{4}$  becomes 4, and we are left with  $\frac{25}{64} \times \frac{4}{1} = \frac{100}{64}$ , which reduces to  $\frac{25}{16}$ .
4. C.  $(\frac{2}{3})^3 = \frac{8}{27}$ . The lowest common denominator of these fractions is 27.  $\frac{8}{27} + \frac{6}{27} = \frac{14}{27}$ .
5. A. The lowest common denominator of these fractions is 18. Therefore,  $1\frac{12}{18} + 2\frac{15}{18} + 3\frac{4}{18} = 6\frac{31}{18}$ , or  $7\frac{13}{18}$ .
6. D. First convert all the fractions to have the lowest common denominator, which is 10. First, determine how much food was fed to the dog:  $3\frac{5}{10} + 2\frac{2}{10} + \frac{1}{10} = 5\frac{8}{10}$ . The amount of food left in the bag is the total amount of 10 minus the amount fed of  $5\frac{8}{10}$ , or  $10 - 5\frac{8}{10} = 4\frac{2}{10}$ , or  $4\frac{1}{5}$ .
7. B. Remember: in multiplying and dividing fractions, we do not need to find a common denominator. Multiply across the numerator and denominator; divide by multiplying by the reciprocal. First, multiply:  $\frac{1}{3} \times \frac{3}{5} = \frac{3}{15}$ , or  $\frac{1}{5}$ . Then, divide, and when you do, multiply by the reciprocal:  $\frac{1}{5} \times \frac{6}{5} = \frac{6}{25}$ .
8. C. To find  $\frac{3}{8}$  of  $\frac{3}{4}$ , multiply:  $\frac{3}{8} \times \frac{3}{4} = \frac{9}{32}$ .
9. C. The total spending is  $350 + 600 + 450 + 200 + 340 + 160 = \$2,100$ . The fraction of income spent on house payments and taxes is equal to  $\frac{600}{2100} = \frac{2}{7}$ .
10. A. Roger hit 9 out of 36 attempts on Day 4, or  $\frac{9}{36} = \frac{1}{4}$ . Thus, he missed 27 out of 36 attempts, or  $\frac{27}{36} = \frac{3}{4}$ .
11. C. First, find the original number.  $\frac{5}{8}m = 15$ . Solving for  $m$  yields  $m = 24$ .  $4m = 4(24) = 96$ . Multiply to find  $\frac{3}{8}$  of 96:  $\frac{3}{8} \times 96 = 36$ .
12. D. Let  $g$  be the number of games at the beginning of the week. If there are 180 games at the end of the week, then  $\frac{2}{5}g = 180$ . Solving for  $g$  yields 450 games.
13. B. If the stock market dropped 25%, then it was 75% of its original value. If it rose back to its original price, it increased back up to 25%. The fraction is equal to  $\frac{25}{75} = \frac{1}{3}$ .

## Percents

1. E. Let's say the owner begins with 100 units of land. If he sold 30%, he has  $100 - 30 = 70$  units remaining. If he sells 15% of the 70, he has  $70 - 10.5 = 59.5$  units remaining. Out of the original 100, he has  $59.5 \div 100 = 59.5\%$  remaining.
2. D. A 20% discount means the sale price will be 80% of the original price.  $(25.5)(0.8) = 20.4$ , or \$20.40.
3. A. If the price of the television decreased by 40%, the value of the television is 60% of the original.  $(0.6)(650) = 390$ .
4. C. The total number of attempts for all 5 days is 165. The total number of hits is 30. To find the percent of the number of hits out of attempts, divide 30 by 165: 0.18181818.... or 18% rounded to the nearest percent.
5. D. Before tax, James's purchase is equal to  $3(16) + 4(3.5) = 48 + 14 = 62$ . 8% of 62 is  $(0.08)(62) = 4.96$ . So the total cost of the purchase is  $62 + 4.96 = \$66.96$ .

6. D. You can find the percent by dividing the amount the Millers spend on food (\$450) by the amount they spend on house payments and taxes (\$600).  $450 \div 600 = 0.75$ , or 75%.
7. E. Convert all of the values to the same unit. 5 minutes and 15 seconds = 5.25 minutes. 5 hours are equal to 300 minutes. So, the percent is equal to  $5.25 \div 300 = 0.0175$ , or 1.75%.
8. B. 15% of 30% is equal to  $(0.15)(0.3) = 0.045$  (or 4.5%).  $(0.045)(840) = 37.8$ .
9. E. You can solve by setting up an equation:  $22 = 0.05x$ , so  $x = 440$ .
10. A. If there is a 40% discount, then \$150 is 60% of the original price. The value of a percent is equal to the percent expressed as a decimal multiplied by the whole, or  $p = \%w$ . In this case,  $150 = 0.6w$ . Solving for  $w$  yields a whole of \$250.
11. A. Convert everything to the same units. 3 inches is equal to 0.25 feet. 8 yards is equal to 24 feet. To find the percent, divide 4.25 feet by 24 feet:  $4.25 \div 24 \approx 17.7\%$  (The nearest whole percent is 18%.)
12. A. 16% of 24% is equal to  $(0.16)(0.24) = 0.0384$  (or 3.84%).  $(0.0384)(460) = 17.664$
13. D. If  $c$  is the original cost of the shirt, then  $c + 0.07c = 27.82$ , or  $1.07c = 27.82$ . Solving for  $c$  yields an original cost of \$26.
14. D. This problem can be expressed as  $42.5 + (42.5)(0.065) = 45.2626$ , or \$45.26 rounded to the nearest cent.
15. D. If the original price of the chair is 45, then 40% off of that price (the sale price) can be expressed as  $45(100\% - 40\%)$  or  $45(0.6)$ . This would give us the sale price of 27. If the sale price is marked down another 20%, then this could be expressed as  $27(100\% - 20\%)$ , or  $27(0.8)$ . This would give us the final price of 21.60.

## Order of Operations

1. B. Use the acronym PEMDAS (parentheses, exponents, multiplication, division, addition, subtraction) to help remember the order of operations. First solve the expression within the parentheses, then brackets; then, solve the exponent, and add.  $2^2 + [7 \div (7)]$  simplifies to  $2^2 + 1$  and finally  $4 + 1 = 5$ .
2. C. First solve the expression within the parentheses; however, remember that you cannot add two numbers if they do not have the same degree. Square 3 to get 9; then add 4 to get 13.  $13 - 7 \times \frac{1}{2}$ , which simplifies to  $13 - 3\frac{1}{2} = 9\frac{1}{2}$ .
3. B. First solve within the parentheses:  $100 \div (8 - 3) \times 2$ , which simplifies to  $100 \div 5 \times 2$ . Then, we do multiplication and division from left to right:  $20 \times 2 = 40$ .
4. C. According to PEMDAS, you must solve the exponents first; since the exponents have the same base (4) and are being divided, you can simply subtract the exponents and keep the base.  $4^3 \div 4^2 = 4^1$ , or 4. Then, multiply, and add.  $4 + 8 \times 9$  simplifies to  $4 + 72 = 76$ .
5. B. First, simplify within the parentheses. This gives us  $80 \div 4^2 + 4$ . Then resolve the exponent for  $80 \div 16 + 4$ . Divide for  $80 \div 16 = 5$ . Add for  $5 + 4 = 9$ .
6. C. First solve within the parentheses, then multiply.  $26 \times 14 = 364$ .
7. B. First solve within the parentheses, then the exponent. Next, multiply, then subtract.  $10 \times 4^2 - 11$  simplifies to  $10 \times 16 - 11$  and finally  $160 - 11 = 149$ .
8. D. First solve within the parentheses, then the exponent. Next, multiply, then subtract.  $8 \times 16 - 3^3$  simplifies to  $8 \times 16 - 27$  and then  $128 - 27 = 101$ .
9. C. First, solve within the parentheses, then divide. Next, subtract.  $11 - \frac{5}{10} \div 6$  simplifies to  $11 - \frac{1}{12} = 10\frac{11}{12}$ .
10. A. First, solve the exponent, then divide. Next, add and subtract from left to right.  $20 \div 5 + 125 - 10$  simplifies to  $4 + 125 - 10$  and finally  $129 - 10 = 119$ .

## Number Theory

1. D. If a number is divisible by 6 and 7, then it must be a multiple of 42. Therefore, any factor of 42 will work. Of the given answer choices, only 21 is a factor of 42.
2. D. 84 because it is the product of the unique factors of 12 and 28: 3, 4, and 7.
3. C. 3 because the prime factorization of 105 is 3, 5, and 7 and possible combinations that result in two-digit factors are:  $3 \times 5$ ,  $3 \times 7$ , and  $5 \times 7$ .
4. A.  $x - y + 3$  because if the difference of  $x$  and  $y$  is a multiple of three, three more than that number must also be a multiple of three (just adding one more group of three).
5. A. 2 and 3 because both 2 and 3 are factors of 6, thus they must be factors of any multiple of 6.
6. A.  $\sqrt{\frac{1}{a}}$  because  $\sqrt{a} \times \sqrt{\frac{1}{a}} = \sqrt{\frac{a}{a}} = \sqrt{1} = 1$ , a rational number.

7.  $c - d$  is an odd integer, because an even number minus an odd number is always odd.
8.  $A. g + h + i$  is divisible by 3, because the sum of  $x$  consecutive integers is always divisible by  $x$ . Choice E is wrong because  $g, h$ , and  $i$  could be negative integers, which would make  $g - h - i$  positive.

## Rules of Divisibility

1. C. The easiest way to verify this answer is to divide 567 by 7 through long division. The answer is 81. If you check the answers, you can quickly eliminate all the wrong answers and land on the correct one.
2. E. Notice that  $(5)2x + (5)y = 5(2x + y)$ , which means it's a multiple of  $2x + y$ . Any multiple of a number will have the same factors as the original number.
3. E. Because  $14a + 14b$  can be written as  $14(a + b)$ , it is divisible by 7 because 14 is divisible by 7 (even if  $a + b$  is not).
4. C. The easiest way to verify this answer is to divide 123 by 3 through long division. The answer is 41. If you check the answers, you can quickly eliminate all the wrong answers and land on the correct one.
5. E. Try choosing a number for  $a$  that is divisible by 7. If you choose  $a = 7$ , then  $3a \div 4$  has a remainder of 1. But if you try another number, like 14, you'll see that  $3a \div 4$  has a remainder of 2. Since you found more than one correct answer, the answer cannot be determined.
6. D. Try choosing examples of  $a$  and  $b$  that disprove each answer choice. For instance, if  $a = 2$  and  $b = 1$ , the product of  $a$  and  $b$  (2) divided by their sum (3) is  $\frac{2}{3}$ , which is less than 1.
7. E. If  $f - g$  is a positive whole number, then we know that  $f$  must be greater than  $g$  (though this is not an answer choice). We don't know that the sum of  $f$  and  $g$  is divisible by both  $f$  and  $g$ ; for example,  $3 + 4 = 7$ , and 7 is not divisible by either. We can't divide one by the other to get a positive whole number. The only choice that makes sense is that the product of two numbers is divisible by those two numbers (since they are inverse operations).
8. C. Try choosing a number for  $W$  such that  $W \div 5$  has a remainder of 4 (like 9, 14, 19, etc.) If you multiply the number by 3 and divide it by 5, you'll see it has a remainder of 2 (it's good to try with more than one value of  $W$  just to be safe).

## Place Value

1. E. The underlined 6 is in the hundredths place; therefore, its value is 6 hundredths.
2. D.  $7.8416 \times 10^5$  in standard form is 784,160. Since 4 is in the thousands place, its value is 4 thousand.
3. A. The standard form of  $4.9025 \times 10^3$  is 4,902.5. Since 0 is in the tens place, its value is 0 tens.
4. A. The value of the 9 in the thousands place is 9 thousands, or 9,000; the value of the 9 in the hundredths place is 9 hundredths, or 0.09.  $9000 \div 0.09 = 100,000$ .
5. E. The underlined 7 is in the thousandths place; therefore, its value is 7 thousandths.
6. D. The underlined 1 is in the ten thousands place; therefore, its value is ten thousand.
7. E. The standard form of  $92.8 \times 10^{-4}$  is 0.00928. Since 9 is in the thousandths place, its value is 9 thousandths.
8. D. The value of the 6 in the tens place is 6 tens, or 60; the value of the 6 in the thousandths place is 6 thousandths, or 0.006.  $60 \div 0.006 = 10,000$ .
9. D. The standard form of  $7,562.18 \times 10^{-3}$  is 7.56218. Since 7 is in the ones place, its value is 7 ones.

## Time/Money Concepts

1. A. We can set up an equation to solve.  $62.50 + 6(4.75) + x = 100$ , where  $x$  is the value left on the gift card after Dylan makes his purchase. So,  $x = 100 - 62.50 - 28.50 = 9$ .
2. C. There are a few ways to solve the problem. One way is to convert the seconds to a decimal. (36 seconds = 0.6 minutes; so,  $2.6 \text{ minutes} \times 4 = 10.4 \text{ minutes}$ , and  $0.4 \text{ minutes} = 24 \text{ seconds}$ .) Another way is to multiply the minutes, then multiply the seconds, and add them together:  $2 \text{ minutes} \times 4 = 8 \text{ minutes}$ ,  $36 \text{ seconds} \times 4 = 144 \text{ seconds}$ . 144 seconds is equal to 2 minutes and 24 seconds, so the total time is 10 minutes and 24 seconds.
3. B. One way to solve is to find the discounted price of one box. First, the regular price of 4 boxes of cereal is  $3.40 \times 4 = 13.60$ . If the discount is 10%, then the price is 90% of the original, or  $3.40 \times 0.9 = 3.06$ . If the fourth box is free, then the total cost is equal to 3 times the cost of 1 box.  $3.06 \times 3 = 9.18$ .  $13.60 - 9.18 = \$4.42$ .
4. E. If  $p$  is equal to the discounted price before tax is applied, then  $0.05p = 2.52$  (or 5% of the original price is equal to the sales tax). So,  $p = \$50.40$ . This is 70% of the original price (since there is a 30% discount), so if  $x$  is the original price of the doll,  $0.7x = 50.40$ , and  $x = \$72$ .

- C. The first half of the distance is 13 miles. If he runs at 6 miles per hour, it takes  $2\frac{1}{6}$  hours, or 2 hours 10 minutes, to run up the mountain. If his average speed down the mountain is 10 miles per hour, it takes him 1.3 hours, or 1 hour 18 minutes, to run down the mountain. Therefore, it takes 2 hours 10 minutes + 1 hour 18 minutes = 3 hours 28 minutes.
- D. After one year, Jack owes  $1.2(\$2,000) = \$2,400$ . After the second year, he owes  $1.2(\$2,400) = \$2,880$ .
- C. The initial deposit,  $x$ , increases by 10% three times, so we can create the equation  $(1.1)(1.1)(1.1)x = 1,331$ . Simplifying gives us  $1.331x = 1,331$ , so  $x = 1,000$ .
- B. If  $p$  is the original price of the sweater, then  $0.8(0.9p) = 36$ . (After the 10% discount is applied, the cost is 90% of the original, and after the 20% discount is applied, the discount is 80% of the discounted price.) So,  $0.72p = 36$ , and  $p = 50$ .

## Estimation

- B. This is close to 72,000 divided by 240, the quotient of which is 300.
- E. These irrational radicals are close to 7 and 9 respectively, the sum of which is 16.
- B. Pretend it is asking "What percent of 5000 is 750?"  $\frac{750}{5000} = \frac{3}{20}$ , which equals  $\frac{15}{100}$ , or 15%.
- D. The first fraction is relatively close to  $\frac{100}{1000}$ , or  $\frac{1}{10}$ . The second fraction is close to  $\frac{250}{1250}$ , or  $\frac{1}{5}$ . Add them to obtain  $\frac{3}{10}$ , or 0.3.
- B. The dividend is close to 10 (since  $10 \times 10 \times 10 = 1,000$ , which is close to 998). The divisor is close to 5 (since  $5 \times 5 \times 5 = 125$ , which is close to 126). The quotient is closest to 2.
- A. Assume it was asking "What is 25% of 8,000?" This is 2,000, so the actual answer is very nearly 2,000.
- D. Round each number to the nearest whole, then add the resulting numbers to come up with 13 total inches.
- B. The dividend is nearly 100,000. The divisor is slightly over 400. So the quotient is somewhat more than 250.
- D.  $\frac{797}{2,502}$  is nearly  $\frac{800}{2,500}$ , which reduces to  $\frac{8}{25}$ , or 32%.
- B. 7 black leopards and 32 spotted leopards were found. This is 7 black leopards  $\div$  39 total leopards. The fraction  $\frac{7}{39}$  is nearly  $\frac{8}{40}$ , which is 20%.

## Unit Analysis

- C. There are 12 inches in 1 foot.  $12 \text{ inches} \times 13 = 156 \text{ inches}$ .
- C. There are 1,000 liters in 1 kiloliter.  $1,000 \text{ liters} \times 2.6 = 2,600 \text{ liters}$ .
- B. There are 1,000 meters in 1 kilometer.  $150 \div 1,000 \text{ kilometers} = 0.15 \text{ kilometers}$ .
- E. There are 1,000 grams in 1 kilogram.  $200 \times 1,000 \text{ grams} = 200,000 \text{ grams}$ .
- E. There are 12 inches in 1 foot, and 5,280 feet in 1 mile.  $1.5 \times 5280 \times 12 \text{ inches} = 95,040 \text{ inches}$ .
- E. There are 1,000,000 millimeters in 1 kilometer.  $2.45 \times 1,000,000 = 2,450,000 \text{ millimeters}$ .
- A. There are 1,000,000 milligrams in 1 kilogram. One sheet of paper weighs 0.000023 kilograms.  $0.000023 \text{ kilograms} \times 150 = 0.00345 \text{ kilograms}$ .
- C. There are 204 pounds of potatoes in the supermarket.  $204 \div 2,000 \text{ tons} = 0.102 \text{ tons}$ .

## Computational Clue Problems

- B. Express both numbers using the same variable. We could express the information as  $x + (x - 7) = 57$ . Therefore,  $x = 32$ .
- C. 35% of \$720 is \$252.  $\$720 - \$252 = \$468$ .
- C. Represent the unknown number as  $x$ .  $(2)(\sqrt[3]{x}) + 6 = 12$ .  $x = 27$ .
- D. Since we don't know how much Arnold had last summer, let's use  $x$  to represent that amount. We could express the information as  $\$600 = 0.8x$ . Therefore,  $x = \$750$ .
- D. Begin by listing perfect squares: 4, 9, 16, 25, 36, 49, 64, etc., until you notice the difference between consecutive perfect squares is 23. Once you reach the squares of 11 and 12, you will notice that their difference is 23.  $144 - 121 = 23$ . Then, take the product of the square roots of these, for  $\sqrt{121} \times \sqrt{144} = 132$ .
- D. When we don't know what a "number" is, we use a variable. Here, we use  $x$ . Thus,  $\frac{(x-4)}{3} = 3$ .  $x = 13$ .
- B. If  $n$  is the first odd integer, the next would be  $n + 2$ , and the next consecutive would be  $n + 4$ . (Prove this to yourself by setting  $n = 1$ .) Therefore, the greatest would be the latter, and the least would be the former. Algebraically, this can be expressed as  $2(n + 4) - n = 11$ . This gives us  $n = 3$ , and  $n + 4 = 7$ .
- E. 20% of \$60 is \$12.  $\$60 - \$12 = \$48$ . 25% of \$48 is \$12.  $\$48 - \$12 = \$36$ .

## Sequences, Patterns, Logic

1. C. 11 is being added each time. To reach the seventh number in the sequence, you must add it 3 more times.  $30 + 3(11) = 63$ .
2. C. The pattern shows a list of perfect squares up to  $5^2$ , including 0. Simply write out the next four perfect squares: 36, 49, 64, and 81.
3. C. The first number is  $3^1$ , the second is  $3^2$ , the third is  $3^3$ , and so forth. Since all of the terms will have 3, a prime number, as its base, each term with an even exponent is a perfect square. There are 10 of these, so  $\frac{10}{20}$  or  $\frac{1}{2}$  is correct.
4. D. Statement A is a syllogism of statements X and Y. Statement B says that animals that have claws are predators, and vice versa, so it is true as well. Statement C says that all cats are predators. Since we know that cats have claws and that animals with claws are predators, this statement is true. Statement E is the contrapositive of statement A, which therefore must also be true. Statement D by process of elimination must be the odd man out then. We also know this is not necessarily true because we only know that if an animal has claws, then it must be a predator, but not that all predators must have claws.
5. B. The formula for calculating the sum of the integers from 1 through  $n$  is  $\frac{n(n+1)}{2}$ . Plugging in 31 for  $n$ , we get 496 pages read from March 1 through March 31. This means Daniel has  $1,000 - 496 = 504$  pages left when March is over.
6. D. The units digit has a pattern: 2, 4, 8, 6, 2, 4, 8, 6... Raising 2 to any exponent that is a multiple of 4 will leave a units digit of 6. 100 is evenly divisible by 4.
7. C. One way to solve this is to draw the checkerboard. If we do, we can count that there are 28 painted squares. Algebraically, this is represented as  $n^2 - (n - 2)^2$ , where  $n$  is the number of squares in any row or column of the checkerboard. Squaring  $n$  gives us the total number of squares there are on the checkerboard, and squaring  $n - 2$  tells us how many squares are inside the checkerboard (since there will always be 2 squares on each side of the board not counted). This gives us  $64 - 36 = 28$ .
8. A. is the contrapositive of the statement in question. If the original statement is true, so is the contrapositive.
9. C. We do not know that Curtis is the youngest, we only know that Brady is between 4 and 5 years older than Ebu and also older than Curtis. But Curtis could have been born between the times that Brady and Ebu were. We also do not know about the relative ages of Alex and Dennis. We know they are the two oldest siblings, but we don't know who is older of the two. This eliminates all choices but one.
10. D. The sum of the first 10 integers is  $\frac{10(11)}{2} = 55$ . This is because if we list out these integers,  $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10$ , each outer pair adds up to 11 a total of 5 times, for a total of 55. If each integer is multiplied by 3, then the sum is multiplied by 3 as well, so the correct answer is 165. One could also repeat the same method of adding in expanded form:  $3 + 6 + 9 + 12 + 15 + 18 + 21 + 24 + 27 + 30$ . Notice each outer pair sums to 33, and this can be done a total of 5 times for  $33 \times 5 = 165$ .
11. D. All the numerators except 1 cancel out with all the denominators except 100 in a telescoping series. All that is left is  $(\frac{1}{100})$ , or 0.01.
12. D. Each term after the first is the sum of the previous two. The eighth term will be 47, the ninth term 76, and the tenth term  $47 + 76 = 123$ .

## Algebra

### Common Factor

1. A. Since we don't know the value of  $b^2$ , the greatest common factor of  $12b^2$  and 16 must also be the GCF of 12 and 16, which is 4. (The factors of 12 are 1, 2, 3, 4, 6, and 12. The factors of 16 are 1, 2, 4, 8 and 16. The greatest factor they have in common is 4.)
2. B. 6 and 15 have a GCF of 3.  $a^3$  and  $a^4$  have a GCF of  $a^3$ . Therefore, the GCF of both expressions is  $3a^3$ .
3. E.  $p$  is not part of the expression 16, so it cannot be part of the GCF. The GCF of 32, 1, and 16 is 1; therefore, 1 is the GCF for all three expressions.
4. A.  $c$  is not part of the expression  $a^2b$ , so it cannot be part of the GCF. The GCF of 9 and 1 is 1, and the GCF of  $ab^2$  and  $a^2b$  is  $ab$ . Therefore, the GCF for both expressions is  $ab$ .
5. A.  $a$  is not a factor of  $40b^2$ , so it is not part of the GCF. 40 and 25 have a GCF of 5.  $b^2$  and  $b$  have a GCF of  $b$ . So, the GCF of both expressions is  $5b$ .
6. E. The GCF of 72, 56, and 40 is 8. The GCF of  $c^5$ ,  $c^3$ , and  $c^4$  is  $c^3$ , and the GCF of  $d^3$ ,  $d^8$ , and  $d^2$  is  $d^2$ . Therefore, the GCF for all three expressions is  $8c^3d^2$ .

7. E. The GCF for 2, 6, and 1 is 1. Since the three expressions do not have common variables, the variables are not part of the GCF. Therefore, the GCF for these expressions is 1.
8. D. You can consider the coefficient and the variables separately using prime factorization (breaking down a number into the prime numbers that are multiplied together to make it).  $6 = 2 \times 3$ ;  $10 = 2 \times 5$ ;  $12 = 2 \times 2 \times 3$ . The coefficient of the LCM is  $2 \times 2 \times 3 \times 5 = 60$  (see previous question for why). The exponent of the variable is the greatest of those listed, or  $z^6$ . So, the LCM of these three terms is  $60z^6$ .
9. A. Consider the variables and coefficients separately.  $12 = 2 \times 2 \times 3$ .  $16 = 2 \times 2 \times 2 \times 2$ . Remember that, to find the LCM, find the greatest number of times each prime factor occurs, then multiply the factor the number of times it occurs. So, the LCM is equal to  $24 \times 3 \times x^3 \times y^3 = 48x^3y^3$ .
10. A. Consider the variables and coefficients separately.  $40 = 2 \times 2 \times 2 \times 5$ .  $24 = 2 \times 2 \times 2 \times 3$ . So, the LCM is equal to  $23 \times 5 \times 3 \times a^5 \times b^2 = 120a^5b^2$ .
11. C.  $6 = 2 \times 3$ .  $8 = 2 \times 2 \times 2$ .  $4 = 2 \times 2$ . So, the LCM is equal to  $23 \times 3 \times c^2 \times d^3 = 24c^2d^3$ .
12. C. Since 7 is prime (its factors are 1 and itself), we only have to find the prime factors of the nonprime coefficients.  $28 = 2 \times 2 \times 7$  and  $14 = 2 \times 7$ . So, the LCM =  $22 \times 7 \times p^7 \times q = 28p^7q$ .
13. C.  $x^2 + 8x + 15$  factors out to  $(x + 5)(x + 3)$  and  $x^2 + 7x + 12$  factors out to  $(x + 4)(x + 3)$ , so their greatest common factor is  $x + 3$ .
14. E.  $9x^2 - 1$  factors out to  $(3x + 1)(3x - 1)$  and  $9x^2 - 6x + 1$  factors out to  $(3x - 1)(3x - 1)$ , so their greatest common factor is  $3x - 1$ .
15. D.  $4x + 8$  factors out to  $4(x + 2)$  and  $6x + 6$  factors out to  $6(x + 1)$ , so their least common multiple is  $12(x + 2)(x + 1)$ , which is equal to  $12(x^2 + 3x + 2)$ , or  $12x^2 + 36x + 24$ .
16. A.  $6(x^2 - 9)$  factors out to  $6(x + 3)(x - 3)$  and  $8(x^2 + 9)$  does not factor any further, so the greatest factor they have in common is the GCF of 6 and 8, which is 2.

## Factoring

1. C. In this equation  $-1$  can be factored out to yield  $-(x^2 - x - 20)$ . To find the factors, find numbers that add to  $-1$  and multiply to  $-20$  (4 and  $-5$ ). Thus the equivalent expression is  $-(x + 4)(x - 5)$ .
2. A. Since 3 is not a common factor of all three terms, it can't be factored out. The 3 must be considered when determine the factors. Consider that  $3 \times 4 = 12$ . This means that  $3x$  will be in one factor and  $+4$  will be in the other. Since  $12 + 1 = 13$ , you can work out which factors make up the given expression. Multiply to check your answer.
3. D. All 3 terms have a common factor of 5, so that can be factored out to yield  $5(3m^2 + 7m + 2)$ . Since  $5 + 2 = 7$ , and  $1 \times 5 = 5$ ,  $(3m + 1)(m + 2)$  are likely factors. Multiply to check your answer.
4. B. All three terms have a common fact of 2, so that can be factored out to yield  $2(m^2 + 12m + 20)$ . Find numbers that add to 12 and multiply to 20: 10 and 2. So this expression can be factored to  $2(m + 10)(m + 2)$ .
5. A. All three terms have a common factor of 2, so 2 can be factored out to yield  $2(k^2 + 5k + 6)$ . To factor, find numbers that add to 5 and multiply to 6: 2 and 3. So this can be factored as  $2(k + 2)(k + 3)$ .
6. E. All three terms have a common factor of 3, which can be factored out to yield  $3(x^2 + 3x - 10)$ . To factor, find numbers that add to 3 and multiply to  $-10$ : 5 and  $-2$ . So the equivalent expression is  $3(x + 5)(x - 2)$ .
7. C. All three terms have a common factor of  $-2$ , which can be factored out to yield  $-2(x^2 + 3x + 2)$ . Numbers that add to 3 and multiply to 2 are 1 and 2, so this expression can be rewritten as  $-2(x + 1)(x + 2)$ .
8. A. All three terms have a common factor of 4, which can be factored out to yield  $4(x^2 + 2x - 15)$ . Numbers that add to 2 and multiply to  $-15$  are 5 and  $-3$ , so the equivalent expression is  $4(x + 5)(x - 3)$ .
9. B. All three terms have a common factor of  $x$ , which can be factored out to yield  $x(x^2 - x - 12)$ . Find numbers that add to  $-1$  and multiply to  $-12$  to solve: 3 and  $-4$ , o the equivalent expression is  $x(x + 3)(x - 4)$ .
10. C. The terms do not have a common factor, so 3 cannot be factored out. Since there is subtraction, one of the factors will have a negative number, but the other will have a positive number. With that information, answer choices A, B, and D can be eliminated. The factors would have to add up to  $-1$  and multiply to  $-2$ , which is only true of choice C. Multiply to check the answer.

## Ratio and Proportions

1. C. Solve by finding unit price:  $\frac{\$7.50}{6} = \$1.25$  per bottle.  $\$1.25 \times 4 = \$5.00$ .
2. D.  $10\text{ft} \times 7\text{ft} = 70$  square feet.  $\frac{\$35.00}{70}$  square feet =  $\$0.50$  per square foot.
3. D.  $\frac{24}{40} = 0.6 = 60\%$ .

4. B. Amelia earned  $15 \times 40 = \$600$  for her first 40 hours and  $22 \times 6 = \$132$  for the 6 additional hours. She earned  $\$600 + \$132 = \$732$  total.
5. D. The lot is  $500 \times 750 = 375,000$  square feet. This means the amount paid per square foot was  $135,000 \div 375,000$ , which we can simplify to  $135 \div 375 = 0.36$ .
6. C. We will solve by using a proportion. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{chocolate}}{\text{vanilla}}$ . Next set up your proportion:  $\frac{3}{2} = \frac{x}{140}$ . Find the cross products:  $3 \times 140 = 2 \times x$ , simplify:  $420 = 2x$ , and solve:  $x = 210$ . 210 students prefer chocolate and 140 students prefer vanilla, therefore  $210 + 140 = 350$  total students surveyed.
7. D. We will solve by using a proportion. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{teachers}}{\text{students}}$ . Next set up your proportion:  $\frac{2}{15} = \frac{T}{S}$ . Find the cross products:  $2 \times S = 15 \times T$ , simplify:  $2S = 15T$ , and solve for  $T$ :  $\frac{2}{15}S = T$ .
8. D. We will solve by using proportions. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{white beans}}{\text{kidney beans}}$ . Next set up your proportions:  $\frac{5}{4} = \frac{w}{k}$  and  $\frac{1}{1} = \frac{w-30}{k+30}$ . Find the cross products:  $5k = 4w$  and  $w - 30 = k + 30$ . Solve the system of equations using substitution. For example,  $w = k + 60$  so  $5k = 4(k + 60)$ . Simplify:  $5k = 4k + 240$  and solve:  $k = 240$ . So,  $w = 240 + 60 = 300$ . There are  $300 - 240 = 60$  more white beans than kidney beans.
9. A. Average speed =  $\frac{\text{total distance}}{\text{total time}} = \frac{90 + 130}{1.5 + 0.5 + 2} = \frac{220}{4} = 55$ .
10. C. Average speed =  $\frac{\text{total distance}}{\text{total time}}$ . If the average speed was 40 miles per hour for 28 miles, then the time can be found by plugging in known values and solving:  $40 = \frac{28}{\text{total time}}$ ,  $40 \times \text{time} = 28$ ,  $\text{time} = \frac{28}{40} = 0.7$  hours. 0.7 hours =  $0.7 \times 60 = 42$  minutes. If the average speed was 35 miles per hour for 28 miles, then the time can be found by plugging in known values and solving:  $35 = \frac{28}{\text{total time}}$ ,  $35 \times \text{time} = 28$ ,  $\text{time} = \frac{28}{35} = 0.8$  hours. 0.8 hours =  $0.8 \times 60 = 48$  minutes. Therefore, the amount of time, in minutes, must be between 42 and 48.
11. A. If a number is decreased by 25%, then the result is 75% or 0.75 of its value. If a number is increased by 40%, then the result is 140% or 1.4 of its value. The result of a 25% decrease and a 40% increase is  $0.75 \times 1.4 = 1.05$  of its value. This represents a 5% increase.
12. C. The discounted price after a 35% decrease is 65% of its original price.  $65\% = \frac{65}{100} = \frac{13}{20}$ .

## Word Problems

1. B. This scenario can be represented by the equation  $600 + 20w = 1000$ , where  $w$  is equal to the number of weeks Lara deposits \$20. Solving for  $w$  yields  $20w = 400$  and  $w = 20$ .
2. C. This scenario can be represented by the equation  $1200 + 50m = 2,800$ , where  $m$  is equal to the number of minutes the pump runs. This simplifies to  $m = 32$ . Therefore, the possible number of minutes Jill can run the pump must be no more than 32.
3. E. If  $x$  is the smaller number, then  $2x$  is the larger number. Therefore,  $x + 2x = 84$  and  $3x = 84$ . So,  $x = 28$ . The larger number is  $2x$ , so the larger number is 56.
4. B. The perimeter is equal to the sum of the sides. If the shorter side is  $s$ , then  $2s + 2(s + 2) = 20$ . This simplifies to  $4s + 4 = 20$ , so  $4s = 16$  and  $s = 4$ . Therefore, the smaller side is 4, and the longer side is  $4 + 2 = 6$ .
5. C. This scenario can be represented by the equation  $400 - 10w = 100$ , in which  $w$  is equal to the number of weeks. The equation simplifies to  $10w = 300$ , and  $w = 30$  weeks.
6. E. Casey makes 8 trucks in 3 hours or  $2\frac{2}{3}$  trucks per hour. Jessie makes 9 trucks in 4 hours, or  $2\frac{1}{2}$  trucks per hour. This means that Casey and Jessie together can make  $2\frac{2}{3} + 2\frac{1}{4}$  toy trucks per hour.  $2\frac{2}{3} + 2\frac{1}{2} = \frac{31}{6}$ .
7. E. Phil can assemble 9 trucks in 3 hours. So,  $\frac{9}{3} = \frac{p}{36}$ , where  $c$  is the number of toy trucks Phil can assemble in 36 hours.  $p = 108$ . Mark can assemble 11 trucks in 4 hours, so  $\frac{11}{4} = \frac{m}{36}$ , where  $m$  = the number of trucks Jessie can assemble in 36 hours.  $m = 99$ .  $108 + 99 = 207$  so Phil and Mark together can assemble 207 toy trucks in 36 hours.
8. E. An hour is equal to 60 minutes. Pete's bags can be shown as  $\frac{5}{6} = \frac{p}{60}$  in which  $p$  is equal to the number of bags Pete can make in an hour.  $p = 50$ . Hannah's bags can be shown as  $\frac{3}{5} = \frac{h}{60}$  in which  $h$  is equal to the number of bags Hannah can make in an hour.  $h = 36$ . Together, Pete and Hanna can stuff  $50 + 36 = 86$  bags in an hour.

9. C. Let  $a$  represent the adult admission and  $c$  represent child admission.  $3a + 5c = 81$  and  $1a + 3c = 39$ . So,  $a = 39 - 3c$ . Substituting in the first equation yields  $3(39 - 3c) + 5c = 81$ . This simplifies to  $117 - 4c = 81$ .  $4c = 36$ , so  $c = 9$ . Substituting back in the first equation to solve for  $a$  yields  $3a + 5(9) = 81$ . This simplifies to  $a = 12$ . So, the cost of one adult and one child admission is  $a + b = 9 + 12 = \$21$ .
10. B. If  $m$  is equal to the cost of 1 carton of milk and  $b$  is equal to the cost of 1 loaf of bread,  $m + 2b = 5.6$  and  $3m + 2b = 10.8$ .  $m = 5.6 - 2b$ , which we can substitute in the second equation:  $3(5.6 - 2b) + 2b = 10.8$ . This simplifies to  $16.8 - 4b = 10.8$  and  $4b = 6$ . Therefore  $b = 1.5$ , or a loaf of bread costs \$1.50.
11. B. This scenario can be shown in the equations  $7h + 3d = 323$  and  $h + d = 61$ , where  $h$  represents the number of hamburgers, and  $d$  represents the number of drinks. Isolating  $d$  in the second equation yields  $d = 61 - h$ . Substituting back into the first equation,  $7h + 3(61 - h) = 323$ , which simplifies to  $4h + 183 = 323$ , or  $4h = 140$ , or  $h = 35$ .
12. A. We know that there are 20 pounds of the mixture, so some number of pounds of chicken food and some number of pounds of cow food is  $x + y = 20$ . If the mixture costs \$3.80, then the total cost of the mixture is equal to  $3.8 \times 20 = \$76.00$ . Therefore, the other equation needed shows the price of each type of food multiplied by the number of pounds is equal to \$76, or  $3.5x + 4.25y = 76$ .
13. E. Given the information in the problem,  $x + y = 20$  and  $3.5x + 4.25y = 76$ . (The sum of the number of pounds of each kind of food is equal to 20, and the total cost is  $3.8 \times 20 = \$76.00$ .) Solve for one.  $x = 20 - y$ . Therefore  $3.5(20 - y) + 4.25y = 76$ . This simplifies to  $0.75y = 6$  and  $y = 8$ . Since  $x + y = 20$ ,  $x$  must be equal to 12.
14. E. Since we know the family bought 9 tickets, we know that  $x + y = 9$ . If we multiply the cost of an adult ticket by the number of adults and the cost of a children's ticket by the number of children, we find the equation  $12.5x + 8y = 99$ .
15. C. We can write a system of equations to solve. We know that the 18% solution contains  $x$  liters of one solution and  $y$  liters of the other, so  $x + y = 12$ . The 18% solution contains  $x$  liters of 20% solution and  $y$  liters of 15% solution, so  $0.2x + 0.15y = 0.18(12)$ , or  $0.2x + 0.15y = 2.16$ . We can use these two equations to find the values of each variables.  $x = 12 - y$ , so  $0.2(12 - y) + 0.15y = 2.16$ , or  $2.4 - 0.2y + 0.15y = 2.16$ . Solving for  $y$  yields  $y = 4.8$ . Plugging that back into the first equation,  $x + 4.8 = 12$ , and  $x = 7.2$ .
16. D. This problem doesn't specify the total amount of solution, but we know that  $0.08x + 0.12(2) = 0.09y$ , in which  $x$  is the number of quarts of 8% solution and  $y$  is the number of quarts of 9% solution. Since we know there are 2 quarts of the 12% solution,  $x + 2 = y$ . Therefore,  $0.08x + 0.24 = 0.09(x + 2)$ . This simplifies to  $0.08x + 0.24 = 0.09x + 0.18$ , which further simplifies to  $0.01x = 0.06x$ , and  $x = 6$ .
17. D. There are 8 pints in a gallon, so there are 16 pints in 2 gallons. If  $x$  is the number of cups of mix needed for 2 gallons of water,  $\frac{2}{1} = \frac{x}{16}$ , so  $x = 32$ .
18. B. Since there are 20 pounds of the 18% peanut mixture,  $x + y = 20$ . We also know that we can multiply the percent of peanuts in each mixture by the number of pounds to find the total amount of peanuts.  $0.25x + 0.11y = 0.18(20)$ , or  $0.25x + 0.11y = 3.6$ . According to the first equation  $x = 20 - y$ , which we can substitute into the second equation:  $0.25(20 - y) + 0.11y = 3.6$ , which simplifies to  $5 - 0.14y = 3.6$ , or  $y = 10$ . Since  $x + y = 20$ ,  $x = 10$ .
19. C. The boat's velocity,  $x$  against the current can be shown by  $3x = 135$ , or  $x = 45$ . The velocity with the current,  $y$ , is equal to  $2y = 104$ , or  $y = 52$ . In other words, the velocity,  $v$ , with the current,  $c$ , can be shown as  $v + c = 52$ , and the velocity without the current can be shown as  $v - c = 45$ . Isolating  $c$  in the first equation yields  $c = 52 - v$ , which we can substitute in the second equation to find the value of  $v$ :  $v - (52 - v) = 45$ , which simplifies to  $v = 48.5$ .
20. B. Let  $d$  be this distance traveled in  $t$  time, and  $d + 1$  be the distance plus one mile ahead that the faster car traveled. Since (velocity)(time) = distance, the slower car can be represented by  $d = 70t$  and the faster car by  $d + 1 = 70t$ . So,  $55t + 1 = 70t$ . Simplifying yields  $t = \frac{1}{15}$  hour, or 4 minutes.
21. E. When graphed, the equation shows a parabola. The height is equal to the maximum value of  $y$ , or the vertex of this parabola. Recall that a quadratic function has the format  $ax^2 + bx + c$ . The value of  $x$  when  $y = 0$  will be the place where the parabola intercepts the  $x$  axis, or the time when the rock hits the ground.  $0 = -2x + 10x + 28$ , which can be factored as  $0 = -2(x + 2)(x - 7)$ , so  $y = 0$  when  $x = -2$  and  $x = 7$ . Since the time the rock was in the air cannot be negative, it was in the air for 7 seconds.
22. D. The function shows a parabola. On the graph of the function, the starting and ending point are the  $x$ -intercepts, or the places on the graph where  $y = 0$ . So,  $0 = -2x^2 + 10x + 12$  can be factored as  $0 = -2(x + 1)(x - 6)$ . Therefore, when  $y = 0$ ,  $x = -1$  and  $x = 6$ . These two values are 7 units apart on the graph of this function (or  $|-1 - 6|$ ), so the rocket landed 7 feet from where it started.

## Interpreting Variables

1. D. A price reduction of 35% means that the shirt is now 65%, or 0.65, of its original price. This is represented by  $p(1 - 0.35)$ , since  $1 - 0.35 = 0.65$ .
2. A. 1,200 represents the starting amount of pages Gene needs to read. To calculate the number of pages he has read over  $d$  days, use the expression 30 times  $d$ , or  $30d$ . Subtract  $30d$  from 1,200 to find the number of pages remaining.
3. E. In the expression  $250 + 600w$ , 250 is the constant, which means it does not change in relation to the variable  $w$ . Given the number of weeks,  $w$ , Tabitha earns 600 times  $w$ , which means she earns \$600 per week. This is in addition to the \$250 that she already has.
4. C. One nickel is 0.05 of a dollar; similarly, a dime is 0.1, and a quarter is 0.25. Therefore, to calculate the number of dollars in  $a$  nickels and  $b$  dimes, use the expression  $0.05a + 0.1b$ . Given 4 quarters, multiply 4 by 0.25 and add to the expression.
5. A. Since the perimeter of the rectangle is 60, it must be true that the sum of its sides equals 60. Given the parameters, we cannot prove that any of the other choices must be true. The perimeter and area of a rectangle are not necessarily equal.
6. D. Sixty times one number can be represented by  $60x$ , and 14 times another number can be represented by  $14y$ . "Product" indicates multiplication, and the product of these two numbers is less than 62. Therefore,  $60x \times 14y < 62$ .
7. E. The base salary can be represented by the constant 30,000; this means the salary does not change in relation to any variables. Since the salesperson earns 800 times every car,  $c$ , that she sells, that can be represented by the  $800c$ . Therefore, her income can be expressed as  $30,000 + 800c$ .
8. B. The cost of the plan can be represented by the constant 40, which means the cost does not change in relation to any variables. For every text message,  $t$ , the cost is 0.15, which can be represented by  $0.15t$ . Therefore, the total cost of the cell phone plan is  $40 + 0.15t$ .
9. D. In the expression  $15 + 5c$ , 15 is a constant, and  $c$  is the variable that changes. The only thing that changes is the amount of time that passes. The plant grows by 5 every month that passes.
10. D. In the expression  $2.5c - 20$ , the constant 20 represents Sebastian's expenses; it does not change in relation to how much profit he earns. The variable that changes,  $c$ , represents the number of cups of lemonade that he sells. For every cup he sells, he earns \$2.50; therefore, his profits can be expressed with  $2.5c - 20$ .
11. D. If Billy has 12 apples, and Laura has an unknown number  $a$  more than Billy, this means Laura must have  $12 + p$  apples.
12. A. Two times one number can be represented by  $2a$ , and 3 times another number can be represented by  $3y$ . "Product" indicates multiplication, and the product is less than or equal to 99. Therefore,  $2a \times 3y \leq 99$ .
13. D. When  $-5$  is plugged in for  $x$ ,  $4(-5) + 6$ , or  $-20 + 6 = -14$ . However, since we are looking for the absolute value of the expression, the absolute value of  $-14$  is 14.
14. D. The variable  $y$  represents the number of years Matthew saves his money. The interest rate is shown as a decimal (percentage), and is added to the original amount times the interest rate.
15. E. In the expression  $120x - 50$ , 50 represents the constant of Fernanda's expenses each week; it does not change in relation to the amount of money she earns. Given the number of hours  $x$ , she earns 120 times  $x$ , or \$120 per hour she works.
16. A. Plug in 4 for  $x$  to represent the number of weeks.  $20(4) + 5$ , or  $80 + 5 = 85$ .
17. D. Eight hundred is the constant, since that is the amount of money Jose begins with. Each week,  $x$ , he spends \$10, which is subtracted from his original \$800. Therefore, the amount of money he has remaining is represented by  $800 - 10x$ .

## Equations Based on Word Problems

1. A. Multiply each side of the equation by 2 to remove the fraction; then divide both sides by  $b$  to isolate  $h$ .
2. E. Divide both sides by  $h$  to isolate  $b$ .
3. E. Divide both sides by  $2r$  to isolate  $\pi$ .
4. C. Divide each side by  $\pi h$  to isolate  $r$ ; then take the square root. The  $\pm$  does not apply here, because a radius cannot be a negative value.
5. B. Multiply each side by 3 to eliminate the fraction; then divide each side by  $4r^3$  to isolate the  $\pi$ .
6. D. Multiply both sides by 3 to eliminate the fraction; then divide by  $\pi h$  to isolate  $r^2$ . Take the square root of both sides. The  $\pm$  does not apply here because a radius cannot be a negative value.
7. E. Multiply both sides by 3 to eliminate the fraction; then divide by  $h$  to isolate  $B$ .
8. B. Subtract  $b$  from both sides to isolate  $mx$ ; then divide by  $m$ .

9. A. Subtract  $a^2$  from both sides to isolate  $b^2$ ; then take the square root of both sides. The  $\pm$  does not apply because the length of a side cannot be a negative value.

## Equations Based on Illustrations

- B. If  $BC = 18$ , then  $AB = \frac{4}{3} \times 18 = 24$ . Therefore  $AC = 42$ . If  $CD = x$ , then we know that  $AD = 3x$ . To find  $CD$ ,  $\frac{x}{(42+x)} = \frac{1}{3}$ . Cross multiply to get  $3x = 42 + x$ , or  $2x = 42$ . Then  $x = 21$ .
- D. Since  $AB + BC = AC$ , and  $AB = \frac{3}{8}$  of  $AC$ ,  $BC$  must be  $\frac{5}{8}$  of  $AC$ .  $BC = 35$ , so  $AC = 56$ , and  $AB = 21$ . Now,  $AD = CD^2$ . Let  $x = CD$  and  $x^2 = AD$ . Thus,  $56 + x = x^2$ . This can be rewritten in standard quadratic form as  $x^2 - x - 56 = 0$ . Factoring yields  $(x + 7)(x - 8) = 0$ . Rejecting the negative root since distance can't be negative, the correct answer is  $x = 8$ . Plug this back in to the equation for  $8^2 = 64$ .
- D. Area of triangle =  $\frac{1}{2}(\text{base} \times \text{height})$ . If the base is 18, and the area is 108, the perpendicular height must be  $\frac{108}{9}$ , or 12. Then, since half the base is 9, and the perpendicular height is 12, use the Pythagorean theorem to obtain  $9^2 + 12^2 = 225$ . The square root of 225 is 15.
- C. Since the area of the rectangle is 70, the height must be 7 if the base is 10. So the perimeter must be  $10 + 7 + 10 + 7 = 34$ . Therefore, the leg length of the triangle must be  $\frac{(34-10)}{2} = 12$ .
- E.  $BC = 2AB$ ,  $CD = 3BC$ , and  $DE = 4AB$ . Therefore,  $CD = 6AB$ , and  $DE = 4AB$ .  $AE = AB + BC + CD + DE$ . This can be rewritten as  $AB + 2AB + 6AB + 4AB = 13AB$ .  $13AB = 39$ , so  $AB = 3$ . Therefore, since  $BD = BC + CD$ , or  $BD = 8AB = 24$ .
- B. Area of trapezoid = height  $\times$  (average of bases). The average of the bases is 20, so the height must therefore be 12. Drop altitudes down from the two apex corners to the longer base. They are both 12 units long. Since the shorter base is 15 units long, the longer base is cut into parts that are 5, 15, and 5 units long respectively. A 5-12-13 right triangle is created on each side of the ensuing rectangle. The length of each leg is therefore 13.
- D. The semicircle has area  $18\pi$ , so a full circle with the same radius would have the area  $36\pi$ , meaning it would have a radius of 6, and diameter 12. The diameter of the circle is the side of the square. Since perimeter for a square =  $4s$ , the perimeter is 48.
- C. The positive perfect squares below 50 are 1, 4, 9, 16, 25, 36, and 49. The only group of three that make up an arithmetic progression are 1, 25, and 49. Therefore, the mean is  $B$ , or 25.
- E.  $AB + BE = 80$ , so  $BE = 72$  if  $AB = 8$ .  $BC + CD + DE = BE$ . If  $CD = \frac{(BC + DE)}{2}$ , then  $2CD = BC + DE$ , and  $3CD = 72$ . Therefore,  $CD = 24$ , and the sum of  $BC$  and  $DE$  is 48. It is given that  $DE$  is twice as long as  $BC$ , so  $DE = 2BC$ , and  $BC + DE = 48$ . Therefore,  $BC + 2BC = 48$ .  $3BC = 48$ , and  $BC = 16$ , with  $DE$  equaling 32.  $AD = AB + BC + DE = 8 + 16 + 24 = 48$ .
- D. Since  $AE = 28$ , then  $CE = 0.5 \times 28 = 14$ . Since we know  $BC = 4$ , then  $BE$  must be  $14 + 4 = 18$ .

## Rational Expressions

- A. To simplify the expression, combine like terms.  $x = \frac{2x}{2}$ , so we can add and subtract like fractions. The numerators can be simplified as:  $2x + x - 5 - x + 1 = 2x - 4$ . So the original expression is equivalent to  $\frac{2x-4}{2} = \frac{x-2}{1} = x - 2$ .
- C. The numerators can be multiplied to yield  $5 \times 2 = 10$ . The denominators can be multiplied as well:  $(x + 3)(x - 7)$ . Use the distributive property:  $x^2 - 7x + 3x - 21 = x^2 - 4x - 21$ . So this expression is equivalent to  $\frac{10}{x^2 - 4x - 21}$ .
- D. In order to add fractions, they must have like denominators. So, the expression can be rewritten as  $\frac{5 \times y}{x \times y} + \frac{3 \times x}{y \times x}$  or  $\frac{5y}{xy} + \frac{3x}{xy} = \frac{5y+3x}{xy}$ .
- B. First, solve for  $x$ . Multiply both sides of the equation by  $x + 1$  to yield  $x = 0.8x + 0.8$ . Subtracting  $0.8x$  from both sides to isolate the variable yields  $0.2x = 0.8$ , so  $x = 4$ . Therefore,  $\frac{x-3}{x-2} = \frac{4-3}{4-2} = \frac{1}{2} = 0.5$ .
- A. Distributing the negative symbol to the expression in parentheses yields  $\frac{x-1}{2} - x - \frac{1}{2}$ . In order to subtract fractions, they must have common denominators, so multiply the middle term by  $\frac{2}{2}$ . So,  $\frac{x-1}{2} - \frac{2x}{2} - \frac{1}{2} = \frac{x-1-2x-1}{2} = \frac{-x-2}{2}$ .
- C. Apply the distributive property to the expression in parentheses to yield  $2x + \frac{2}{3}$ . Multiply  $2x$  by  $\frac{3}{3}$  so that all terms have like denominators:  $\frac{x+2}{3} + \frac{6x}{3} + \frac{2}{3} = \frac{7x+4}{3}$ .

7. A. First, solve for  $x$ . Multiply both sides of the equation by  $x + 3$  to yield  $x = 0.625x + 1.875$ . Subtracting  $0.625x$  from both sides to isolate the variable yields  $0.375x = 1.875$ , so  $x = 5$ . Therefore,  $\frac{x-4}{x-1} = \frac{5-4}{5-1} = \frac{1}{4} = 0.25$ .
8. D. In order to add fractions, they must have like denominators. So, the expression can be rewritten as  $\frac{2(x-2)}{(x+1)(x-2)} + \frac{6(x+1)}{(x-2)(x+1)} = \frac{2x-4}{(x+1)(x-2)} + \frac{6x+6}{(x-2)(x+1)} = \frac{8x+2}{(x+1)(x-2)}$
9. A. In order to add fractions, they must have like denominators. So, the expression can be rewritten as  $\frac{5(x-1)}{(x+1)(x-1)} - \frac{2(x+1)}{(x-1)(x+1)} = \frac{5x-5}{(x+1)(x-1)} - \frac{2x+2}{(x-1)(x+1)} = \frac{3x-7}{(x+1)(x-1)} = \frac{3x-7}{x^2-1}$ .
10. C. The numerators can be multiplied to yield  $4 \times 2 = 8$ . The denominators can be multiplied as well:  $(x+2)(x-6)$ . Use the distributive property:  $x^2 - 6x + 2x - 12 = x^2 - 4x - 12$ . So this expression is equivalent to  $\frac{8}{x^2 - 4x - 12}$ .

## Exponential Expressions

1. A. Simply try cubing the answer choices to see what happens. Since every choice is negative, they will be negative when cubed: Ex:  $(-3)^3 = -27$ . Since every choice is negative, the one closest to zero will be the LEAST negative, or the greatest in value. This will yield  $(-\frac{1}{4})^3 = -\frac{1}{64}$ .
2. C. Any number to the fourth-power will be positive:  $(-3)^4 = 81$ ,  $(3)^4 = 81$ . So the number with the least value will be 0:  $(0)^4 = 0$ .
3. B. Keep in mind order of operations – PEMDAS. For this problem, we must do the math within the parentheses before bringing in the exponent outside the parentheses. When multiplying like variables together, their exponents simply ADD together:  $a^3 \times a^{-1} = a^{3-1} = a^2$ . Next, we have an exponent raised to a power. Here, the exponents MULTIPLY:  $(a^2)^2 = a^{2 \times 2} = a^4$ .
4. A. Again, we add the like terms in the parentheses together first.  $3xy + 2xy = 5xy$ . Notice that only the coefficients in front of  $xy$  add together ( $2 + 3 = 5$ ), and the exponent is NOT yet affected. Next, we raise this to the power outside the parentheses:  $(5xy)^2 = 25x^2y^2$ . Notice that the power of 2 is applied to BOTH the coefficient and the variables. Finally, multiply this by the 5 out front:  $5(25x^2y^2) = 125x^2y^2$
5. D. Unlike the last problem, we cannot add the terms inside the parentheses because the variables are NOT the same. So we just have to expand the expression:  $(x^2 + y^2)^2 = (x^2 + y^2)(x^2 + y^2) = x^4 + x^2y^2 + x^2y^2 + y^4 = x^4 + y^4 + 2x^2y^2$ .
6. E. For this problem, it's easiest to resolve the rational exponent inside the parentheses, and then take the  $-1$  power outside the parentheses into account. Again, subtract the exponents of like variables (top-bottom):  $(x^{2-3}y^{1-2}z^{3-1}) = x^{-1}y^{-1}z^2$ . Now raise this expression to the exponent outside the parentheses by multiplying each exponent by  $-1$ :  $(x^{-1}y^{-1}z^2)^{-1} = x^1y^1z^{-2}$ . The negative exponent sends the  $z$ -term to the denominator.
7. C. The negative exponent can be rewritten as the reciprocal of the positive exponent:  $(x+y)^{-2} = \frac{1}{(x+y)^2}$   
Expanding the bottom term:  $(x+y)^2 = (x+y)(x+y) = x^2 + 2xy + y^2$ .
8. D. It's important to notice that  $i^2 = -1$ , and thus  $i^4 = 1$ . That means if  $i$  is raised to a multiple of 4, it equals 1. So it's helpful to rewrite the expression with the exponent of the highest multiple of 4:  $i^{45} = i^{44+1} = i^{44}i^1$ . Since 44 is a multiple of 4,  $i^{44} = 1$ . So  $i^{44}i^1 = i = \sqrt{-1}$ .
9. E. The probability of flipping a penny and landing on heads is  $\frac{1}{2}$ . To find the probability of subsequent events taking place, we simply multiply the probability of all the events together:  $(\frac{1}{2})(\frac{1}{2})(\frac{1}{2})(\frac{1}{2})(\frac{1}{2}) = (\frac{1}{2})^5$
10. B. Substitute the given value of 2.5 seconds into the equation for  $-10(2.5)^2 + 2(2.5) + 100$ . This simplifies to  $-62.5 + 5 + 100 = 42.5$ .

## Radical Expressions

1. B.  $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ , so we can find the square root of each number within the radical to find the equivalent expression.  $\frac{\sqrt{36}}{\sqrt{49}} = \frac{6}{7}$
2. C.  $\sqrt[a]{x} = x^{\frac{1}{a}}$ . Therefore,  $\sqrt[3]{x^6} = (x^6)^{\frac{1}{3}}$ . Since exponent rules dictate that  $(x^a)^b = x^{a \times b}$ ,  $(x^6)^{\frac{1}{3}} = x^2$ .

3. D.  $\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$ , so we can find an equivalent expression by finding the cubed root of both numbers inside the radical.  $\frac{\sqrt[3]{216}}{\sqrt[3]{26}} = \frac{6}{3} = 2$ .
4. A.  $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ , so we can find the square root of each number within the radical to find the equivalent expression.  $\sqrt{x^2} = x$ , so that can be pulled out of the radical.  $\frac{\sqrt{16}}{\sqrt{36}} = \frac{4}{6} = \frac{2}{3}$ . Therefore, the equivalent expression is  $\frac{2x}{3}$ .
5. C. Substitute 4 for  $x$  first and multiply to yield  $\sqrt{\frac{16}{64}} \cdot \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ , so we can find the square root of each number within the radical to find the equivalent expression.  $\frac{\sqrt{16}}{\sqrt{64}} = \frac{4}{8} = \frac{1}{2}$ .
6. E. Since the denominator is irrational, the equivalent expression should have a rational denominator. Multiply both the numerator and denominator by  $\sqrt{2}$ :  $\frac{4 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$ .
7. D. Since the denominator is irrational, the equivalent expression could have a rational denominator. Multiply both the numerator and denominator by  $\sqrt{3}$ :  $\frac{9 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{9\sqrt{3}}{3} = 3\sqrt{3}$ .
8. E. Since  $\sqrt[a]{x} = x^{\frac{1}{a}}$  we can extrapolate that  $\sqrt[a]{x^b} = x^{\frac{b}{a}}$ . When substituting for  $x$ , this expression is then equivalent to  $2^{\frac{6}{3}}$  or  $2^2 = 4$ .
9. A. Because  $\sqrt{x} = x^{\frac{1}{2}}$ , we can find the value of the innermost term by dividing the exponent by 2.  $\sqrt{x^{48}} = x^{24}$ . Apply to the middle radical:  $\sqrt{x^{24}} = x^{12}$ . The same can be applied to the outermost radical.  $\sqrt{x^{12}} = x^6$ .
10. A. Since the denominator is irrational, the equivalent expression could have a rational denominator. Multiply both the numerator and denominator by  $\sqrt{5}$ :  $\frac{5 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} = \frac{5\sqrt{5}}{5} = \sqrt{5}$ .
11. D. We can simplify these by pulling out numbers with whole number cubed roots.  $54 = 27 \times 2$  and  $\sqrt[3]{27} = 3$ , so  $\sqrt[3]{54} = 3\sqrt[3]{2}$ . Similarly,  $16 = 8 \times 2$  and  $\sqrt[3]{8} = 2$ , so  $\sqrt[3]{16} = 2\sqrt[3]{2}$ . We can add terms with the same radicand. The original expression can therefore be rewritten as  $3\sqrt[3]{2} + 2\sqrt[3]{2} = 5\sqrt[3]{2}$ .
12. C. In this case, we can find the value of the expression inside the radical. If  $x = 20$ , then  $\sqrt{\frac{5 \times 20}{25}} = \sqrt{\frac{100}{25}} = \sqrt{4} = 2$ .
13. D. Because  $\sqrt[a]{x} = x^{\frac{1}{a}}$ , we can find the value of the innermost term by dividing the exponent by 3.  $\sqrt[3]{x^{72}} = x^{24}$ . The same can be applied to the outermost radical.  $\sqrt[3]{x^{24}} = x^8$ .
14. C. Since the denominator is irrational, the equivalent expression could have a rational denominator. Multiply both the numerator and denominator by  $\sqrt{2}$ :  $\frac{6 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{6\sqrt{2}}{2} = 3\sqrt{2}$ .
15. D. Since the denominator is irrational, the equivalent expression could have a rational denominator. Multiply both the numerator and denominator by  $\sqrt{24}$ :  $\frac{36 \times \sqrt{24}}{\sqrt{24} \times \sqrt{24}} = \frac{36\sqrt{24}}{24}$ .  $\sqrt{24}$  can be simplified as  $\sqrt{4 \times 6} = 2\sqrt{6}$ , so the original expression can be rewritten as  $\frac{(36 \times 2)\sqrt{6}}{24} = \frac{72\sqrt{6}}{24} = 3\sqrt{6}$ .

## Polynomial Expressions

- D. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $x + 4 - x^2 + 3x - 6$ , and then like terms can be combined to yield:  $-x^2 + 4x - 2$ .
- A. Use the distributive property to multiply, multiplying  $3a$  by both terms in the parentheses, yielding:  $12ax - 9ay$ .
- C. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $2x^2 - 3x + 5 + 3x^2 + x - 7x + 9$ , and then like terms can be combined to yield:  $5x^2 - 9x + 14$ .
- B. Use the distributive property to multiply. We can apply FOIL to this expression to determine the order of multiplication: first, outer, inner, last. So:  $(x \times x) + (x \times -6) + (4 \times x) + (4 \times -6) = x^2 - 6x + 4x - 24 = x^2 - 2x - 24$ .
- C. Use the distributive property to multiply. We can apply FOIL to this expression to determine the order of multiplication: first, outer, inner, last. So:  $(3x \times 2x) + (3x \times 7) + (-2 \times 2x) + (-2 \times 7) = 6x^2 + 21x - 4x - 14 = 6x^2 + 17x - 14$ .
- E. This expression can be rewritten as  $3(x + y)(x + y)$ . The coefficient of the term containing  $xy$ , then, is 6.

7. E. Use the distributive property to multiply. Each term in the first polynomial must be multiplied by each term in the second. So:  $(x^2 \times x^2) + (x^2 \times 2x) + (x^2 \times -3) + (-x \times x^2) + (-x \times 2x) + (-x \times -3) + (3 \times x^2) + (3 \times 2x) + (3 \times -3) = x^4 + 2x^3 - 3x^2 - x^3 - 2x^2 + 3x + 3x^2 + 6x - 9$ . Now combine like terms:  $x^4 + x^3 - 2x^2 + 9x - 9$ .
8. B. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $3x^2 + 2x - 2 + 3x^2 + x - 3x - 2$ , and then like terms can be combined to yield:  $6x^2 - 4$ . ( $2x + x - 3x = 0$ ). Notice that you cannot simply divide by 2.
9. D. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $x^2 + 4x + 2 - 4x^2 + 6 + 7x - 8$ , and then like terms can be combined to yield:  $-3x^2 + 11x$ .
10. C. Use the distributive property to multiply. We can apply FOIL to this expression to determine the order of multiplication: first, outer, inner, last. So:  $(5x^2 \times 2x) + (5x^2 \times -6y) + (3y \times 2x) + (3y \times -6y) = 10x^3 - 30x^2y + 6xy - 18y^2$ .
11. B. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $x^2 + 5x - 6 - 4x^2 - 9x - x - 5$ , and then like terms can be combined to yield:  $-3x^2 - 5x - 11$ .
12. B. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $8x^2 + 7x + 9 - 3x^2 + 5x - 2$ , and then like terms can be combined to yield:  $5x^2 + 12x + 7$ .
13. E. Use the distributive property to multiply. We can apply FOIL to this expression to determine the order of multiplication: first, outer, inner, last. So:  $(6x \times 2x) + (6x \times -5) + (-3 \times 2x) + (-3 \times -5) = 12x^2 - 30x - 6x + 15 = 12x^2 - 36x + 15$ . Notice that you cannot simply divide all terms by 3.

## Linear Equations

1. B. Add 5 to both sides of the equation which results in  $-20 = x$  or  $x = -20$ .
2. C. Subtract 18.5 from both sides of the equation which yields  $-2a = -8$ . Then divide both sides by  $-2$  which results in  $a = 4$ .
3. A. Subtract  $3b$  from both sides of the equation which yields  $5b + 20 = -5$ . Then subtract 20 from both sides which yields  $5b = -25$ . Finally, divide both sides by 5 which results in  $b = -5$ .
4. E. Distribute 7 over  $(x + 1)$  which yields  $9x - 1 = 7x + 7 - 2x$ . Combine like terms which yields  $9x - 1 = 5x + 7$ . Subtract  $5x$  from both sides of the equation which yields  $4x - 1 = 7$ . Add 1 to both sides which yields  $4x = 8$ . Divide both sides by 4 which results in  $x = 2$ .
5. C. Distribute  $-4$  over  $(y + 1)$  which yields  $3y - 4y - 4 + 7 = 1 - 4y$ . Combine like terms which yields  $-y + 3 = 1 - 4y$ . Add  $4y$  to both sides of the equation which yields  $3y + 3 = 1$ . Subtract 3 from both sides which yields  $3y = -2$ . Divide both sides by 3 which results in  $y = -\frac{2}{3}$ .
6. E. Distribute 4 over  $(x - 1)$  which yields  $4x - 4 - x = 3x - 4$ . Combine like terms which yields  $3x - 4 = 3x - 4$ . Subtract  $3x$  from both sides which yields  $-4 = -4$ . This is a true statement since  $-4 = -4$ . Hence, there are infinitely many solutions.
7. E. We must isolate  $x$ . Divide both sides of the equation by 6 which results in  $x = \frac{y}{6}$ .
8. D. We must isolate  $L$ . Divide both sides of the equation by  $W$  which results in  $L = \frac{A}{W}$ .
9. A. We must isolate  $b$ . Divide both sides of the equation by  $\frac{1}{2}$  (or alternatively, multiply both sides by 2) which yields  $36 = bh$ . Divide both sides by  $h$  which results in  $b = \frac{36}{h}$ .
10. A. We must isolate  $x$ . Multiply both sides of the equation by  $y$  which yields  $x = ky$ .
11. C. We must isolate  $W$ . Subtract  $2L$  from both sides of the equation which yields  $P - 2L = 2W$ . Divide both sides by 2 which results in  $\frac{2P - 2L}{2} = W$ .
12. D. We must isolate  $r$ . Divide both sides of the equation by the product  $\pi h$  which yields  $\frac{V}{\pi h} = r^2$ . Take the square root of both sides which yields  $\sqrt{\frac{V}{\pi h}} = r$ .
13. D. We must isolate  $x$ . Factor  $x$  out of the expression  $ax + 3x$  which yields  $12 = x(a + 3)$ . Divide both sides of the equation by  $a + 3$  which results in  $\frac{12}{a + 3} = x$ .
14. C. Identify the  $y$ -intercept ( $b$ ) of the line which yields  $b = 5$ . Identify the slope ( $m$ ) of the line which yields  $m = -\frac{5}{2}$ . Write the equation of the line by substituting  $b$  and  $m$  into  $y = mx + b$  which results in  $y = \frac{5}{2}x + 5$ .
15. D. Use any two points to find the slope by substituting into  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . For example, using the points  $(-4, -3)$  and  $(-2, 0)$  yields  $m = \frac{0 - (-3)}{-2 - (-4)} = \frac{3}{2}$ . Substitute  $m$  into  $y = mx + b$  which yields  $y = \frac{3}{2}x + b$ . Use any point to find  $b$  by substituting in  $x$  and  $y$ . For example, using the point  $(-4, -3)$  yields  $-3 = \frac{3}{2}(-4) + b$  and results in  $b = 3$ . Substitute  $b$  into the equation which results in  $y = \frac{3}{2}x + 3$ .

16. E. Identify the  $y$ -intercept ( $b$ ) of the line which yields  $b = -1$ . Identify the slope ( $m$ ) of the line which yields  $m = -\frac{1}{3}$ . Write the equation of the line by substituting  $b$  and  $m$  into  $y = mx + b$  which results in  $y = -\frac{1}{3}x - 1$ .
17. C. Use any two points to find the slope by substituting into  $m = \frac{y_2 - y_1}{x_2 - x_1}$ . For example, using the points  $(-4, -3)$  and  $(-1, 3)$  yields  $m = \frac{3 - (-3)}{-1 - (-4)} = \frac{6}{3} = 2$ . Substitute  $m$  into  $y = mx + b$  which yields  $y = 2x + b$ . Use any point to find  $b$  by substituting in  $x$  and  $y$ . For example, using the point  $(-4, -3)$  yields  $-3 = 2(-4) + b$  and results in  $b = 5$ . Substitute  $b$  into the equation which results in  $y = 2x + 5$ .

## Quadratic Equations

1. A. One way to solve is to use the quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . The coefficients are  $a = 3$ ,  $b = 4$ , and  $c = 10$ . So,  $x = \frac{-6 \pm \sqrt{6^2 - 4(3)(10)}}{2(3)}$  which can be simplified as  $x = \frac{-6 \pm 4}{10}$ . Therefore, the possible solutions are  $\frac{-2}{10} = -\frac{1}{5}$  and  $\frac{-10}{10} = -1$ .
2. B. Move all of the terms to one side of the equal sign to yield  $x^2 - x - 12 = 0$ . Then find the factors of the equation; the equation can be rewritten as  $(x + 3)(x - 4) = 0$ . In order for the product to be equal to 0, one of the factors must also be equal to zero, so the solutions to the equation are  $-3$  and  $4$ .
3. A. We can complete the square to find the solution. In this case, find the square root of each side of the equation, or  $\sqrt{(x - 3)^2} = \sqrt{16}$ . So,  $x - 3 = \pm 4$ . Thus  $x = 7$  or  $x = -1$ .
4. C. We can factor out 3 from each term to yield  $3(x^2 - 8x + 12)$ . The expression in parentheses can be further factored as  $3(x - 2)(x - 6)$ . Since one of the factors must be equal to 0 for the whole expression to be equal to 0, the solutions are  $x = 2$  and  $x = 6$ .
5. E. If you picture the arc of the rock as the curve of a parabola on a graph, and the ground as the  $x$ -axis, then the place on the graph where the rock hits the ground is the intercept with the  $x$ -axis. The parabola intercepts the  $x$ -axis when  $y = 0$ , so we can find the answer by using the equation  $0 = -3x^2 + 15x + 18$ . We can factor out  $-3$  to yield  $-3(x^2 - 5x - 6) = 0$ . This can be further factored as  $-3(x + 1)(x - 6) = 0$ , so the possible solutions are  $-1$  and  $6$ . Since the intercept at  $-1$  represents 1 second before the rock was thrown, only  $6$  makes sense in context. Therefore, the time from when Dante throws the rock to when it hits the ground is 6 seconds.
6. D. This equation can't be easily factored, but we can complete the square. Adding 25 to both sides of the equation yields  $x^2 + 10x + 25 = 9$ . This can be rewritten as  $(x + 5)^2 = 9$ , so we can solve for  $x$  by taking the square root of both sides:  $\sqrt{(x + 5)^2} = \sqrt{9}$ . This yields  $x + 5 = \pm 3$ , so the solutions are  $x = -8$  and  $x = -2$ .
7. B. This equation can be rewritten as  $x^2 - x - 30 = 0$ . This equation can be factored as  $(x + 5)(x - 6) = 0$ . Since one of the factors must be equal to 0 for the whole expression to be equal to 0, the solutions are  $x = -5$  and  $x = 6$ .
8. A. This equation can't be easily factored, but we can complete the square. Adding 16 to both sides of the equation yields  $x^2 - 8x + 16 = 4$ . This can be rewritten as  $(x - 4)^2 = 4$ , so we can solve for  $x$  by taking the square root of both sides:  $\sqrt{(x - 4)^2} = \sqrt{4}$ . This yields  $x - 4 = \pm 2$ , so the solutions are  $x = 6$  and  $x = 2$ .
9. E. If you picture the arc of the rocket as the curve of a parabola on a graph, and the ground as the  $x$ -axis, then the place on the graph where the rocket hits the ground is the intercept with the  $x$ -axis. The parabola intercepts the  $x$ -axis when  $y = 0$ , so we can find the answer by using the equation  $0 = -x^2 + 7x + 8$  or  $x^2 - 7x - 8 = 0$ . This can be factored as  $(x + 1)(x - 8) = 0$ , so the possible solutions are  $-1$  and  $8$ . Since the intercept at  $-1$  represents 1 second before the rocket was launched, only  $8$  makes sense in context. Therefore, the time from when Amar launches the rocket to when it hits the ground is 8 seconds.
10. E. One way to solve is to use the quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . The coefficients are  $a = 2$ ,  $b = -7$ , and  $c = 5$ . So,  $x = \frac{7 \pm \sqrt{(-7)^2 - 4(2)(5)}}{2(2)}$  which can be simplified as  $x = \frac{7 \pm 3}{4}$ . Therefore, the possible solutions are  $\frac{10}{4} = \frac{5}{2}$  and  $\frac{4}{4} = 1$ .
11. B. This equation can be rewritten as  $x^2 - 7x - 8 = 0$ . This equation can be factored as  $(x + 1)(x - 8) = 0$ . Since one of the factors must be equal to 0 for the whole expression to be equal to 0, the solutions are  $x = -1$  and  $x = 8$ .
12. D. This equation can be rewritten as  $x^2 - 6x - 27$ . This equation can be factored as  $(x - 9)(x + 3) = 0$ . Since one of the factors must be equal to 0 for the whole expression to be equal to 0, the solutions are  $x = 9$  and  $x = -3$ .

13. D. This equation can be rewritten as  $x^2 + 10x + 21$ . This equation can be factored as  $(x + 3)(x + 7) = 0$ . Since one of the factors must be equal to 0 for the whole expression to be equal to 0, the solutions are  $x = -3$  and  $x = -7$ .
14. B. This equation can't be easily factored, but we can complete the square. Adding 49 to both sides of the equation yields  $x^2 - 14x + 49 = 36$ . This can be rewritten as  $(x - 7)^2 = 36$ , so we can solve for  $x$  by taking the square root of both sides:  $\sqrt{(x - 7)^2} = \sqrt{36}$ . This yields  $x - 7 = \pm 6$ , so the solutions are  $x = 13$  and  $x = 1$ .
15. D. If you picture the arc of the ball as the curve of a parabola on a graph, and the ground as the  $x$ -axis, then the place on the graph where the ball hits the ground is the intercept with the  $x$ -axis. The parabola intercepts the  $x$ -axis when  $y = 0$ , so we can find the answer by using the equation  $0 = -x^2 + x + 12$  or  $x^2 - x - 12 = 0$ . This can be factored as  $(x + 3)(x - 4) = 0$ , so the possible solutions are  $-3$  and  $4$ . Since the intercept at  $-3$  represents 3 seconds before the ball was kicked, only  $4$  makes sense in context. Therefore, the time from when Carlos kicked the ball to when it hits the ground is 4 seconds.

## Inequalities

- A. Subtract  $x$  and add 2 to  $5x + 6$  to isolate the variable.  $4y > 4x + 8$ . Divide both sides by 4:  $y > x + 2$ .
- D. You can find common denominators or use benchmark fractions to compare and find the correct answer. In this case,  $\frac{1}{2} > \frac{3}{8}$  and  $\frac{1}{2} < \frac{2}{3}$ . The other choices do not make the inequality true;  $\frac{1}{10} < \frac{3}{8}$  and  $\frac{7}{10}, \frac{3}{4}, \frac{5}{6}$  are greater than  $\frac{2}{3}$ .
- C. Isolate the variable. First add 2 to all terms:  $6 < -3x < 15$ . Then divide by  $-3$  and switch the signs:  $-2 > x > -5$ . Therefore,  $x < -2$  and  $x > -5$ .
- C. If Marsha's earrings cost \$3 and she sells them for \$12, then she makes a \$9 profit from each pair. So she needs to sell the number of pairs,  $e$ , multiplied by the profit \$9 to make \$300.
- E. Isolating the variable yields  $-1x < -14$ , or  $x > 14$  (dividing both sides by  $-1$  requires flipping the inequality sign).
- E. Isolate the variable.  $-2x \leq 10$ , or  $x \geq -5$ . (Dividing both sides by a negative requires flipping the inequality sign.)
- D. Isolate each variable. In the first inequality,  $6 \leq -2x$ , or  $-3 \geq x$ . (Dividing both sides by a negative requires flipping the sign.) In the second inequality,  $3x \leq 9$ , or  $x \leq 3$ . Combine the terms: if  $x \leq -3$  and  $x \leq 3$ .
- B. Simplifying the inequality yields  $mx > -20$ . If  $m = -4$ , and dividing both sides by  $-4$  changes the signs, then  $x < 5$ .
- D. Solve for  $x$  in the inequality. Simplifying yields  $-3x - 6 > x - 2$ , or  $-4x > 4$ , or  $-x > 1$ . Dividing both sides by  $-1$  requires flipping the signs, so  $x < -1$ . The graph of this inequality should have an open circle at  $-1$  and an arrow pointing to the right to show that the solutions for  $x$  include all rational numbers less than, but not including,  $-1$ .
- E. If the club spent \$200 and they want to make \$100 more than what they spent, then they need to make \$300. If they are selling tickets for \$8 each, multiply 8 by the number of tickets. Thus  $8t \geq 300$  for the club to make its goal.
- D. Isolate the variable. Simplifying the inequality yields  $48x + 8 \geq 3x - 1$ , or  $45x \geq -9$ . This yields  $x \geq -\frac{1}{5}$ .
- B. To isolate the variable, multiply both sides of the inequality by 6. This yields  $x \leq -3$ .
- C. Samantha can spend no more than \$20, so the sum of the base price of the cab and the number of miles multiplied by 2 must be less than or equal to \$20.
- B. Multiplying or dividing by a negative number flips the inequality, so dividing 25 by  $-5$  to isolate the variable will change the sign from  $<$  to  $>$ .
- C. Isolate the variables. Simplifying the inequality yields  $ax \leq -21$ . If  $a = -3$ , then dividing both sides of the inequality by  $-3$  yields  $x \geq 7$  (remember to flip the sign).
- D. You can find common denominators or use benchmark fractions to compare and find the correct answer. In this case,  $\frac{7}{10} > \frac{2}{9}$  and  $\frac{7}{10} < \frac{3}{4}$ . The other choices do not make the inequality true;  $\frac{1}{10} < \frac{2}{9}$  and  $\frac{4}{5}, \frac{9}{10}, \frac{9}{11}$  are greater than  $\frac{3}{4}$ .
- C. Multiplying or dividing by a negative number flips the symbol, so dividing 24 by  $-3$  to isolate the variable will change the sign from  $<$  to  $>$ .

## Scientific Notation

- D. Scientific notation is expressed by a number between 1 and 10 multiplied by 10 raised to a degree. When converting into scientific notation, moving the decimal point to the left indicates a positive power. Moving the decimal 4 places from 42900.0 to 4.29 indicates a power of 4.

- B.  $1 \div 8,000 = 0.000125$ . When converting into scientific notation, moving the decimal point to the right indicates a negative power. Moving the decimal 4 places from  $0.000125 \times$  to 125 indicates a power of  $-4$ .
- E. A positive power of 4 indicates a move of the decimal to the right 4 places; therefore, 0.0628 becomes 628.
- B. You cannot add these numbers because they are being raised to different powers.  $9.5 \times 10^6 = 9,500,000$  and  $5.9 \times 10^5 = 590,000$ . Their sum is 10,090,000, or  $1.009 \times 10^7$ .
- B.  $3.8 \times 5 = 19$ , therefore  $(3.8 \times 10^4) \times 5 = 19 \times 10^4$ . Convert this into proper scientific notation by moving the decimal 1 place to the left, which increases the power by 1.
- B.  $4.1^2 = 16.81$ . When raising a power to another power, multiply the exponents.  $(10^4)^2 = 10^8$ . Therefore,  $(4.1 \times 10^4)^2 = 16.81 \times 10^8$ . Convert into proper scientific notation by moving the decimal 1 place to the left, which increases the power by 1.
- E. You cannot subtract these numbers because they are being raised to different powers.  $7.3 \times 10^6$  expanded equals 7,300,000, and  $3.7 \times 10^5$  expanded equals 370,000.  $7,300,000 - 370,000 = 6,930,000$ , which in scientific notation is  $6.93 \times 10^6$ .
- D. Expand both numbers, subtract, and then convert into scientific notation.  $4.07 \times 10^7 = 40,700,000$ .  $6.378 \times 10^6 = 6,378,000$ .  $40,700,000 - 6,378,000 = 34,322,000$ , or  $3.4322 \times 10^7$ .
- A. To find the perimeter, find twice the length and twice the width, and add.  $2(9.2 \times 10^3) + 2(1.32 \times 10^4)$  or  $18.4 \times 10^3 + 2.64 \times 10^4$  which gives us  $18,400 + 26,400 = 44,800$ , or  $4.48 \times 10^4$ .
- B. Use division.  $\frac{4.4 \times 10^9}{1.1 \times 10^8} = 4 \times 10$ , or 40.

## Geometry & Measurements

### Pythagorean Theorem

- C. In the Pythagorean Theorem ( $a^2 + b^2 = c^2$ ),  $a$  and  $b$  are the legs of a right triangle, and  $c$  is the hypotenuse. So,  $c$  is the unknown side in this triangle. In other words,  $a = 5$  and  $b = 12$ , so  $5^2 + 12^2 = c^2$ .  $25 + 144 = 169$ , so  $c^2 = 169$ , and  $c = 13$ .
- B. We know the length of the base and we know the area of the triangle, but we don't know the height. We can find the height with the equation for the area of a triangle ( $\frac{1}{2}bh$ , or half the base times the height). This is  $9 = \frac{1}{2}(3)h$ . This simplifies to  $h = 6$ . Use the Pythagorean Theorem to find the length of the hypotenuse,  $c$ .  $c^2 = 3^2 + 6^2 = 9 + 36 = 45$ . Therefore,  $c = \sqrt{45} = 3\sqrt{5}$ .
- C. The Pythagorean Theorem relates to the lengths of the sides of right triangles. 3-4-5 triangles are common ( $3^2 + 4^2 = 5^2$  or  $9 + 16 = 25$ ), so we can reason that the same will hold true for multiples of 3, 4, and 5. Thus, 3, 4, and 5 are a Pythagorean Triple, as are 6, 8, and 10, and 9, 12, and 15, which is the same as  $\sqrt{81}$ , 12, and 15. Choice B is also a Pythagorean Triple, because squaring each number yields  $5 + 7 = 12$ . However,  $6^2 + 10^2 \neq 24^2$ , so this set is not a Pythagorean Triple.
- C. We can find the distance between these points by drawing a right triangle for which the line between the points is the hypotenuse. The two legs of the triangle would meet at the point  $(7, -6)$ , so  $a = 4$  units and  $b = 12$ . Apply the Pythagorean Theorem to find the length of the hypotenuse:  $4^2 + 12^2 = c^2$ . So,  $c^2 = 16 + 144 = 160$ . Therefore,  $c = \sqrt{160}$ , which we can rewrite as  $4\sqrt{10}$ .
- A. We can find the distance between these points by drawing a right triangle for which the line between the points is the hypotenuse. The two legs of the triangle could meet at the point  $(3, -3)$ , so  $a = 8$  and  $b = 2$ . Apply the Pythagorean Theorem to find the length of the hypotenuse:  $8^2 + 2^2 = c^2$ . Therefore,  $c^2 = 64 + 4$  and  $c = \sqrt{68} = 2\sqrt{17}$ .
- C. We can find the missing sides first by applying the equation for area of a triangle ( $\frac{1}{2}bh$ , or half the base times the height) to find the missing height.  $16 = \frac{1}{2}(4)h$ . This simplifies to  $h = 8$ . To find the missing hypotenuse, apply the Pythagorean Theorem:  $c^2 = 4^2 + 8^2 = 16 + 64 = 80$ . So  $c = \sqrt{80} = 4\sqrt{5}$ . The perimeter is equal to the sum of the sides, or  $4 + 8 + 4\sqrt{5} = 12 + 4\sqrt{5}$ .
- A. We can find the distance between these points by drawing a right triangle for which the line between the points is the hypotenuse. The two legs of the triangle would meet at the point  $(-3, 2)$ , so  $a = 4$  units and  $b = 6$ . Apply the Pythagorean Theorem to find the length of the hypotenuse:  $4^2 + 6^2 = c^2$ . So,  $c^2 = 16 + 36 = 52$ . Therefore,  $c = \sqrt{52}$ , which we can rewrite as  $2\sqrt{13}$ .
- A. We can find the distance between these points by drawing a right triangle for which the line between the points is the hypotenuse. The two legs of the triangle would meet at the point  $(-5, -2)$ , so  $a = 10$  and  $b = 8$ . Apply the Pythagorean Theorem to find the length of the hypotenuse:  $10^2 + 8^2 = c^2$ . Therefore,  $c^2 = 100 + 64$  and  $c = \sqrt{164} = 2\sqrt{41}$ .

9. E. We can find the missing sides first by applying the equation for the area of a triangle ( $\frac{1}{2}bh$ , or half the base times the height) to find the missing height.  $6 = \frac{1}{2}(4)h$ . This simplifies to  $h = 3$ . To find the missing hypotenuse, apply the Pythagorean Theorem:  $c^2 = 3^2 + 4^2 = 9 + 16 = 25$ . So  $c = \sqrt{25} = 5$ . The perimeter is equal to the sum of the sides, or  $3 + 4 + 5 = 12$ .
10. A. We can find the missing sides first by applying the equation for the area of a triangle ( $\frac{1}{2}bh$ , or half the base times the height) to find the missing height.  $14 = \frac{1}{2}(4)h$ . This simplifies to  $h = 7$ . To find the missing hypotenuse, apply the Pythagorean Theorem:  $c^2 = 4^2 + 7^2 = 16 + 49 = 65$ . So  $c = \sqrt{65}$ . The perimeter is equal to the sum of the sides, or  $4 + 7 + \sqrt{65} = 11 + \sqrt{65}$ .
11. B. The shortest distance between  $X$  and  $Y$  is the diagonal between them. We can create a triangle with that diagonal as the hypotenuse, the 5-inch length as one leg, and the distance from  $X$  to the point below  $Y$  as the other leg. This is 5 in because its legs are 3 and 4, forming a Pythagorean triple. Thus, the diagonal from  $X$  to  $Y$  has legs of 5 and 5. This leaves us with  $25 + 25 = c^2$ , or  $50 = c^2$ . Taking the square root leaves us with  $\sqrt{25} \times \sqrt{2} = 5\sqrt{2}$ .
12. E. The ladder and its distance from the building make a right triangle with the building, so finding the height of one story is like finding the unknown leg of a right triangle. We can use the equation  $4^2 + b^2 = 16^2$ , which simplifies to  $b^2 = 256 - 16 = 240$ . So,  $b = \sqrt{240}$ , which can be rewritten as  $4\sqrt{15}$ . This is the height of the first story, so the height of the entire 4-story building is  $4 \times 4\sqrt{15} = 16\sqrt{15}$ .

## Perimeter, Area, Volume

1. D. Since the square has a side length of 8, its area must be 64. The diameter of the circle is equal to the side length of the square, so its diameter is 8 and its radius is 4, so its area is  $16\pi$ . The shaded region is the difference in the areas of the square and the circle, giving us  $64 - 16\pi$ . Notice we cannot simply divide by 4, since this is not an equation.
2. B. The right triangle has legs 8 and 6, so its area is  $\frac{1}{2}(8)(6) = 24$ . Its hypotenuse is the circle's diameter. We can use the Pythagorean Theorem to find its length, which is 10, so the circle has a radius of 5 and an area of  $25\pi$ .
3. E. The width of the rectangle is 7, so the perimeter is  $2(8 + 7) = 30$ .
4. C. The missing width is 4 mm and the missing height is 14 mm. We can split the shape into two rectangles, one with dimensions 14 and 4, the other with dimensions 7 and 3, for a total area of  $(14)(4) + (7)(3) = 56 + 21 = 77$ .
5. D. The 7cm side has a matching side on the left, and the 2 cm side also has a matching side on the left. There are two horizontal sides missing their lengths. We do not know what each length is, but we know that they add up to 9, so the total perimeter is  $2(7) + 2(2) + 12 + 3 + 9 = 42$ .
6. B. If the area of the circle is  $100\pi$ , then its radius must be 10 and its diameter must be 20, so its circumference is  $20\pi$ .
7. C. The hash marks show that two sides are congruent, so the triangle is isosceles, and the two congruent sides are each 10. We can split any isosceles triangle down the middle into two congruent right triangles. Here, each right triangle has a base of 6 and a hypotenuse of 10. We can use the Pythagorean Theorem to find the height, which is 8, so the area of the entire triangle is  $\frac{1}{2}(12)(8) = 48$ .
8. E. The garden will have two lengths of 63 and four lengths of 21, for a total fencing length of  $2(63) + 4(21) = 210$ .
9. B. If Circle  $X$  has a circumference of  $\pi$ , then its diameter must be 1, and its radius is 0.5. If Circle  $Y$  has a circumference of  $4\pi$ , then its diameter must be 4, and its radius is 2. The difference in their radii is therefore  $2 - 0.5 = 1.5$ .
10. D. If the perimeter is 36, then the side lengths must be 9, so the area is  $9(9) = 81$ .
11. B. If the area is 36, then the side lengths must be 6, so the perimeter is  $4(6) = 24$ .
12. D. The height shown splits the isosceles triangle into two congruent right triangles, each with base 5 and height 12. We can use the Pythagorean Theorem to find the hypotenuse, which is 13, so the perimeter is  $13 + 13 + 10 = 36$ .
13. D. The placemat has an area of  $144\pi$  square centimeters, while the dinner plate, has an area of  $64\pi$  square centimeters. The difference in area is  $80\pi$  square centimeters.
14. D. Since triangle  $ABC$  has legs 6 and 8, we can use the Pythagorean Theorem to find the length of the hypotenuse, which is 10, and its perimeter is 24. Since triangle  $XYZ$  is similar and has a hypotenuse of 30, the scale factor is 3, so its side lengths are 18, 24, 30, and its perimeter is 72. The difference between the perimeters is  $72 - 24 = 48$ .

15. A. The cube root of 64 is 4, so if the volume of a cubic box is 64 inches cubed, its side length is 4 inches.
16. D. The volume of the larger box is 120 cubic centimeters. The volume of the smaller box is 60 cubic centimeters. The difference is 60 cubic centimeters.
17. B. Using the formula for volume of a rectangular prism,  $5 \times 11 \times L = 385$ . This simplifies to  $55L = 385$ , so  $L = 7$ . The length of the box is 7 inches.
18. D. All answer choices multiply to 504 except for 16, 9, and 4, which multiply to 576.
19. C. The answer is 49 cubic inches. 49 equals  $7^2$ . It only has three divisors, 1, 7, and 49. Their product is 343, which does not equal 49. This would be the only possible volume for any rectangular prism with each side length being a number of inches equal to a divisor of 49.
20. C. The volume of a triangular prism is the area of the base times the length of the prism. This is  $\frac{1}{2}(7)(4)(6) = 84$ .
21. A. If  $hw = 6$ ,  $hl = 10$ , and  $lw = 15$ , then multiplying everything together results in  $(lhw)^2 = 900$ , so  $lhw = 30$ . (Ignore  $-30$ , as volume cannot be negative.)
22. E. If the base of the larger cube is 60, each side length must be 15. This means you can fit 5 of the smaller cubes along each dimension, for a total of  $(5)(5)(5) = 125$  small cubes.

## Problems Using Shapes and Angles

1. A. An exterior angle is the angle between any side of a shape, and a line extended from the next side. For an interior right angle, the exterior angle will be  $90^\circ$ .
2. C. The sum of all angles of a hexagon is  $720^\circ$ . A regular hexagon has 6 equal angles, so each one is equal to  $720 \div 6 = 120^\circ$ .
3. C. The triangle inequality theorem states that a side of a triangle has to be less than the sum of the other two sides, or  $|a - b| < c < a + b$ . The only list of sides for which this is true is C.
4. A. First,  $45^\circ$  represents  $\frac{1}{8}$  of the circle (since there are  $360^\circ$  in the circle, and  $360 \div 45 = 8$ ), so the area of the shaded region will be  $A = \frac{1}{8}(\pi r^2)$ .  $AB$  is a radius of the circle, so we know the value of  $r$ .  $A = \frac{1}{8}\pi(12)^2 = 18\pi$ .
5. E. Because the lines are parallel, the angle that measures  $72^\circ$  is supplementary to the angle that measures  $3x^\circ$ , so  $180 - 72 = 3x$ , which simplifies to  $x = 36$ .
6. B. Triangles are similar when their angles are congruent and their sides are proportional. In this case, the sides can be shown in the proportion  $\frac{6}{10} = \frac{x}{20}$ . So,  $x = 12$ .
7. C. An isosceles triangle has 2 congruent angles. Since we are told the triangle has exactly one angle measuring  $42^\circ$ , then we know we are looking for one of the other two congruent angles. The sum of angles in a triangle is  $180^\circ$ , so the third angle must be  $42 + 2x = 180^\circ$ , or  $138 \div 2 = 69^\circ$ .
8. E. This triangle has height  $h$  and base  $h - 4$ .  $A = \frac{1}{2}bh$ , so  $A = \frac{1}{2}h(h - 4)$ , or  $\frac{1}{2}(h^2 - 4h)$ .
9. A. The arc measure is equal to the number of degrees of the arc's angle. The measure of this angle is equal to the arc measure of  $\angle AB$  and  $\angle BC$ , or  $80 + 40 = 120$ .
10. E. Since  $PR = RQ$ ,  $7b - 3 = 5b - 1$ . Simplifying yields  $2b = 2$ , so  $b = 1$ . The total length of segment  $PQ$  is therefore  $7(1) - 3 + 5(1) - 1 = 8$ .
11. E. The sum of angles in a quadrilateral is  $360^\circ$ . There are two  $46^\circ$  angles in this parallelogram, so the sum of the remaining angles is equal to  $360 - 2(46) = 268$ . The remaining two angles are congruent, so each is equal to  $268 \div 2 = 134^\circ$ .
12. B.  $XC$  passes through centroid  $Q$ . The other lines are either part of the perimeter of the triangle or do not pass through the point.
13. D.  $\angle CEB$  and  $\angle AED$  are opposite angles and thus congruent. If  $x$  is the measure of  $\angle CEF$ , then  $82 = 24 + x$  and  $x = 58^\circ$ .
14. D. The sum of all angles of an octagon is  $1,080^\circ$ . A regular octagon has 8 equal angles, so each one is equal to  $1,080 \div 8 = 135^\circ$ .
15. C. In the figure, the angle that measures  $74^\circ$  is supplementary with the adjacent angle, so  $74 + 2x = 180$  and  $x = 53$ .
16. D. You can use the sum of triangle angles and supplementary angles to solve. Working right to left, the angle supplementary to  $120^\circ$  is equal to  $60^\circ$ . So the triangle on the right has angles that measure  $60 + 86 + ? = 180$ . The unknown angle is 34. The bottom right angle in the left triangle can be shown with the equation  $34 + 96 + ? = 180$ . The unknown angle here is 50. So  $x$  can be found via the equation  $50 + 36 + x = 180$ .  $x = 94^\circ$ .

17. D. Segment  $BD$  creates two congruent triangles. Because the sum of the angles in a triangle is  $180^\circ$ , the measure of  $\angle ADB$  is  $180 - 35 - 70 = 75^\circ$ .  $\angle BDC$  is congruent to  $\angle ABD$  so  $\angle ADC$  measures  $35 + 75 = 110^\circ$ .
18. B. If  $A$  is the center of the circle, then  $AC = AB$ .  $AC$  and  $AB$  represent the base and height of the right triangle, so we can apply the formula  $A = \frac{1}{2}bh$  to find the area.  $A = \frac{1}{2}(8)(8) = 32$ .
19. A. One way to solve the problem is to use supplementary angles. The 3 angles above the horizontal line are supplementary. Since the right angle is equal to  $90^\circ$ , the sum of the other two angles must be  $90^\circ$ . You can represent this  $5x = 90 - 65$ , which simplifies to  $x = 5$ .

## Coordinates

1. A. Parallel lines have the same slopes. If the line is in  $y = mx + b$  form,  $m$  represents the slope. So the slope of the line is 2.  $7 = 4(2) + b$ , so  $b = -1$ . The equation of the line is  $y = 2x - 1$ .
2. C. The base of the right triangle is 4, and the height to this base is 5. So the area is half base  $\times$  height, or 10.
3. A. The slope of the new line must be  $\frac{1}{4}$ , the negative reciprocal of  $-4$ . To find the equation of the new line,  $y = \frac{x}{4} + b$ . Since  $(8, 3)$  is on the line,  $3 = 2 + b$ , so  $b = 1$ . For the  $x$ -intercept, set  $y = 0$ .  $0 = \frac{x}{4} + 1$ .  $-1 = \frac{x}{4}$ , so  $x = -4$ .
4. B. The center is 3 units up/down and 3 units right/left from any of the four vertices. Since the center is at  $(4, 1)$ ,  $(7, 4)$  is one of the four vertices. The other three are  $(7, -2)$ ,  $(1, 4)$ , and  $(1, -2)$ .
5. C. Only  $(0, -3)$  solves this inequality. The point  $(1, -3)$  would be another solution if there was an equals sign instead of an inequality sign.
6. B. Set  $3x + 4$  equal to  $5x - 2$ . Subtract  $3x$  from both sides and add 2 to both sides to obtain  $2x = 6$ . Now divide both sides by two to get  $x = 3$ . Plug that value into either of the two equations at the top and get  $y = 13$ . The point  $(3, 13)$  is the correct answer. Be careful to keep the  $x$  and  $y$  coordinates in the right order and not choose C.
7. C. Use the distance formula. The difference between 4 and  $-1$  is 5. The difference between 4 and negative 8 is 12.  $25 + 144 = 169$ , which is the square of 13.
8. E. The distance between the first two points is 14. Between the first and third point it is the square root of  $25 + 144$ , or 13. Between the second and third point, use the distance formula again to obtain  $d^2 = \sqrt{(14 - 5)^2 + 12^2} =$  the square root of  $81 + 144$ , which equals 15. Therefore, the perimeter is  $13 + 14 + 15$ , which is 42.
9. C. One base measures 4, the other measures 6. The height is 4. So the average of the bases is 5. Multiply this by the height to get the area, 20.
10. D.  $3^2 + 4^2 = 25$ , the square of 5. All the other distances are irrational.

## Transformations

1. A.  $(4 - 2, 2 + 3)$ , or  $(2, 5)$ .
2. A. We know that point  $P$  begins in quadrant I, and that if it is reflected twice, first across the  $y$ -axis (ending up in quadrant II), then across the  $x$ -axis, it will end up in quadrant III, where all coordinates are negative. This rules out all but the first and last choices.
3. E. Since we know that the  $x$ -axis translation moved  $R$  from 7 to  $-1$ , we know there was a total change of 8. So,  $t = 8$ . This means  $8 + 1 = 9$ , the number of units down from 5. This is  $5 - 9 = -4$ .
4. B. Reflecting across the  $x$ -axis negates the  $y$ -coordinate and does nothing to the  $x$ -coordinate. Then translating 3 units leftward subtracts three from the  $x$ -coordinate.
5. C.  $(6, 8) = (-x, y + 4)$ .  $x = -6$  and  $y = 4$ .
6. D. Focus on point C. From the reflection, it becomes  $(4 - 0, 3)$ , and then from the translation it becomes  $(4, 3 + 2)$ .  $(4, 5)$  is correct.
7. E.  $(-5, 9) = (-x, -2 - y)$ .  $x = 5$  and  $y = -11$ .
8. C. First  $(4, 7)$  becomes  $(-4, -7)$  from the rotation of  $180^\circ$ . Then the translation 2 units up moves it to  $(-4, -5)$ .
9. B. When a point is rotated  $90^\circ$  counterclockwise,  $(x, y)$  becomes  $(-y, x)$ . So  $(4, 2)$  becomes  $(-2, 4)$ . Then it moves 2 units leftward and becomes  $(-4, 4)$ .
10. D. The length of the base is 4, and the height is 6. So the area of the triangle is 12, since that is  $\frac{1}{2} \times$  base  $\times$  height. Both height and base are multiplied by 2, so area is multiplied by 4. The answer is 48.
11. C. First, every coordinate of the triangle is multiplied by 3. B dilates from  $(2, 3)$  to  $(6, 9)$ . Then, the  $y$ -coordinate is altered by  $+2$ , so  $(6, 9)$  becomes  $(6, 11)$ .

12. A. The parallelogram's area equals base  $\times$  height, so if both base and height are cut by a factor of  $\frac{1}{4}$ , the area will be cut by a factor of  $\frac{1}{16}$ .  $\frac{1}{16}$  of 64 is 4.

## Slope

1. C. This equation is already in slope-intercept form  $y = mx + b$ , where  $m$  represents the slope. Therefore, the slope is  $\frac{5}{7}$ .
2. D. Rearrange the equation into slope-intercept form  $y = mx + b$ .  $-5y = -7x + 30$  or  $y = \frac{7}{5}x - 6$ .
3. D. Parallel lines have equal slopes. Rearrange the equation into slope-intercept form to first find the slope.  $4y = -12x + 10$  so  $y = -3x + \frac{5}{2}$ . The slope is  $-3$ ; equation D also has a slope of  $-3$  because  $-9$  (the  $x$  coefficient) divided by  $3$  is  $-3$ .
4. B. Rearrange the equation into slope form.  $8y = -3x + 12$  or  $y = -\frac{3}{8}x + \frac{3}{2}$ .
5. C. Use the slope formula  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$  and plug in the coordinates to find the slope.  $\frac{-2 - 0}{0 - 5} = \frac{-2}{-5} = \frac{2}{5}$ .
6. D. Use the slope formula  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$  to solve for the missing  $x$ -coordinate. Plug in the coordinates that are given, and set the equation equal to the slope.  $\frac{4 - 7}{x - 1} = \frac{1}{2}$  so  $\frac{-3}{x - 1} = \frac{1}{2}$  and  $-6 = x - 1$  so  $-5 = x$
7. A. Parallel lines have equal slopes. Rearrange the equation into slope-intercept form to first find the slope.  $2y = x + 5$  or  $y = \frac{1}{2}x + \frac{5}{2}$ . The slope is  $\frac{1}{2}$ . Equation A also has a slope of  $\frac{1}{2}$ .
8. D. Rearrange the equation into slope-intercept form to first find the slope.  $-5y = -8x + 20$  or  $y = \frac{8}{5}x - 4$ . Since perpendicular lines have slopes that are negative reciprocals of each other, the slope of a perpendicular line must be  $-\frac{5}{8}$  as shown in equation D.
9. A. Rearrange the equation into slope-intercept form.  $3y = -\frac{1}{2}x + 6$  or  $y = -\frac{1}{6}x + 2$ . The slope is  $-\frac{1}{6}$ .
10. D. Use the slope formula  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$  and plug in the coordinates to find the slope.  $\frac{5 - 8}{10 - 0} = -\frac{3}{10}$ .
11. C. Use the slope formula  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$  to solve for the missing coordinates. Plug in the coordinates that are given, the variable  $k$  for the missing coordinates, and set it equal to the slope.  $\frac{k - 6}{-2 - k} = \frac{3}{5}$  or  $5(k - 6) = 3(-2 - k)$ . This simplifies to  $5k - 30 = -6 - 3k$ , or  $8k - 30 = -6$  and finally  $8k = 24$ , which leads to  $k = 3$ .

## Spatial Reasoning

1. A. The top of cylinder is a circle but providing a cross-section on a slant does not create a circle; the shape becomes distorted into an ellipse.
2. B. There are 20 ways to choose 3 objects from a group of 6. However, three combinations are illegal, since they involve three points on the same line.  $20 - 3 = 17$ . The possible triangles are: PQR, PQS, PST, PRU, PSU, PQU, PRT, PTU, QRT, QTU, QRS, QSU, QST, RSU, RST, and RTU.
3. E. Count each small triangle inside for a total of 9. There is the big triangle, making a total of 10. Then, there are 3 medium sized triangles, for a total of 13.
4. D. Use the Pythagorean theorem.  $8^2 + 15^2 = 289$ . 289 is the square of 17.
5. D. Each of the 3 squares on the left measure  $x$  by  $x$ . There are a total of 4 squares that measure  $2x$  by  $2x$ . There is only one way to make a square that measure  $3x$  by  $3x$ . This makes a total of 8 squares.
6. B. Notice that the bottom of the heart points to the side of the triangle. This is impossible in the first choice, since the hearts point toward each other, not toward the triangle. This is also impossible in the third choice, because of the same reason. In the last choice, the heart's bottom points toward the star, and in the fourth, the hearts bottom never point toward the triangle.
7. A. In the second choice, two arrows point in the same direction, but the third points away from it on the right. Orienting the net as a cube shows us that two of the middle arrows point in the same direction, but the arrow pointing away from the central line is on the wrong side. It is impossible for two arrows to point toward each other in this net, ruling out the third choice. The only two arrows to point in different directions run along the center of the net, and the arrow that points to the downward arrow is on the wrong side. The only two arrows pointing in the same direction are in the middle of the net, but no arrow will point to the one that follows the first.
8. D. We can see that the net must have the circle adjacent to the cross and the diamond. We can rule out the second and last choices because the circle and diamond are opposite. The first choice doesn't work because the circle is in the wrong place. We can rule out the third choice because the cross is opposite the

circle on the right, and the cross would be in the wrong place compared with the circle toward the bottom. The fourth choice works if we orient the net so the cross faces us, the circle is above it, and the bottom triangle wraps around next to the cross on top.

## Data Analysis & Probability

### Mean, Median, Mode

- B. Find the mean by adding all the ages, and then dividing by the number of people. The total of the ages is 290.  $290 \div 10 = 29$ .
- C. Find the median by rearranging the numbers in order from smallest to largest, then find the number that is in the middle of the set. For the set  $\{3, 5, 5, 8, 31, 36, 37, 38, 62, 65\}$  both 31 and 36 are the middle numbers; find the middle by adding them, and dividing by 2.  $\frac{31+36}{2} = 33.5$ .
- D. To find the range, subtract the smallest number from the largest number of the set. The largest number is 65, and the smallest number is 3.  $65 - 3 = 62$ .
- C. To find the mean, divide the number of visitors by the number of days. The total number of visitors is 483, and the number of days is 7.  $483 \div 7 = 69$ .
- B. Placed in ascending order, the data set becomes  $\{57, 57, 58, 59, 69, 95, 98\}$ . The middle number of this set is 59.
- A. The number 57 appears more often than any other number in this set.
- D. The largest number is 98, and the smallest number is 57.  $98 - 57 = 41$ .
- B. Jolene jogged an average of 4.5 miles per day during April, May, and June, which means that the total number of miles per day she jogged for these 3 months is 13.5 ( $4.5 \times 3 = 13.5$ ). Similarly, the total number of miles per day she jogged for July and August is 11 ( $5.5 \times 2 = 11$ ). Over this 5-month period, she jogged a total of 24.5 ( $13.5 + 11 = 24.5$ ). To find the average miles per day, divide 24.5 by 5.  $24.5 \div 5 = 4.9$ .
- A. If the first integer of this set is  $x$ , then the consecutive even integers are  $(x + 2)$ ,  $(x + 4)$ , and  $(x + 6)$ . Since  $x$  is the smallest number, solve for  $x$  by setting up an equation that shows the average of these integers equal to 53.  $\frac{x+(x+2)+(x+4)+(x+6)}{4} = 53$ , or  $\frac{4x+12}{4} = 53$ . This gives us  $x + 3 = 53$  and  $x = 50$ .
- B. Of the prices given, the range of the set is \$170 ( $\$240 - \$70 = \$170$ ). The total of the 5 prices is \$720, the mean of which is \$720 divided by 5.  $\$720 \div 5 = \$144$ .
- D. It is not necessary to write out all the factors of 24; since we know that 1 and 24 are factors, we know these would be the lowest and highest numbers in the factor set.  $24 - 1 = 23$ .
- B. The set of prime numbers less than 20 are  $\{1, 2, 3, 5, 7, 11, 13, 17, 19\}$ . The two middle numbers are 7 and 11, so the median is 9.
- C. For a number to be added to a set and not affect the mean, the number must be equal to the mean. The total of the given set is 105.  $105 \div 7 = 15$ . If the number 15 were added to the set, it would not affect the mean.
- D. Listed in ascending order, this set is  $\{1, 2, 4, 8, 8, 9, 9\}$ , of which the median is 8. If another 8 were added, the median would remain 8.
- C. The sum of Susie's previous tests (375) plus her fifth test (95) is 470. Therefore, the mean of her five tests is  $470 \div 5 = 94$ .
- C. In order to score an average of 90 with four tests, Paul must score a total of 360 points ( $90 \times 4 = 360$ ). With his three tests, he has scored a total of 264 points ( $92 + 85 + 87 = 264$ ). Therefore, in order to reach the total of 360 points, he must score a 96 on his fourth test ( $360 - 264 = 96$ ).
- B. Over three tests, Brandon scored a total of 261 points ( $3 \times 87 = 261$ ). If after four tests, his average became 83, this means he scored a total of 332 points ( $4 \times 83 = 332$ ). To find the score of the fourth test, subtract the points of the three tests from the points of the four tests.  $332 - 261 = 71$ .

### Probability

- D. To find the probability of either of 2 independent events occurring, add the probabilities of each event.  $0.25 + 0.55 = 0.8$ . This can be written in percentages as  $25\% + 55\% = 80\%$ .
- D. To find the probability of 2 independent events both occurring, multiply the probability of each event. We know that  $P(\text{tie}) = 0.1$ . The probability of NOT winning is the same as  $P(\text{loss}) + P(\text{tie})$ , or  $0.6 + 0.1 = 0.7$ . Therefore,  $0.1 \times 0.7 = 0.07$ .
- D. There are 15 positive integers greater than 4 and less than 20. Of this subset, 6 numbers are prime (5, 7, 11, 13, 17, and 19). The probability of selecting one of these numbers is 6 out of 15, or  $\frac{2}{5}$ .
- A. The total number of attendees is 60. Since there are 10 female students, there is a 10 out of 60 chance that a female student is chosen, or  $\frac{1}{6}$ .

5. D. The total number of students surveyed is 200. The number of students who do not take biology or algebra is 56. Therefore, the probability of selecting a student who do not take biology or algebra is 56 divided by 200, or 28%.
6. D. The total number of cards is 30. Since there are 10 red cards in the deck, the chance of selecting a red card is 10 out of 30, or  $\frac{1}{3}$ .
7. C. To find the probability of 2 dependent events occurring, multiply the probabilities of each event. There is a 1 out of 3 chance that Sammy will be selected first; after that, there are only 2 choices left. There is now a 1 out of 2 chance that Betty will be chosen after Sammy.  $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$ .
8. D. The probability of selecting a card of any shape is 100%, or 1. Regardless of which card was chosen, there is now only one more shape of that type in the set; therefore, there is a 1 out of 7 chance, or  $\frac{1}{7}$ , of selecting the card of the same shape.
9. C. To find the probability of both events occurring, multiply the probabilities of each event.  $0.3 \times 0.4 = 0.12$ .
10. E. To find the probability of these 3 dependent events occurring, multiply the probabilities together.  $30\% \times 30\% \times 30\% = 2.7\%$
11. E. There are 12 beads in total. The chance of selecting a blue bead upon first try is 4 out of 12, or  $\frac{4}{12}$ . Of those remaining, the chance of selecting another blue bead is reduced to 3 out of 11, or  $\frac{3}{11}$ . To find the probability of both of these events occurring, multiply these probabilities together. Reduce  $\frac{4}{12}$  to  $\frac{1}{3}$ , then multiply  $\frac{1}{3} \times \frac{3}{11} = \frac{3}{33}$ , or  $\frac{1}{11}$ .
12. D. The total number of shoppers is 150. Of these, 40 were shopping for shoes, but not pants. The probability of randomly selecting one of these shoppers is 40 divided by 150, which simplifies to  $\frac{4}{15}$ .
13. B. If the probability of picking a blue plate is  $\frac{5}{12}$  out of a cabinet of 36 plates, this means that there are 15 blue plates in total. You can find this total by solving the proportion  $\frac{5}{12} = \frac{x}{36}$ . Since the question is asking for the number of plates that are NOT blue, subtract 15 from 36 to find 21.
14. B. Read the question carefully. The question states that the probability of picking a red apple is  $\frac{2}{3}$ . This means that the total number of apples must be evenly divisible by 3. There could be any number of total apples in the bucket, but the only one that works is one that is divisible by 3. The fact that some other number of green apples is added is irrelevant.
15. D. To find the probability of 2 dependent events occurring, multiply the probabilities of each event. The probability of Brad being chosen first is 1 out of 5, or  $\frac{1}{5}$ . There are now 4 names left; of these, the probability of Emily NOT being chosen is 3 out of 4, or  $\frac{3}{4}$ . Therefore,  $\frac{1}{5} \times \frac{3}{4} = \frac{3}{20}$ .

## Counting

1. A. For every place in the sequence, there are four possibilities. So, since there are four places for letters, there are  $(4)(4)(4)(4) = 256$  possibilities.
2. D. There are  $(6)(4)(5)$  possible animal/color/number combinations. That is 120 in total.
3. D. If you must pick two out of the eight, there are "8 choose 2" ways to do this, which can be calculated as  $\frac{8(7)}{2} = 28$ . (The formula for "n choose r" is  $\frac{n!}{(n-r)!(r!)}$ . When you are "choosing 2" out of a set of 2 or more, the formula is  $\frac{n(n-1)}{2}$ .)
4. B. All numbers in set A are relatively prime to all numbers in set B, so all products will be distinct. With that being said, there are 4 choices in set A and 3 choices in set B, so there are 12 possible distinct products.
5. B. There are 10 choices for the first digit, 26 for the letter, and 10 for the final digit.  $(10)(26)(10) = 2,600$ .
6. B. There are "5 choose 2" ways to pick a group of 2 from a set of 5. This is  $5(4) \div 2 = 10$ . Since two different groups of 2 must be chosen from two different groups of 5, the final answer is  $(10)(10) = 100$  different committees can be chosen.
7. A. You may list the possibilities out: ERED, EDER, ERDE, EDRE, DERE, REDE. There are 6 possibilities.
8. C.  $10(9) \div 2 = 45$ . There are 45 different pairs the teacher could pick.
9. C. The answer is "13 choose 2," which is  $13(12) \div 2 = 78$ , since you are "choosing" 2 states to visit out of the 13 original colonies.

10. E. There are 4 possibilities for the first digit, since leading zeroes are not permitted. Then there are 5 possibilities for both the second and third digits. This is  $4(5)(5) = 100$  possibilities in total.
11. C. If you are choosing 9 players to play, you are choosing 2 players to sit out. (That's why "n choose r" always equals "n choose n - r." So you have 11 players and you are choosing 2 to sit out. The answer is  $11(10) \div 2 = 55$ .
12. A. Of the six-letter combinations, the three A's can be in places (1, 3, 6) (1, 4, 6), (1, 3, 5) and (2, 4, 6). For each distinct placement of the A's, there are 6 ways to scramble the O, X, and C. Since there are four ways to place the A's, the correct answer is  $6(4) = 24$ .

## Set Theory

1. C. The correct answer is 24. To find the total number of students in the class, sum the number of students with glasses and the number of students with freckles. This gives  $10 + 12 = 22$ . Then, subtract the number of students with both as they have been counted twice. Finally, add the number with neither. This gives  $22 - 6 + 8 = 24$ .
2. C. The correct answer is 8. In the set of numbers from one through ten inclusive, there are 5 even numbers: 2, 4, 6, 8, and 10. The prime numbers in this set are 2, 3, 5, and 7. The union of these two sets gives: 2, 3, 4, 5, 6, 7, 8, and 10, which is 8 distinct integers in the union.
3. C. The correct answer is 17. Subtracting the intersection from the sum of the two sets results in the union of the sets:  $9 + 12 - 4 = 17$ .
4. C. The correct answer is 12. The union of two sets equals the sum of the sets minus their intersection. Here this means:  $18 = 11 + x - 5$ , where  $x$  is the number of elements in Set L. Rearranging to solve gives 12 as the correct answer.
5. D. The correct answer is 8. The number of integers in the union of two groups is the number of distinct integers in both groups. Here, the union of Sets A and B is:  $\{1, 2, 3, 4, 7, 8, 9, 10\}$  and this union contains 8 integers.
6. C. The correct answer is 10. The union of two sets equals the sum of the sets minus their intersection. Here this means:  $15 = 10 + x - 5$ , where  $x$  is the number of elements in Set B.
7. D. The correct answer is 9. To find the number of students who have both pets, first find the total students with a cat or a dog by adding:  $23 + 40 = 63$ . Then subtract the students who have neither pet from the total number of students:  $60 - 6 = 54$ . This shows there are 54 students who have a cat or dog or both. To obtain the number of students who have both, subtract 54 from 63 to get the final answer of 9.
8. B. The correct answer is 12. Sets N and O have the integers 3 and 9 in their intersection.  $3 + 9 = 12$ .
9. B. The correct answer is 5. First, subtract the number of pizzas with no toppings from the total to find the number of pizzas with toppings. This gives:  $25 - 4 = 21$ . Next, add the pizzas in the two categories to get  $8 + 18 = 26$ . Finally, subtract the number of pizzas with toppings from this sum:  $26 - 21 = 5$ . This is the number of pizzas with both toppings.
10. D. The correct answer is  $\{0, 1, 3, 9, 25\}$ . First, find the union of sets F and G, which is  $\{0, 1, 2, 3, 4, 9, 25\}$ . Then, find where this union has numbers in common with set H. This intersection of set H and the union of sets F and G is  $\{0, 1, 3, 9, 25\}$ .
11. C. The correct answer is 37. The union of Sets C and D is  $\{0, 1, 5, 6, 7, 8, 10\}$ . Taking the sum of these integers gives:  $0 + 1 + 5 + 6 + 7 + 8 + 10 = 37$ .
12. C. The correct answer is 5. The perfect squares less than or equal to 100 are: 1, 4, 9, 16, 25, 36, 49, 64, 81, and 100. Out of these, 5 integers end in a 4, 6, or 9. This means there are 5 elements in the intersection of these two sets.

## Reading Charts & Graphs

1. A. Percent change is calculated by dividing the amount of change by the original amount (converted to a percent). Thus, although the 50-59 year age group had the greatest decrease in the number of homeowners (14 million homeowners), the decrease in the number of 20-29 year-old homeowners (about 13 million homeowners) is a greater percentage of the initial number of homeowners. The former is about  $\frac{14}{67} = 20\%$  and the latter is about  $\frac{13}{33} = 40\%$ . Without calculating, we can see that because the numerators are approximately the same, the fraction with the smaller denominator will be the greater percentage change.
2. B. There are a total of 160 million homeowners in 2010 (that are represented on the bar graph). Of those, 33 million are aged 30-39. The percentage of homeowners aged 30-39 in 2010 is 33 million divided by 160 million (represented as a percent). This is closest to 20%.
3. C. This is the only interval in which the line of both populations have a negative slope.

4. E. In 2010 there are 40,000 women and 20,000 men. The difference between the two populations is  $40,000 - 20,000 = 20,000$ .
5. C. 90 students have one sibling, 30 students have no siblings, and the difference between the two numbers is 60.
6. B. \$1,000 was withdrawn over the course of 2016, and \$1000 is about 4.5% of \$22,000, which was the starting balance of the account in 2016.
7. D. The number of students who scored below a 65. All we know is that there are 2 students who scored between 60 and 69; there is no way of knowing the distribution of the students within that score bracket.
8. D. 3 students scored between 50 and 60 and 2 students scored between 60 and 70. Thus the total number of students who scored less than 70 is  $2 + 3 = 5$ .
9. A. 30 cans were collected in week 4 and 25 cans were collected in week 1. 30 is 5 more than 25; thus, 5 more cans were collected in week 4 than in week 1.
10. D. The number of cans decreased by 5 from week 1 to week 2. Percent increase/decrease is always calculated based on the initial or original quantity, so 5 out of 25 cans is 20%.

## Verbal – Synonyms

### Introductory

1. D. "Diagram" derives from the suffix "-gram", which has to do with something written (think "telegram"). So, we can confirm that it has to do with something written down or drawn. One uses an implement, like a pen or pencil to do the writing.
2. B. "Illegitimate" has the prefix "il-", which means "without." So "illegitimate" can be thought of as "without legitimacy." Something that is "legitimate" is "valid" or "lawful," so "illegitimate" means something that is not valid or lawful. "Unauthorized" means "unapproved" or "illegal."
3. A. Something that is "mature" has reached its most complete or established level, so something that is "immature" is still growing. This is because the prefix "im-" means "not" (think "impossible"). Something that is "undeveloped" is similarly not in its final form of development.
4. C. The prefix "post-" means "after," and "postpone" means to move to a later date, or rather, to move to "after." To "put off" is to schedule something for a later date.
5. A. "Prediction" includes the word "predict," which means to anticipate something. To "guess" is to speculate about something. We could also recognize the prefix "pre-," which has to do with "before," and the root word "diction," which has to do with words.
6. D. To "transfer" is to give something over. To "give" is to transmit something from one party to another. The prefix "trans-" has to do with movement or going across something (think "transportation").
7. B. "Unify" has the prefix "uni-," which means "one." To "unify" is thus to "bring together." To "put together" is to bring separate pieces together.
8. A. "Strengthen" is based on the word "strength," so to "strengthen" means to make stronger. "Fortify" means to toughen or harden something (think of a "fort").
9. E. "Disrespectful" includes the prefix "dis-," which means "not," so "disrespectful" means "not respectful." To not be respectful is to be rude. To be "impolite" is to be inappropriate or bad-mannered (recall that "im-" also means not, so we could say that being "impolite" is being "not polite").
10. E. "Distinctive" has the root word "distinct," which means unique. The suffix "-ive" means "having the nature of" or "full of." So, something distinctive is "full of distinction or uniqueness." To be "special" is to be individual in some way.
11. B. "Dismissive" means being unconcerned. Think of the word "dismiss," which means "send away," and recall the meaning of the suffix "-ive." To be "indifferent" is to be uncaring. To be "unsure" is to be indecisive, not uncaring.
12. E. To "emit" is to discharge something. This comes from the root word "mit", which is used in words like "transmit" and "remit," and means "send." To "give off" is to release something or send it. Don't confuse this with "omit," which means "leave out".
13. D. "Innovative" has the root word "innovate," which means to create something revolutionary. It derives from the root word "nova," which means "new" (think of a "renovation"). Something that is "groundbreaking" is new and against the norm. "Noteworthy" means special, but not necessarily radical.
14. B. "Export" has the prefix "ex-," which means "out" or "away from." The word also includes the root word "port," which means "carry" (think "portable"). So, to "export" is to "carry away from." Said differently, this is to "send to" someone else.

15. A. "Vacant" has the root word "vac," which means "empty" (think "vacuum"). To be "vacant" is to be unfilled. "Unoccupied" means "unpopulated" or "empty." A vacant store may be closed, but be careful to choose the closest meaning.
16. C. To "revitalize" something is to regenerate something, or refresh something and give new energy to something. Think of the prefix "re-," which means "again," and the root word "vita," which means "life" (which relates to energy). To "invigorate" is to stimulate something, or instill it with "vigor" (energy).
17. C. Where "subjective" means biased, its opposite, "objective," means unbiased, or balanced. To be "neutral" is to be impartial.
18. C. "Plausible" means likely, or probable. "Reasonable" means realistic, or believable.
19. E. To "preclude" is to prevent or prohibit. Think of the prefix "pre-," which means "before," and the root "clud," which means "shut" or "close" (think "exclude"). So, if we "shut" something out "before" we know anything about it, we are ruling it out.
20. B. "Subjugate" has the prefix "sub-," which means "lower." To "subjugate" someone is to make them lower than yourself. To "conquer" is to take over someone or something and make them lower than you.
21. C. To "aspire" is to desire or seek something. To "hope for" is to wish for something.
22. D. "Solidify" is based on the word "solid," so to "solidify" is to make something hard. To "reinforce" something is to make it stronger, or more supported.
23. A. To "boycott" is to shun or reject something. To "refuse" is to decline something, not buy it.
24. A. To "commemorate" something is to honor something through observance. When we "show respect," we are often paying tribute to, or showing admiration for something.
25. D. "Enthusiastic" comes from the word "enthusiasm," which means excitement. Someone who is "eager" is animated by strong feels of excitement and desire.
26. E. Something that is "formidable" is challenging or scary. "Intimidating" means threatening or nerve-racking.
27. D. To be "immune" is to be resistant to outside forces. Think of being immune to sickness. To be "invulnerable" is to be safe from harm, or invincible.
28. E. To "sacrifice" is to give something up loved or desired (think of sacrificing desserts as part of a diet!). To "forfeit" is to lose or surrender something. A sacrifice has a deeper meaning than a simple extermination, which is to get rid of something unwanted.
29. B. A "strategy" is an approach or a tactic. A "plan of action" is a scheme or outlined approach. A strategy can be used to navigate a conflict, and may involve rules, but remember not to choose associations when more direct synonyms are available.
30. E. "Unanimous" has the prefix "una-," which comes from a Latin word meaning "one." It also includes the root word "animus," which means "mind" (today, the word "animus" is it's own stand-alone word, which means "hatred," a feeling). To be "unanimous" is to be "of one mind." "United" means coming together as one.
31. B. To "affect" something is to influence it in some way. To "impact" something is to sway something or exert an impression on something.
32. A. To "alter" something is to make a change. To "amend" something is to adjust or modify. "Fix" is not the correct synonym because it has a positive connotation, whereas "alter" has a neutral one.
33. E. "Appropriate" means fitting or polite. Someone who is "proper" is well-mannered and acts according to established norms, which may or may not be "gentle" or "rough."
34. C. To "arrange" is to assemble, or coordinate (think of arranging a vacation or meeting). To "organize" is to structure something.
35. B. To "assess" something is to measure or analyze something. To "evaluate" is to judge or determine the quality of something.
36. E. To "demonstrate" something is to show how something works. To "reveal" is to show something. An argument is part of this, but not necessarily; one can simply show someone something without arguing.
37. B. To "devise" is to create or develop something, such as a plan. To "invent" is to generate something new.
38. A. "Effect" is a noun and describes the result or consequence of something. An "end product" is an outcome or consequence. "Affect" is a verb and means "to change."
39. E. A "critique" is an analysis or evaluation. An "assessment" is a review of something.
40. D. "Exclude" has the suffix "-clud" which means "close," so "exclude" can be taken to mean "to close out." To "deny" is to refuse or reject.
41. C. To "imply" is to indicate something rather than making an explicit statement. To "suggest" is to hint at something without being obvious.
42. B. To "influence" something is to impact or sway a result; another way of saying this is to say that one shapes a result. The act of shaping something is influencing how it is made.

43. D. To “inquire” is to seek information through asking. This word is related to “query,” which means “to ask.” To “question” is to request information.
44. D. An “intention” is a purpose or aim (think of “intent” or “intentional”). A “goal” is a desired outcome or aim.
45. B. “Interact” has the prefix “inter-,” which means “between,” so “interact” can be thought of as an “act” between more than one person. “Communicate” fits the bill here, since the other words could theoretically be completed without another person.
46. A. To “involve” is to encompass or engage something. To “include” is to contain or incorporate something. “Welcome” does denote inclusion but is not specific enough.
47. D. To “persuade” is to encourage someone to do something. To “convince” is to encourage or sway someone towards a belief or course of action.

## Intermediate

1. E. “Binary” has the prefix “bi-,” which means “two,” and word “binary” itself means consisting of two things. “Paired” denotes two things used together.
2. A. To “enact” is to bring about, or start. To “put in place” means to instate or establish.
3. D. A “hyperbole” is an overstatement (the prefix “hyper-” means “over,” “above,” and “excessive”). An “exaggeration” is a magnification beyond (over) the limits of truth.
4. E. “Rational” means sane, and the prefix “ir-” means “not,” so “irrational” means not sane, or illogical. Something that is “preposterous” is not reasonable. Don’t be confused by the similar prefix “in-” in “invaluable.”
5. B. The prefix “inter-” means “between.” “Interim” denotes an interval between two moments. Something that is “temporary” is short-lived and exists between moments.
6. B. “Micron” means minuscule and is based on the prefix “micro-,” which also means small. A “speck” is small bit or particle. A colossus is the opposite of a speck and is something huge (think “colosseum”).
7. C. “Monotony” has the prefix “mono-” which means “one,” or “single,” so “monotony” has the denotation of uniformity or sameness. A “lack of variety” indicates a lack of diversity or change, or uniformity. Note that “single ownership” is meant to confuse you because it includes the idea of “single.” However, ownership is denoted by the suffix “-opoly,” which in this case would be “monopoly.”
8. D. Something that is essential is vital, so “nonessential” means not vital. “Superfluous,” which has a prefix “super-” that means “above” or “beyond,” means unnecessary. Something superfluous is beyond necessary.
9. D. The prefix “peri-” means “around” (think of a “periscope” in a submarine) and “periphery” means around the outside. Something that is “outlying” lies on the outside.
10. D. The prefix “proto-” means “first,” and a “prototype” is a first model of something. A “mock-up” is a first draft.
11. B. “Subtlety” is related to the word “subtle,” which means being understated. Something with “nuance” is slight and indirect.
12. E. “Synchronize” has the root word “sync,” which means “together.” To “cooperate with” means to act together or as one. A dance or swimming may be synchronized, or it may not be. One example of synchronizing might be to stand or place something in a coordinated fashion, but this is not the best meaning of the word.
13. B. “Picturesque” means charming or pleasurable. Something that is “delightful” is pleasing to the senses.
14. D. To “exemplify” is to embody; think of an “example.” To “represent” is to show or typify.
15. B. To be “versatile” is to be multi-faceted and adaptable. The word includes the root “vers,” which means “to turn (think “reverse” or “convert”). “Flexible” means open to change, or able to change or turn easily.
16. C. “Contemptuous” contains the word “contempt,” which means intense dislike. Like the suffix “-ious,” “-ous” means that something is “full of” or “characterized by” something else. So, to be contemptuous is to be “full of dislike.” To be “derisive” is to be hateful, and is the only other intensely negative word (inflexible is slightly negative).
17. E. To “relinquish” is to let go of something. To “abandon” is to surrender something.
18. A. “Lucid” has the prefix “luc-,” which means “light.” Something that has light can be seen, and “lucid” means being understandable (or “seen” in a more figurative sense). To be “coherent” is to be clear and understood.
19. E. “Mandatory” contains the word “mandate,” which is a command, obligation, or requirement. Something that is commanded or obligated is “unavoidable.” This thing may or may not be reversible (or undone).
20. A. “Miniscule” has the prefix “mini-,” which means small. Something that is “infinitesimal” is incredibly small. The other choices do not pertain to the size of something.

21. E. "Pandemonium" means total mayhem. "Complete chaos" denotes something that is totally out of control.
22. A. "Paternal" has the prefix "pat-," which means father, and father has a connotation of care and safety. To be "protective" is to defend others from harm.
23. D. "Sentimental" contains the word "sentiment," which denotes feeling and emotion. "Emotional" means full of emotion and sensitivity.
24. D. The prefix "sub-" means "below" and the root word "terra" means "earth," so "subterranean" literally means "below the ground." "Underground" is the best answer.
25. B. To "envision" is to visualize something that may or may not be actually visible. To "imagine" is to picture or see something that is not immediately present.
26. A. Something that is "incontrovertible" is beyond question. "Undeniable" means unable to be denied or falsified, like something that is "beyond question."
27. B. "Precipitous" comes from the word "precipice," which means cliff; "precipitous" means being on a high ledge. Something that is "steep" is high up and cliff-like.
28. C. "Reciprocal" means something that is jointly experienced (think of the word "reciprocate). "Mutual" means something that is shared equally.
29. B. Something that is "eclectic" is diverse. "Varied" denotes a mixture of something.
30. E. "Jovial" means extremely happy. Somebody who is "merry" is full of joy. By using connotation, we can eliminate "garish" as too negative, and "rare" as too neutral.
31. D. "Tranquility" comes from the word "tranquil," which means "calm." "Peace" denotes something that is calm and still.
32. E. "Tumult" is mayhem. "Commotion" is any sort of disruption or chaos.
33. E. To "analyze" is to carefully examine something. "Scrutinize" means to inspect or study.
34. D. To "conceive" is to "come up with," or imagine. To "think up" means to generate an idea.
35. B. To "deduce" is to determine something through logical conclusions. To "figure out" is to infer something based on evidence.
36. B. "Significance" denotes something important, or something substantial. Something with "substance" has worth and meaning.
37. E. "Speculate" means to "gamble" or "guess without firm evidence." One might want to learn more about something so as to avoid speculating. If one knows for sure or understands deeply, then one does not need to guess randomly.
38. E. Something that is "counterfeit" is not authentic. "Phony" means fake, or disingenuous.
39. C. "Placid" means peaceful. "Calm" also denotes tranquility and quiet.
40. C. "Tangible" means something that is definite and concrete. "Real" denotes a similar certainty and perceptible quality.
41. C. An "enigma" is something that is perplexing, or doesn't make sense. A "mystery" is something that defies logic and certainty.
42. A. "Tenacious" has the root word "ten," which means "hold," so we can think of "tenacious" as meaning "holding on." "Resolute" means being firm or unyielding.
43. C. To "obliterate" means to demolish. To "destroy" is also to defeat or eliminate.
44. B. Something that is "tentative" is uncertain or reliant on specific factors. "Provisional" means conditional or unconfirmed.
45. E. To "curtail" is to limit something. To "pare down" is to curb or shorten something.
46. A. A "respite" is a break from any sort of duress. "Relief from" denotes a divergence from something difficult.
47. C. To "hinder" is to prevent. "Impede" means to obstruct or stop.

## Advanced

1. D. "Dissuade" is the opposite of "persuade" and means to discourage. To "deter" is to prevent something from happening.
2. E. Considering that the prefix "ex-" means "out," we can understand "exorcise" to mean to "bring out," or "purge." "Drive out" best captures this meaning. This may be associated with a scary action, but is not the closest meaning.
3. A. Something that is "extraneous" is beside the point – think of "extra" information. "Irrelevant" means unrelated.
4. E. The prefix "in-" means "in" and "nate" means "born," so taken together we can understand "innate" to mean something that is inherent or inborn. "Hereditary" denotes something that is existent from birth.

5. A. The prefix “mal-” means bad and “dict” means speak; “malediction” means a profanity. A “spiteful word” is a nasty word.
6. C. Something that is “ambiguous” is confusing or has more than one meaning (the prefix “ambi-” means “both” – think “ambidextrous”). The prefix “un-” means “not,” so “unambiguous” means “not confusing.” Something that is “clear” is straightforward.
7. E. To be “conscientious” is to be considerate and attentive. “Aware” matches this definition, since it means that one takes notice.
8. B. The prefix “chron-” relates to time and “chronic” means occurring over a long period of time. Something that is “lasting” is long-term. We sometimes associate “chronic” with “illness,” but this doesn’t necessarily mean “painful.”
9. D. “Cred” means “believe” and “incredulous” could be understood to mean “without belief” (since the prefix “in-” means “not”). Someone who is “doubtful” has a hard time believing something.
10. E. A “dictum” is an authoritative pronouncement. A “formal decree,” or an official ruling, is the best match. A “fervent idea” is close but not specific enough, since the root word “dict” pertains to an actual word, not just an idea.
11. D. The prefix “en-” means “cause,” and “engender” itself means to generate. When something is generated or created, it is brought about.
12. E. The prefix “omni-” means “all” and “potent” means powerful, so “omnipotent” literally means “all powerful.” “Almighty,” which means incredibly powerful, best matches this meaning. One who is omnipotent would certainly be effective (at something), but there is a difference between being powerful and using that power to do something. An omnipotent being might be “cosmic,” but not necessarily.
13. D. The prefix “pat-” means “father,” and “patronize” means “to belittle”; we can think of this as a father talking down to a child. To “condescend” is to demean someone.
14. B. “Empathy” is the quality of understanding another person’s experience (the suffix “-pathy” has to do with feelings, generally – think “sympathy” or “psychopathy”). “Compassion” means being considerate towards another and is the only word with a positive connotation that has to do with feelings.
15. B. “Cacophony” has the suffix “-phon” which means “sound”; “cacophony” means loud, chaotic sounds. A “din” is similarly a disruptive noise, and paired with “discordant,” the phrase “discordant din” denotes commotion.
16. B. The suffix “-scrib” means “write,” and the prefix “trans-” means “move between.” So, to transcribe is to literally move writing from one place to another, or to duplicate it. “Copy” best captures this meaning, since abridge and condense both suggest a change is being made.
17. D. “Inscription” contains “script,” which means “written,” and the word “inscription” means an engraving. A “carved message” is any sort of writing that is written into something else.
18. B. To “sensationalize” is to exaggerate something or make something more extreme. To “embellish” is to overstate something for dramatic effect. To sense is to feel, but sensationalize has a different feeling than just merely feeling.
19. E. “Protracted” means “elongated”; the prefix “pro-” can relate to doing something forward. The word contains the root “tract,” which has to do with dragging or pulling (think “tractor”). So, together, we can think of “protracted” as meaning “dragged forward,” or “extended.”
20. D. A “quandary” is a difficult problem. An “impossible dilemma” has a similar connotation of a predicament. This is a challenging word to remember. Consider that this word derives from “quando,” which means “when.” A question one might ask oneself when faced with a quandary is when it will be completed.
21. E. To “vacillate” is to fluctuate between two or more things. To “waver between” is to be indecisive.
22. C. “Acumen” denotes high intelligence and strong decision-making. The word shares a similar root as “acute,” which means “sharp,” though in this case, it is also accompanied by the root “men,” which has to do with thought. Thus, someone with a sharp mind is one with “good judgement.”
23. D. Something that is “auspicious” bodes well. “Favorable” means demonstrating promising results. One way to remember this is that the word begins with “au,” which is the symbol for gold (which is very good) on the periodic table, and is related to the word “aurum,” which is Latin for “gold.”
24. D. To “undulate” is to move in a wavelike motion. “Swell” denotes a growth in size similar to that of waves. Things that do not have to do with water can also undulate (like sound waves, for example).
25. C. Someone who is “articulate” is clear and understandable. “Eloquent” denotes a similar type of fluency and clarity.
26. C. The prefix “clar-” means “clear,” and the suffix “-ify” means to make. So, together, this is to “make clear,” which is the definition of “elucidate.” Note that “elucidate” contains the root “luc,” which has to do with light, or understanding.

27. A. To “complement” is to fit together nicely. To “harmonize with” is to match well. Do not confuse “complement” with “compliment,” the latter of which means to “flatter” or “commend.” Note that these two choices are similar enough to be eliminated out of hand.
28. D. Something that is “concise” is extremely short but may or may not be persuasive. “Pithy” means brief.
29. A. “Logical” has the root word “logic,” which means “reason,” and has to do with the mind. Something that is “cogent” is clear and rational, and also has to do with the mind, since it begins with the prefix “cog-,” which means “to learn” (think of “cognition,” or the act of thinking).
30. A. “Requisite” has the same prefix as “require,” and both words mean “obligatory.” Something that is “necessary” is essential.
31. E. Something that is “noxious” is unpleasant or harmful. “Disgusting” means sickening.
32. C. To “harangue” is to scold, or verbally abuse. To “berate” is to criticize passionately.
33. B. “Replete” means “full of,” or “fully supplied.” To be “sated” is to be satisfied or filled to excess.
34. E. “Reprehensible” means wrong or shameful. “Unacceptable” means improper or ill-suited.
35. A. To be “cynical” is to be incredibly negative. Someone who is “pessimistic” expects bad outcomes. Use connotations or word charges to eliminate choices.
36. D. “Poignant” means emotionally full or moving. Something that is “touching” is affecting.
37. E. “Terse” describes something that is brief. Something that is “brusque” is sharp and to the point.
38. D. “Languid” means relaxed and slow. “Leisurely” denotes an unhurried and peaceful manner.
39. E. Something that is “resplendent” is dazzling and stunning and sounds like “splendid.” “Glorious” can be used to describe something that is magnificent.
40. D. Something that is “ponderous” is heavy and burdensome. “Tedious” describes something that is wearying or tiresome. To “ponder” something is to think or contemplate something, but note that “contemplate” is a verb, and “ponderous” is an adjective. Something that one “ponders” or thinks seriously about can be said to be serious, or heavy, topic.
41. C. Someone who is “timorous” is scared (think of “timid”). To be “nervous” is to be worried.
42. E. “Obsolete” means old or out-of-date. Something that is “archaic” is ancient or outdated. Many electronics quickly become out-of-date, but don’t confuse the adjective for applicable nouns.
43. D. Someone who is “reticent” is restrained or quiet. “Taciturn” means reserved or introverted.
44. B. “Affable” means friendly and easy-going. Someone who is “pleasant” is warm and agreeable. Something laughable is ridiculous, and while an affable person may laugh a lot, they may not be ridiculous.
45. A. Someone who is “obsequious” attempts to gain favors through compliments because he or she is submissive. “Subservient” means submissive or servile.
46. B. The prefix “super-” means “higher in quality” or “above,” and “supercilious” means behaving in a superior manner. Someone who is “arrogant” believes herself to be better (higher) than others.
47. A. “Chicanery” is any sort of trickery. Use elimination. “Deception” comes from “deceive,” which means to mislead. This trickery may or may not be complicated or crazy.

## Verbal – Analogies

### Guided Practice – Antonyms

1. A. Optional is the opposite of required, so this is an antonym analogy. Vital, which means crucial, is the opposite of unimportant.
2. D. North is the opposite of south, so this is an antonym analogy. Black is the opposite of white.
3. D. Brief is the opposite of lasting, so this is an antonym analogy. Complete is the opposite of partial.
4. B. Benign, which means kind, is the opposite of malignant, which means hurtful, so this is an antonym analogy. Note that the prefix “ben-” means “good” (“beneficial”) and the prefix “mal-” means “bad” (“malicious” or “malware”). Pious, which means respectful, is the opposite of profane, which means rude.
5. E. Exuberant, which means excited, is the opposite of languid, which means unenergetic, so this is an antonym analogy. Fundamental is the opposite of superfluous, which means unnecessary (recall that the prefix “super-” means above, or in excess of). One who is boisterous is excited or energetic.
6. A. Merciful, or having mercy, is the opposite of pitiless, which means having no pity, so this is an antonym analogy. Merciless, which means without mercy, is the opposite of forgiving.
7. A. Eternal is the opposite of transitory, which means fleeting, so this is an antonym analogy. Quarrelsome describes someone who argues, and is the opposite of amenable, which means agreeable.
8. C. A malady, or illness, is the opposite of a cure (recall that “mal-” has a negative connotation), so this is an antonym analogy. Consensus, which means total agreement, is the opposite of disparity, or disagreement.

9. C. Verdant, which means fertile, is the opposite of barren, which means unfruitful, so this is an antonym analogy. Candid, which means fully honest, is the opposite of restrained.
10. D. Pretentious, which means conceited, is the opposite of modest, which means humble, so this is an antonym analogy. Ominous, which means threatening, is the opposite of promising.

## Guided Practice – Association

1. D. Open and sesame are paired together via the phrase “open sesame,” so this is an association analogy. Pretty and please follow a similar structure and are paired together via the phrase “pretty please.”
2. A. One might say “null and void,” as one might say “forgive and forget.” This is an association analogy. One mends a break, but this is in the opposite order.
3. D. Fun and games are associated via the phrase “fun and games,” so this is an association analogy. Supply and demand are associated via the term “supply and demand.”
4. B. The only relationship between under and weather is one that makes the saying “under the weather,” so this is an association analogy. While one uses a mouth to bite (a fish, perhaps), the only other saying that is idiomatic like the stem is “bite the bullet.”
5. C. Salesman and traveling are associated via the profession known as “traveling salesman,” so this is an association analogy. Pig and suckling are associated via “suckling pig,” which is a pig fed on its mother’s milk.
6. E. Another word for “meat from a lamb” is “mutton. Another word for “meat from a chicken” is “poultry.” This is an association analogy
7. D. Reference and obscure are often paired together in the phrase “obscure reference,” so this is an association analogy. Mythical and beast are often paired together in the term “mythical beast.”
8. B. A “walking” and “shoe” go together as “walking shoe,” so this is an association analogy. “Garbage” and “can” go together as “garbage can.”
9. A. “Meat from a pig” is referred to as “pork”, so this is an association analogy. Similarly, “meat from a cow” is referred to as “beef.”
10. E. Dagger and cloak are associated via “cloak and dagger,” which refers to mystery situations, so this is an association analogy. Mortar and brick are associated via the phrase “brick and mortar,” which refers to properties that have a physical presence.

## Guided Practice – Cause-and-Effect

1. D. The moon affects changes in tides, so this is a cause/effect analogy. Pigments, which are coloring matter, affect the colors of a given object. An orbit is a type of path.
2. E. Fertilizer generates growth, so this is a cause/effect analogy. Plants generate oxygen.
3. A. Flowers create nectar, so this is a cause/effect analogy. Wings are able to lift flying objects into the air. Bees is to pollen is incorrect because it does not follow the structure of the question stem.
4. E. A baker makes bread, so this is a cause/effect analogy. A reporter writes articles.
5. C. A lack of speed leads to cessation, which means slowing down or coming to an end, so this is a cause/effect analogy. A lack of humility, the act of being humble, causes arrogance, or being conceited.
6. C. A lack of rain leads to a drought, so this is a cause/effect analogy. A lack of light causes darkness.
7. A. A lack of balance causes instability, so this is a cause/effect analogy. A lack of community leads to isolation. Remember to match the order presented in the question-stem.
8. A. Training leads to proficiency, or expertise, so this is a cause/effect analogy. Disagreement leads to conflict. A resolution is a potential effect of a conflict.
9. C. Assurance leads to confidence, so this is a cause/effect analogy. Doubt leads to uncertainty.
10. A. Negligence, or being careless, does not lead to precision, so this is a cause/effect analogy. Confidence does not lead to hesitation. This is a type of outcome, but the word is too general to complete the stem.

## Guided Practice – Defining

1. C. A playwright writes a script, so this is definition analogy. An author similarly writes a novel. An actor plays a role, which is also a defining relationship, but author and novel is closer since it embodies the same defining relationship (to write).
2. B. A tower receives or sends a signal, so this is a definition analogy. A computer receives or sends an e-mail.
3. B. The moon orbits the earth, so this is definition analogy. The earth orbits the sun.

4. B. A mask obscures sight, so this is definition analogy. Fog obscures vistas, or landscapes.
5. D. A mechanic repairs a vehicle, so this is definition analogy. A blacksmith similarly repairs a horseshoe.
6. C. Hair is taken away by a barber during a haircut, so this is definition analogy. Writing is taken away by an eraser.
7. D. Vegetation sprouts from a garden, so this is definition analogy. Moss also sprouts from a rock. Notice that soil and seed are in the opposite order of the question stem.
8. B. A sorcerer says an incantation, or spell, so this is definition analogy. A monk says a prayer.
9. E. A shovel is used by an arborist, or tree surgeon, so this is definition analogy. A wheel is used by a driver. The wheel is found in a car, but is not used by the car itself.
10. C. A river comes together with other rivers at a confluence, so this is definition analogy. A street comes together with other streets at an intersection.

## Guided Practice – Degree/Intensity

1. D. Trickle is a less extreme version of deluge, or a flood, so this is a degree/intensity analogy. Singe is a less extreme version of char, which means to significantly burn.
2. D. Unlikely is a less extreme version of impossible, so this is a degree/intensity analogy. Vague is a less extreme version of incomprehensible, which means impossible to understand.
3. E. Red is darker version of pink, so this is a degree/intensity analogy. Black is a darker version of gray.
4. A. Smart is a less extreme version of omniscient, which means all knowing, so this is a degree/intensity analogy. Strong is a less extreme version of omnipotent, which means all powerful. Notice that being powerful and being weak are polar opposites, not different degrees of the same thing.
5. E. Small is a slightly less extreme and vaguer version of microscopic, so this is a degree/intensity analogy. Something that is big is less so than something that is capacious, which is also more specific. Notice that elephant and minutia are both nouns, while the question stem consists of two adjectives.
6. D. Dislike is a less extreme version of detest, so this is a degree/intensity analogy. Like is a less extreme version of adore. Conflict and fight are equally intense. One does not necessarily love when one empathizes.
7. C. A slow pace is a less extreme version of a glacial, or extremely slow, pace, so this is a degree/intensity analogy. Calm is a less extreme version of halcyon, which means tranquil.
8. B. A fib, or small lie, is a slightly less extreme version of a lie, so this is a degree/intensity analogy. Difficult is a slightly less extreme version of arduous.
9. B. Pesky is a less extreme version of insufferable (something that one cannot stand), so this is a degree/intensity analogy. Lengthy is a less extreme version of interminable, which means never-ending.
10. D. Plush, which means luxurious, is a more extreme version of comfortable, so this is a degree/intensity analogy. Indestructible is a more extreme version of durable. If it is indestructible, it is permanent, which is the opposite of temporary, not a more/less extreme version of it.

## Guided Practice – Function/Object

1. A. A pen is used to write, so this is a function/object analogy. A utensil is used to eat.
2. D. A caricature, or comical drawing, is used to ridicule, so this is a function/object analogy. A calculator is used to compute. Count is to abacus is incorrect because it does not follow the structure of the question stem.
3. A. A key is used to unlock something, so this is a function/object analogy. An edict, or announcement, is used to proclaim.
4. C. A sycophant, or a suck-up, flatters, so this is a function/object analogy. An emissary, or ambassador, represents a territory or organization.
5. B. A helmet is used to protect the head, so this is a function/object analogy. A flag is used to designate any sort of organization or territory. Clean is to soap and pinch is to tweezer are incorrect because they do not follow the structure of the question stem.
6. C. A harbor offers sanctuary, so this is a function/object analogy. An infirmary offers rehabilitation.
7. A. A benediction is a saying that carries very positive intention, or a blessing. This is just as a regulator provides control over something. So, this is a function/object analogy. Note that a therapist may provide calm, but this is in the opposite order as the question-stem.

- D. A compass helps to locate, so this is a function/object analogy. An epitaph, which is a statement made about someone who has passed away, is used to commemorate.
- D. A wing helps a flying object fly, so this is a function/object analogy. A nutrient helps a living organism sustain itself.
- E. A salve, or remedy, is used to relieve pain, so this is a function/object analogy. An incision is used to separate.

## Guided Practice – Grammar

- C. Man is a singular form of men, so this is a grammar analogy. Goose is a singular form of geese. Note that woman and women are in the wrong order when compared with the question-stem.
- A. Walk is plural, and walks is singular, so this is a grammar analogy. Are is plural, and is is singular.
- D. Sought is a past tense of seek, so this is a grammar analogy. Sold is a past tense of sell.
- A. Ran is a past tense of run, so this is a grammar analogy. Ate is a past tense of eat. Notice that go and gone are in the incorrect order.
- A. Flown is a past participle tense of fly, and flew is a past tense of fly, so this is a grammar analogy. Forbidden is a past participle of forbade.
- A. Did is the past tense of do, so this is a grammar analogy. Knew is the past tense of know.
- D. Cacti is the plural form of cactus, so this is a grammar analogy. Fungi is the plural form of fungus.
- C. Spoken is a past participle of speak, so this is a grammar analogy. Sprung is a past participle of spring.
- B. Stolen is a past participle of steal, so this is a grammar analogy. Stunk is a past participle of stink, while stank is the past tense of stink.
- B. Chose is a past tense of choose, so this is a grammar analogy. Blew is a past tense of blow.

## Guided Practice – Individual/Object

- B. A butcher uses a knife, so this is an individual/object analogy. A cook uses ingredients.
- A. A seamstress uses a thimble when sewing, so this is an individual/object analogy. An astronomer uses a telescope.
- E. A scientist uses a microscope, so this is an individual/object analogy. A maid uses a duster.
- E. A navigator uses a compass, so this is an individual/object analogy. A miller, or person who owns a grain mill, uses a grindstone.
- B. A pharmacist works with drugs, so this is an individual/object analogy. A mason (stone worker) works with hammers, which are used when building with stone. A designer uses fabric, but this is in the opposite order as the question stem.
- C. A soldier wields a rifle, so this is an individual/object analogy. A reaper (think of the “grim reaper”) wields a sickle, which is a type of blade.
- C. A sculptor uses a chisel, so this is an individual/object analogy. A stenographer, or someone who transcribes speech, uses a keyboard. Note that a cartographer uses maps, but this is in the wrong order.
- E. An extraterrestrial uses a spacecraft, so this is an individual/object analogy. A chemist uses a vial (and is a type of occupation; the person may or may not be mad or intelligent).
- B. An investigator works with clues, so this is an individual/object analogy. A linguist works with languages, which is more specific than merely thoughts or sounds.
- D. A tanner creates leather, so this is an individual/object analogy. A viper creates venom.

## Guided Practice – Noun/Verb

- E. Money is deposited, so this is a noun/verb analogy. An e-mail is typed.
- E. A bouquet is arranged, so this is a noun/verb analogy. Merchandise is purchased.
- E. A shopper makes a purchase, so this is a noun/verb analogy. A trickster connives, or comes up with a scheme.
- A. A bully intimidates, so this is a noun/verb analogy. A companion befriends others.
- A. An adversary competes against another competitor, so this is a noun/verb analogy. An accuser alleges, or makes an accusation.
- A. An attorney is an advocate for his/her client, so this is a noun/verb analogy. An employer compensates his/her employees. Rebel is to instigate is incorrect because an instigator is one who causes something, though this does not necessarily mean that that person disagrees with it.

7. A. An imperfection tarnishes, or taints, an object with its flaw, so this is a noun/verb analogy. A bulldozer razes, or destroys structures.
8. C. A tyrant, or oppressive ruler, dominates his/her subjects, so this is a noun/verb analogy. Rain falls down from the sky.
9. E. A roof protects the top of a structure, so this is a noun/verb analogy. A funnel is a cone-shaped object that directs the flow of liquid.
10. A. One validates, or confirms, a hypothesis, so this is a noun/verb analogy. One weaves a garment.

## Guided Practice – Part/Whole

1. C. An act is one section of a play, so this is a part/whole analogy. A stanza, or verse, is a section of a poem.
2. C. A lyric is a part of a song, so this is a part/whole analogy. A paragraph is a section of an essay.
3. A. A ship is one part of a fleet, or group of ships, so this is a part/whole analogy. A wolf is one part of a pack.
4. A. A strand of hair is one part of someone's hair, so this is a part/whole analogy. A drawer is one part of a dresser.
5. D. A mother is one individual within a family, so this is a part/whole analogy. A galaxy is one part of the universe, which is made up of many galaxies. Gun is to bullet is incorrect because it does not follow the structure of the question stem.
6. A. An accessory is one element of an outfit, so this is a part/whole analogy. A sole is one part of a shoe.
7. B. Many droplets make up a puddle, so this is a part/whole analogy. Many grains of sand make up a dune, or sand hill.
8. E. Many names make up a roster, so this is a part/whole analogy. A pupil is one part of an eye.
9. D. A room is one part of a home, so this is a part/whole analogy. A seat is one part of a theater.
10. B. A symbol is just one part of a cipher, or code, so this is a part/whole analogy. A worker is one part of a staff.

## Guided Practice – Purpose/Object

1. A. A glove is used to catch a baseball, so this is a purpose/object analogy. A net is used to catch butterflies.
2. E. A match is used to light a candle, so this is a purpose/object analogy. A brush is used to comb (detangle or groom) fur. Do not confuse the action with the object in this case. Note that tidy is a verb or adjective, but the question stems is noun to noun.
3. C. A violin is played with a bow, so this is a purpose/object analogy. A drum is played with a stick.
4. C. A shovel is used to move snow, so this is a purpose/object analogy. A spoon is used to "move" or scoop soup.
5. C. An eraser is used to clear paper, so this is a purpose/object analogy. A broom is used to clear the ground.
6. D. The object of a basketball is to be shot into a hoop, while the object of an arrow is to be shot at a target, so this is a purpose/object analogy. Both question words are nouns, so we can eliminate write and ensnare. A photograph is a type of image, and a barometer is used to detect pressure, not temperature.
7. B. A rag is used to clean up a mess, so this is a purpose/object analogy. A mop is used to clean up the floor.
8. D. A stick is used to hit a puck, so this is a purpose/object analogy. A fuse is used to light an explosive.
9. A. Glue is used to combine pieces of something together, so this is a purpose/object analogy. A staple is used to combine pieces of paper together. Note that the relationship is "to combine," but this is not the correct choice as the action is applied to something (pieces and paper).
10. A. A syringe is used to administer an injection, so this is a purpose/object analogy. A testimony is used to provide evidence in a trial. Notice that "allege" is a verb, and both question words are nouns.

## Guided Practice – Type/Kind

1. A. A swan is a type of bird, so this is a type/kind analogy. Spaghetti is a type of pasta. Both a woodpecker and a hawk are types of birds.
2. B. A backpack is a type of bag, so this is a type/kind analogy. A saxophone is a type of instrument.
3. D. A poodle is a type of dog, so this is a type/kind analogy. A puma is a type of cat.
4. C. A baguette is a type of bread, so this is a type/kind analogy. Soda is a type of beverage (that happens to contain water and carbonation and sugar).

5. A. A pigeon is a type of bird, so this is a type/kind analogy. A manor, or large estate, is a type of structure. Vegetable is to carrot is incorrect because it does not follow the structure of the question stem.
6. A. A physicist is a type of scientist, as a sneaker is a type of shoe. An alibi is a specific kind of excuse, as an ape is a specific kind of primate (both are used in the wrong order).
7. D. An arm is a type of appendage, so this is a type/kind analogy. A thumb is one kind of digit, or finger.
8. A. Slang is a type of language, so this is a type/kind analogy. A governor is a type of politician.
9. D. Jazz is a type of music, so this is a type/kind analogy. Poetry is a type of writing.
10. D. Dandelions are a type of weed, so this is a type/kind analogy. Ballet is a type of dance.

## Guided Practice – Whole/Part

1. C. A link is one part of a chain, so this is a whole/part analogy. A bone is one part of a skeleton. Windshield is to truck is incorrect because it does not follow the structure of the question stem.
2. D. An item is just one element of a list, so this is a whole/part analogy. A piece makes up just one part of a larger collection. A handle is part of a drawer, but is presented in the wrong order.
3. E. A collar is one part of a jacket, so this is a whole/part analogy. Enamel, the protective coating of a tooth, is one part of the tooth.
4. B. An employee is one element of a company, so this is a whole/part analogy. A protestor is one part of a protest.
5. B. A day is part of a week, so this is a whole/part analogy. Antlers are part of a stag. Saturday is to weekend is incorrect because it does not follow the structure of the question stem.
6. E. A plant is one part of a garden, so this is a whole/part analogy. An insect makes up one piece of a swarm.
7. D. A month is made up of weeks, so this is a whole/part analogy. A school is made up of classrooms. Note that school is used as a noun, as are the two words in the question-stem.
8. A. The rind is one part of cheese, so this is a whole/part analogy. The pit is one part of an avocado.
9. E. A story is part of a film, so this is a whole/part analogy. A competitor is part of a competition.
10. A. An essay can be broken down into paragraphs (or said to consist of paragraphs), so this is a whole/part analogy. A building can be broken down into levels (or said to consist of levels, or floors). A building may or may not have a lobby, elevators, or cameras. Though they can commonly be found in Buildings

## Guided Practice – Synonym

1. E. Precede, or to come before, has the same meaning as lead, so this is a synonym analogy. Forgo, which means to give up, has the same meaning as decline.
2. E. Incapacity, or incapability, is similar in meaning to powerlessness, so this is a synonym analogy. Insight has the same meaning as awareness.
3. A. Eloquent, or articulate, is similar in meaning to expressive, so this is a synonym analogy. Rare is similar in meaning to unique. Presumptuous is to presume and fanatical is to fanfare are incorrect because they do not follow the noun-to-noun structure of the question stem.
4. B. Analysis and evaluation are similar in meaning, so this is a synonym analogy. Gesture and action have the same meaning. The other answer choices are incorrect because they are too specific.
5. D. Subjective (the opposite of objective, or definite) and personal have similar meanings, so this is a synonym analogy. Approximate and imprecise are similar in meaning in that something is indefinite.
6. E. Ignominious, or shameful, is similar in meaning to disgraceful, so this is a synonym analogy. Laudable (from the same root as “applaud”), or admirable, is similar to praiseworthy.
7. E. Rife, or widespread, is similar to rampant, so this is a synonym analogy. Potent, which means powerful, has the same meaning as influential.
8. E. cursory, or superficial, is similar in meaning to perfunctory, which also means hastily and not meaningfully performed, so this is a synonym analogy. Infallible, which means without mistakes, has the same meaning as perfect.
9. E. To wane, or to decrease over time, has a similar meaning to diminish, so this is a synonym analogy. To relate to something, or to have a sympathetic relationship to someone or something, is similar to understanding it.

10. C. Malevolent, which means cruel, is similar in meaning to wicked, so this is a synonym analogy. Insidious, which means evil, is similar to sinister, which means threatening.

## Mixed Practice 1

1. E. Poles are used when operating skis, so this is a purpose/object analogy. Handlebars are used when operating a bicycle.
2. E. A conductor uses a baton, so this is an individual/object analogy. A mathematician uses an equation to solve problems. Notice that the other choices are verbs.
3. A. Shot is the past tense of shoot, so this is a grammar (tense) analogy. Sat is the past tense of sit.
4. E. A person sets a placemat, so this is a noun/verb analogy. A person schedules a meeting. Dish is to wash is incorrect because it does not follow the structure of the question stem.
5. E. A goose is one part of a flock of geese, so this is a part/whole analogy. A horse is one part of a herd.
6. B. Salmon is a type of fish, so this is a type/kind analogy. A spatula is a type of utensil.
7. B. Theoretical is associated with physics via the branch of science "theoretical physic," so this is an association analogy. Mad and scientist are associated with each-other via the term "mad scientist." Green is a type of color, while a hypothesis is a belief. A visor is part of a helmet, and an experiment is something done to research.
8. A. A sprinter participates in a race, so this is a definition analogy. An athlete participates in a marathon.
9. A. A message is made up of many words, so this is a whole/part analogy. An anthology is made up of many books, or novels. It may or may not be the same protagonist in each, and may be published by different people, and read by different people.
10. B. A zephyr, or light breeze, is a less extreme version of a gale, which is a strong wind, so this is a degree/intensity analogy. A ripple is a less extreme version of a tsunami, which can be found on a pond, lake, or tributary.
11. E. Lotion is used to soothe, so this is a function/object analogy. A clamp is used to compress something. Notice that a thimble is used in sewing, but this is the opposite order of the question stem. A shovel is used to dig a hole, but hole is a noun, not the action itself, like soothe or dig would be.
12. A. Sound causes an end to silence, so this is a cause/effect analogy. Hygiene causes an end to filth.
13. C. Exemplary, which means excellent, has a similar meaning to admirable, so this is a synonym analogy. Immutable, which means final or unalterable (the prefix "im-" means not and the root word "mut" is shared with "mutate" and means "change"), has the same meaning as permanent.
14. C. Sweltering, which means extremely hot, is the opposite of frigid, so this is an antonym analogy. Elusive, which means hard to understand, is the opposite of obvious.

## Mixed Practice 2

1. B. A broom is used to sweep, so this is a function/object analogy. Dynamite is used to explode something. Danger is a noun, and the question stem contains a noun and a verb.
2. A. A headache is a less extreme version of a migraine, so this is a degree/intensity analogy. A cut is a less extreme version of a gash.
3. D. A gardener uses shears, so this is an individual/object analogy. A waiter uses a tray. Canvas is to painter is incorrect because it does not follow the structure of the question stem. A cyclist uses a bike, not just a single wheel.
4. E. You drink a beverage, so this is a noun/verb analogy. You chew food.
5. B. Stars make up a constellation, so this is a part/whole analogy. A window is made up of a number of panes.
6. E. Rhythm is one part of a song, so this is a whole/part analogy. A cup is one part of a gallon (there are 16 cups in a gallon). Coffee is a type of bean, and voice is a part of speech, though this is the opposite order as the question stem.
7. D. A rake is used to sweep up and organize messy leaves on the ground, so this is a purpose/object analogy. A comb is used to "organize" or untangle messy hair. A wig is made up of hair.
8. E. Pompous, which means conceited, is similar in meaning to arrogant, so this is a synonym analogy. Squalid, which means filthy, has a similar meaning to fetid, which means rotten. Something sacrilegious is disrespectful, not sacred.

9. A. Deride, which means to ridicule, is the opposite of admire, so this is an antonym analogy. Appease, or satisfy, is the opposite of provoke. This might happen during a negotiation, or not.
10. A. Wreak and havoc are associated via the phrase “to wreak havoc,” so this is an association analogy. Run and amok are associated via the phrase “to run amok,” which means to act wildly.
11. A. A finale concludes a play, as an epilogue concludes a story. This is a defining relationship.
12. A. Brass is a type of metal, so this is a type/kind analogy. Water is a type of liquid.
13. C. Sworn is a past participle of swear, and swore is a past tense of swear, so this is a grammar (tense) analogy. Taken is a past participle of take, and took is a past tense of take.
14. A. Gluttony, the act of eating large quantities, leads to obesity, so this is a cause/effect analogy. Labor causes exhaustion.

## Mixed Practice 3

1. B. Grief is the opposite of joy, so this is an antonym analogy. Tolerance is the opposite of bigotry.
2. A. Bottomless and abyss are often heard together via the phrase “bottomless abyss,” so this is an association analogy. Aluminum and foil are often considered together via the household item “aluminum foil.”
3. B. A thinker generates ideas, so this is a cause/effect analogy. A writer generates novels.
4. A. A bee creates honey, so this is a definition analogy. A bird creates a nest.
5. C. Fanaticism is an extreme amount of enthusiasm, so this is a degree/intensity analogy. A decree is a more formal command. It’s not a question – it’s telling someone what to do.
6. E. A synopsis is used to summarize, so this is a function/object analogy. A blanket is used to warm.
7. E. Stolen is the past participle of steal, so this is a grammar (tense) analogy. Broken is the past participle of break.
8. E. A strawberry is a type of fruit, so this is a type/kind analogy. A croissant is a type of pastry.
9. C. A singer uses a microphone, so this is an individual/object analogy. A musician uses an instrument.
10. C. A screwdriver is used in conjunction with a screw, to drive it into an object, so this is a purpose/object analogy. A stake is used in a conjunction with a mallet, which is used to drive the stake into the ground.
11. E. Toxin and poison have similar meanings, so this is a synonym analogy. Pinnacle, which means the highest point, has the same meaning as summit.
12. A. A month is one part of a year, so this is a whole/part analogy. A minute is one part of an hour.
13. A. A yolk is one part of an egg, so this is a part/whole analogy. A spoke is one part of a wheel.
14. D. One collects mementos, so this is a noun/verb analogy. One also peruses, or scans or reads, a report. One can also underline parts of a report, but underline is also a verb, where memento is a noun.

## Mixed Practice 4

1. A. Resilient is the opposite of feeble, or weak, so this is an antonym analogy. Sedate, which means calm, is the opposite of energetic.
2. B. The sun generates light, so this is a cause/effect analogy. A chicken generates an egg.
3. B. A florist deals with or organizes flowers, so this a definition analogy. A librarian deals with or organizes books.
4. D. To compliment is a less extreme version of to fawn, which means to praise, so this is a degree/intensity analogy. To explain is a less extreme version of to pontificate, which is to express one’s opinions in a pompous and dogmatic way. To fawn is to provide a servile display of exaggerated flattery, and to pontificate is to not just explain something, but do so in an exaggerated way.
5. C. A referee uses a whistle, so this is an individual/object analogy. A carpenter uses a hammer. An athlete wears a uniform, but the uniform itself isn’t used to complete a task.
6. D. Believing is the gerund form of believe, so this is a grammar analogy. Reading is the gerund form of read.
7. B. A fence is used to separate two areas, so this is a noun/verb analogy. A plunger is used to free up a toilet.
8. E. A wallet is used to store money, so this is a purpose/object analogy. A folder is used to store documents. A folder can be part of an organizer. The function provided itself (storage) is not the relationship shown; rather, the relationship is between two things.
9. A. Many counties make up a state, so this is a whole/part analogy. Many boards make up a floor.

10. A. Prim and proper are often heard together in the phrase “prim and proper,” so this is as an association analogy. Front and center are often heard together in the phrase “front and center.”
11. C. To be brusque, or harsh, is a type of tone, so this is a type/kind analogy. From is a type of preposition.
12. E. An appellation, or a title, is used to identify something, so this is a function/object analogy. A respite, or break, is time used to recover.
13. E. To venerate, or praise, has a similar meaning as revere, which means to admire, so this is a synonym analogy. To assert has a similar meaning as declare.
14. A. A headline is one part of an article, so this is a part/whole analogy. A cell is one unit in a prison.

## Mixed Practice 5

1. C. Rapid is the opposite of gradual, so this is an antonym analogy. Reckless is the opposite of prudent, which means cautious.
2. A. Suffocation is caused by a lack of air, so this is a cause/effect analogy. Hunger is caused by a lack of food.
3. D. A plug is used to stop up a drain, so this is definition analogy. A bandage is used to stop bleeding.
4. C. A tome, which is an extremely large book, is a more extreme version of a book, so this is a degree/intensity analogy. A labyrinth, which is a massive maze, is a more extreme version of a maze.
5. B. A lens is used to focus sight, so this is a function/object analogy. A bulb is used to illuminate.
6. A. Knives is the plural form of knife, so this is a grammar analogy. Loaves is the plural form of loaf.
7. D. One plays a game, so this is a noun/verb analogy. One scores a point. One wears a uniform, but this is not in the same order as the question stem.
8. D. Dilemma has a similar meaning to predicament, so this is a synonym analogy. A phenomenon has the similar meaning as marvel, which is any occurrence that causes wonder or admiration. A grimace is a type of expression, and a protestor is the opposite of a conformist.
9. C. A camera takes (or produces) a pictures, so this is a purpose/object analogy. An education is used to produce learning, which in this case is embodied by a diploma.
10. D. A student is one member of an entire class, so this is a part/whole analogy. A bird is one member of a flock of birds.
11. A. A boot is a type of shoe, so this is a type/kind analogy. An earring is a type of jewelry.
12. B. A camper uses a tent, so this is an individual/object analogy. A mountaineer uses a harness. Boots is to hiker is incorrect because it does not follow the structure of the question stem.
13. C. A grid is comprised of columns, so this is a whole/part analogy. A movie is comprised of scenes. A movie is recorded on film, and the color is just one aspect of a film.
14. B. Call and beck are associated via the phrase to be at one’s “beck and call,” so this is an association analogy. Butter and bread are associated via the phrase “bread and butter.”

## Mixed Practice 6

1. A. Emerge is the opposite of vanish, so this is an antonym analogy. Coddle, which means to fawn over, is the opposite of neglect.
2. D. The words rank and file are associated via the phrase “rank and file,” so this is an association analogy. Cut and paste are similar associated via the phrase “cut and paste.”
3. E. A flame melts wax, so this is definition analogy. Heat similarly melts chocolate. It can be hot at the beach or the desert, but this isn’t the same thing as describing what heat does to something.
4. C. A fete, or day of festivities, is used to celebrate something, so this is a function/object analogy. Philanthropy is used to share with those who are less fortunate.
5. E. A thespian, or actor, uses a script, so this is an individual/object analogy. A guide uses a map (and might describe landmarks or work with tourists).
6. E. A counselor advises clients, so this is a noun/verb analogy. A spectator observes something.
7. C. A bystander is one person in a crowd, so this is a part/whole analogy. A harpist is one musician in an orchestra. A contestant does participate, but this is not what the contestant participates in (instead, we might say “contestant is to contest”).
8. E. A sock covers and warms a foot, so this is a purpose/object analogy. A coat covers and warms a torso.
9. C. Red is a type of color, so this is a type/kind analogy. A bee is a type of insect.
10. D. The entrée is one part of a menu, so this is a whole/part analogy. The crust is one part of pie.

11. D. To deviate, or shift, has a similar meaning to veer, so this is a synonym analogy. To transpire, or occur, has the same meaning as happen (perspire and sweat are synonyms).
12. C. Exercise helps relieve frailty, so this is a cause/effect analogy. Sleep helps alleviate fatigue.
13. B. Took is a past tense of take, so this is a grammar (tense) analogy. Saw is a past tense of see.
14. C. To ruminate is a more extreme version of to think, so this is a degree/intensity analogy. Fire is a less extreme version of conflagration, which is an extensive fire. Simply pondering or thinking deeply is different from the action of deciding.

## Mixed Practice 7

1. E. Mischievous is the opposite of respectful, so this is an antonym analogy. Obligatory, or required, is the opposite of optional.
2. B. The words hearty and hale are associated via the phrase "hale and hearty," so this is an association analogy. Salad and soup are associated via the phrase "soup and salad." Cucumbers or other vegetables might be in a salad, but hale is certainly not in a hearty (whatever that means).
3. E. A heater results in warmth, so this is a cause/effect analogy. The result of exercise is health.
4. D. An excuse covers up a mistake, so this is a definition analogy. A lie covers up the truth.
5. D. Snip is a less extreme version of cut, so this is a degree/intensity analogy. Tear is a less extreme version of shred.
6. A. Got is a past tense of go, so this is a grammar (tense) analogy. Gave is a past tense of give.
7. E. A lecturer devises a speech, so this is an individual/object analogy. A mathematician devises a formula.
8. E. A competitor opposes, so this is a noun/verb analogy. A champion wins. Winning is part of victory, but champion is a better choice because the word describes a person, as does competitor.
9. E. A patch is one part of a quilt, so this is a part/whole analogy. An ant is one part of a colony.
10. D. A snorkel is used to get air when snorkeling, so this is a purpose/object analogy. Effort is used to obtain a certain result (whether it's what you want or not is different).
11. D. An orchid is a type of flower, so this is a type/kind analogy. An octagon is a type of shape (which is studied in geometry).
12. A. A sentence is one part of a paragraph, so this is a whole/part analogy. Many states make up a country (while many countries make up a planet or continent).
13. D. To confide (tell a secret) has a similar meaning as to reveal, so this is a synonym analogy. To perceive has the same meaning as to detect.
14. A. A rebellion is used to overthrow someone in power, so this is a function/object analogy. A psychic is someone who knows things that others don't, or that are impossible to know, like the future. One would use a psychic to understand it, or see it.

## Mixed Practice 8

1. A. A volleyball is hit with a hand, so this is a purpose/object analogy. A baseball is hit with a bat.
2. D. A knight carries a lance, or long wooden shaft, so this is a definition analogy. A coach carries a whistle.
3. B. Terrible is an adjective and terribly is an adverb, so this is a grammar analogy. Sneak is an adjective and sneakily is an adverb.
4. C. An instructor uses a curriculum for his teachings, so this is an individual/object analogy. A baker uses flour for baking. The baker makes desserts and pies, but doesn't use these to do something. A baker may be considered a type of chef, but this does not agree with the type of analogy being described in the question.
5. A. An actor performs, so this is a noun/verb analogy. A merchant sells (merchandise to a customer).
6. B. A pane is one part of a window, so this is a part/whole analogy. A tile is one part of a mosaic.
7. D. A cloth is used to wipe a surface, so this is a purpose/object analogy. A napkin is used to wipe a mouth. It may clean up food or water, but from a surface, like a mouth, pants, etc.
8. D. A snake is a type of reptile, so this is a type/kind analogy. A radish is a type of vegetable (that can be found in a salad).
9. B. Transcript has the same meaning as documentation, so this is a synonym analogy. Diversion has the same meaning as distraction.
10. B. An article is one element of a magazine, so this is a whole/part analogy. A word makes up one part of a sentence. Essay is incorrect because it does not follow the structure of the question stem.

11. D. The effect of education is learning, so this is a cause/effect analogy. The effect of exercising is strength.
12. E. The purpose of a vigilante is to avenge, so this is a function/object analogy. The purpose of an apprentice is to be educated, learn or train (from an artisan).
13. E. Bizarre is a more extreme version of strange, so this is a degree/intensity analogy. Steadfast, or unwavering, is a more extreme version of dependable.
14. A. Inept, or stupid, is the opposite of skilled, so this is an antonym analogy. Fickle, or ever-changing, is the opposite of stable.

## Mixed Practice 9

1. E. A blizzard is a more extreme version of snowfall, so this is a degree/intensity analogy. A downpour is a more extreme version of rain. A monsoon or tempest are very strong examples of rainfall, but do not match the question stem order or analogy type.
2. B. Frivolously is the adverb form of frivolous, so this is a grammar analogy. Graciously is the adverb form of gracious.
3. B. A curator deals with, or arranges art, so this is an individual/object analogy. A composer deals with, or arranges, musical notes.
4. E. A physician diagnoses problems, so this is a noun/verb analogy. A narrator describes events (and may or may not be reliable or trustworthy).
5. B. A razor is used to cut the hair of a beard, so this is a purpose/object analogy. A knife is used to cut bread (and may or may not be sharp, or used as a weapon).
6. D. A year is one tenth of a decade, so this is a part/whole analogy. A note is similarly one element of music.
7. B. A knife is used to cut a potato, so this is a purpose/object analogy. Scissors are used to cut through paper.
8. B. Consult has a similar meaning to discuss, so this is a synonym analogy. Recur has the same meaning as repeat.
9. E. A letter is one part of an alphabet, so this is a part/whole analogy. A blade is one part of a propeller.
10. E. An octopus is a type of invertebrate, so this is a type/kind analogy. An acorn is a type of nut. A sequoia is a type of tree, but this is the opposite order of the question stem.
11. D. A prank is meant to bamboozle, or deceive, so this is a function/object analogy. Narration is meant to elucidate, or explain.
12. E. Bacteria causes decomposition, so this is a cause/effect analogy. An allergen causes irritation. Pollen is a type of allergen, which can be airborne.
13. D. A jester is the object of derision, or ridicule, so this is a definition analogy. An idol is the object of veneration, or praise or worship.
14. C. Specific is the opposite of vague, so this is an antonym analogy. Indelible, or permanent, is the opposite of erasable.

## Mixed Practice 10

1. B. Immemorial and time are associated via the term "time immemorial," so this is an association analogy. Wrought and iron are associated via the term "wrought iron."
2. B. Trees provide shade, so this is a cause/effect analogy. Matches provide flames.
3. A. Rode is a past tense of ride, so this is a grammar (tense) analogy. Rang is a past tense of ring.
4. C. An illustrator uses a marker, so this is an individual/object analogy. A photographer uses a camera.
5. C. An adventurer travels, so this is a noun/verb analogy. A warrior fights.
6. E. A unit is one part of a textbook, so this is a part/whole analogy. A slice is one piece of a cake.
7. B. A fisher uses bait, so this is an individual/object analogy. A jeweler uses gold. A bank may store gold, and gold may appear in bar form. Notice the question stem pairs an object with a person.
8. A. Aroma has a similar meaning to scent, so this is a synonym analogy. Distinction has a similar meaning to difference.
9. B. A fedora is a type of hat, so this is a type/kind analogy. A tractor is a type of machinery.
10. B. A facsimile is a copy of a manuscript, so this is a definition analogy. A clone is a copy of a person. Replica or duplicate could be synonyms for clone.

11. E. Empty is a less extreme version of desolate, which means totally deserted, so this is a degree/intensity analogy. Poor is a less extreme version of destitute, which means extreme poverty. A wasteland is barren, while to be full can mean to be satisfied. Note that wasteland is a noun, and both pairs are adjectives.
12. D. The function of a network is to connect things together, so this is a function/object analogy. The function of a metaphor is to express an idea. This is similar to what a simile does. Notice that connect is a verb, and only express and abbreviate (which means to shorten) are verbs.
13. E. A pilot flies an airplane, so this is a definition analogy. A child flies a kite.
14. E. A bucket holds water, so this is a purpose/object analogy. A leash is meant to enable control of, or "hold," a dog. A greenhouse contains things, but the purpose itself is not the object of the analogy. What might work instead is perhaps greenhouse is to plants.

## Reading Comprehension

### Fiction

#### Passage #1

1. A. *Inference*. Missee Sahib is young and not educated in the ways of the world. There is no evidence to suggest that she is eloquent, since there is barely any dialogue and the narrator says nothing to that effect. The narrator tells us that the girl grew up wealthy, not destitute. She is not described as particularly despondent or acting older than her age.
2. D. *Detail*. Throughout the passage, the narrator uses "the place" to stand in for "school," which is mentioned only toward the end of the passage. We can infer that an *ayah* is a person, not a place. The bungalow is where she grew up, not where she is going.
3. B. *Detail*. The narrator tells us toward the end of the passage that the girl was "troubled by the thought that [her father] could not stay with her" when she traveled to "the place." While the other statements might be true, we don't have evidence to support any of them.
4. B. *Inference*. The question asks for Missee Sahib's point of view. While the narrator tells us that she was rich, there is evidence to suggest that she is accustomed to it and doesn't recognize her privilege. The narrator writes that "she did not know all that being rich meant" and that she had "always lived in a beautiful bungalow, and had been used to seeing many servants..." Therefore, we can infer that Missee Sahib felt this to be normal, not privileged, and certainly not spartan or unfortunate.

#### Passage #2

1. A. *Detail*. The narrator writes that the narrator's "father had brought [him] out from Scotland". South Africa, New Zealand, and Vancouver are mentioned as places where "Imperialist ladies" sought to bring together people from exotic locations, and counted the narrator, who lived in Bulawayo for some "years", among them.
2. B. *Detail*. The narrator describes, in this passage, how the narrator is dissatisfied with his life, offering many reasons. The narrator tells us that he is 37, but doesn't say this is "very old" or a reason why he is unhappy. The narrator is described as being "sound in wind and limb," which tells us that he is healthy. The ditch referred to is metaphorical, not physical. We are told that the narrator has "enough money to have a good time."
3. A. *Tone/Mood/Style*. A simile draws parallels between two different things or ideas using the word "as, such as," or "like." A metaphor makes a comparison between two otherwise unrelated things to characterize something better. Allegory is a type of symbolism where a concept is explained via an example. Hyperbole is a great exaggeration or overemphasis of something. Personification attaches human traits and characteristics to inanimate objects, things, or animals.
4. E. *Detail*. The narrator tells us that the narrator felt "liverish" about the weather, "couldn't get enough exercise," "had no real pal to go about with," and was generally uninterested in socializing with the likes of Imperialist ladies. The narrator had been "building up [plans]" while in Bulawayo to go to England, or London.
5. E. *Tone/Mood/Style*. Hyperbole is a great exaggeration or overemphasis of something. One cannot literally yawn one's head off, but the exaggeration tells us more about just how bored the narrator is actually feeling.

#### Passage #3

1. E. *Inference*. Morgan is described as being exceptionally "cool...even in moments of sudden and imminent peril." This contrasts with the fact that Morgan loses his cool, turning pale, firing his gun at nothing, and running away. This does not foreshadow Morgan's later reactions, as the opposite actually happened.

2. E. *Main Idea*. While there is certainly excitement, and sensory imagery is given throughout the passage, it is the actual encounter with The Infernal Thing that is the focus of the passage. The narrator describes his feelings and observations leading up to and during this encounter. We aren't told anything about the Thing itself. There are no instructions about preparing for a hunt.
3. C. *Tone/Mood/Style*. The narrator spends a great deal of time describing what he sees once he realizes that he is experiencing something dangerous. The narrator spends all of the second-to-last paragraph and much of the last paragraph describing the sight in the grass – how it was a “line of disturbance” that was “distinctly disquieting.” The other pieces of information are included, but are all secondary to the terror of the sight.
4. C. *Tone/Mood/Style*. The narrator starts off unconcerned about the sound in the bush, becomes nervous and tense when he sees that Morgan is scared, and then is scared when he sees the movement in the grass.

#### Passage #4

1. B. *Detail*. The passage states that Tom wanted to get a “fair price” for this “treasure,” suggesting that he wanted to sell it, not toss, destroy, recycle, or provide/give it away.
2. D. *Detail*. Before the meeting with Madison, the pair thought that they had a treasure – a diamond, as indicated in the dialogue toward the end of the passage. They later find out from Madison that it is in fact just salt.
3. B. *Inference*. We can infer from the dialogue toward the end of the passage that Tom believes the treasure to be a valuable diamond, not a worthless piece of salt. We can also infer that “twelve shillings per ton” is not a large sum, since the quantity is measured in tons. Tom was excited about his discovery earlier in the passage, and has his hopes dashed by the end.

#### Passage #5

1. C. *Inference*. When Della's face loses its color, she has just had an idea, though the passage doesn't say so explicitly. This is the moment that she realizes she can earn money by selling her hair. She doesn't like it, because it is one of the two possessions in which she takes “a mighty pride,” but she knows she has to do it.
2. A. *Tone/Mood/Style*. The author uses hyperbole here to demonstrate the energy with which Della sought Jim's present. It is not meant to convey the idea that she literally destroyed, stole, scared, or made a mess, but to show that she is shopping vigorously.
3. A. *Inference*. Look in context; the author mentions the royal jewels because Della's hair would “depreciate” those fine things. Thus, we can infer that the author seeks to describe the value and beauty of Della's hair.
4. B. *Tone/Mood/Style*. This figurative language applies to Della's hair, as evidenced in line 15.

#### Passage #6

1. E. *Detail*. The passage describes how this was Horner's first year teaching, and that he found it to be challenging (the opposite idea as “trivial”). This is because there was tension between him and his students, and he was new to teaching. “Grave” has many other meanings, but in context, none of these makes sense.
2. E. *Inference*. In the second paragraph, the narrator tells us that Horner is not ogreish and cruel, and is unlike Herod, who simply enjoys hurting people. The passage doesn't tell us anything about Horner's own education. Instead, it suggests that “a strong arm he must have”.
3. A. *Detail*. The requisite is a requirement. In this case, the passage describes how it is necessary for the students to respect the teacher's “bodily strength.”
4. B. *Tone/Mood/Style*. In the last sentence, the narrator tells us that Horner had “secret resolutions.” This conveys a very negative mood, ruling out the two positive moods. Horner may be disappointed or even embarrassed, but the language “we say not with what secret resolutions” suggests something even worse – so bad that the narrator won't tell us!
5. A. *Detail*. The narrator tells us that the master (Horner) looked at the “infant giant”, so they both aren't the same person. We can tell that the infant giant is Joshua, who behaves as if an infant.

#### Passage #7

1. C. *Inference*. The sentence describes how going to the beach is better than going elsewhere (“where one is always in danger of discovering...”). We can infer that a more frequented watering-place would be an alternative to the beach, or some other vacation destination. It's not necessarily a hunting trip, swimming pool, wilderness, or a “savage tract of country.”
2. E. *Inference*. The narrator tells us that “some consider the Brant rather slow” and that others were “surprised” when the two arrived with “overstuffed trunks” and that they had brought with them

“everything...that men of elegant leisure could require.” The narrator doesn’t imply that the two are scoundrels, or tell us that the other guests were wealthy. If anything, the narrator implies that the rest of the guests were enjoying a simple and casual vacation. Thomas is not described as being rude, and there is no mention of hunting or animal restrictions. The two are never described as being friendly with suspicious men.

3. D. *Detail*. The sentence describes how the men “brought almost everything with them that [they] could require,” suggesting that they brought many things. The following sentence describes these belongings (cigar-boxes, guns, etc.). While awnings were mentioned, chattels refer to more than just the awnings.
4. A. *Inference*. In the last paragraph, the narrator tells us that “it took them a week to shoot breakfast,” so they were not so good at what they did (and did not feed everyone for a week). In addition, the narrator tells us that “you would have imagined that all game-birds were about to become extinct in that region,” not that this actually happened. Instead, he tells us that the dogs themselves were “crestfallen” and displayed “canine humiliation.” We don’t know that the two men were humiliated.

#### Passage #8

1. B. *Detail*. Before this sentence, she describes how life is full of “deep sorrow” and “fraud” and that there is “sickening doubt” and “false hope.” The line in question describes how the author asks who could possibly want – or desire – this type of life.
2. E. *Tone/Mood/Style*. “Web of society” is a metaphor, since it uses a dissimilar object to describe and clarify the concept of the central object (in this case, “society”). In personification, human characteristics are given to the nonhuman. In this case, a stream cannot literally murmur like a person does, but describing it in this way helps to paint a more detailed picture of a stream. The other choices are not literary devices.
3. C. *Detail*. The author writes that “I have lived. I have spent days and nights of festivity...now shut the door on the world.” The other examples are quotes from the passage that either describe the problems of society or a proposed solution.
4. A. *Tone/Mood/Style*. The author’s view of society is dim at best, and borders on the hostile. The author does not care about society, and does not seem hopeful or eager. Instead, the author actively dislikes society and argues for a life apart.
5. E. *Main Idea*. The author makes an impassioned case against one way of life and in favor of another, but stops short of providing specific and detailed instructions. While there some personal experiences used as evidence, this is not the goal of the overall passage. The author does not employ humor to convey her message. The phrase “Let us” at the end of the passage suggests a recommendation.

#### Passage #9

1. D. *Tone/Mood/Style*. The bridge analogy describes the old man paving the way for younger generations. The old man says that he is building bridges for other people, but doesn’t say that he’s relying on himself. The pilgrim suggests that the old man is wasting his time, but the old man explains why this is not the case. Burning bridges is never mentioned in the passage. It is possible to cross the chasm without a bridge; it is just difficult to do so.
2. C. *Main Idea*. As the old man ages, he learns how to overcome obstacles and is able to share his knowledge with future generations. The old man builds a bridge to help the young. The passage suggests that rivers can be conquered, as the old man has done. The pilgrim questions why the old man is working on the bridge, but the old man responds positively about working on it. The author does not advocate for isolation; rather, involvement and concern.
3. E. *Inference*. The chasm is described as “vast and wide and steep” which could be troubling to some – those less experienced, for example. The chasm is described negatively – as something to be overcome, ruling out pleasure, beauty, and joy. Making money or paying a price are not part of the passage.
4. B. *Inference*. Twilight in the passage signifies the end of the old man’s life. It relates the end of the day to the end of one’s life. The passage doesn’t describe the light in the scene, so the reader does not know if the sun reflects off the river or shines through the trees. Twilight is the end of the day, so morning is not a possibility. The difficult challenge is the chasm, not the twilight.
5. C. *Inference*. The old man is not in a hurry, but stays to help the youth cross the chasm. This is selfless, not naïve or carefree. The old man is concerned for the youth, but not preoccupied, which implies that he cannot do other things.

#### Passage #10

1. D. *Tone/Mood/Style*. The author is impassioned by the changing landscape, using strong language and imagery to convey her feelings. The poem is not at all comical, nor is it frustrated. She does not show contempt for other seasons, nor for winter. The tone is not indifferent – the author carefully reflects on winter.

2. E. *Tone/Mood/Style*. A leaf speaking is an example of personification, or giving human qualities to nonhuman things. A metaphor likens one thing to something different in order to help explain it. A simile, while similar to personification, is a comparison using “like” or “as.” Metonymy replaces a name of a thing for the name of a part of that thing. Leaves are not replacing anything; they are leaves. Ethos is a rhetorical term used to describe a passage’s appeal to credibility.
3. D. *Main Idea*. The poet reflects on the changing season. Daylight saving time is never mentioned. While the other choices are mentioned, they are not the primary focus of the passage. The author mentions plants and roses and blossoms as a way to show the reader what specific changes there are.

### Passage #11

1. D. *Tone/Mood/Style*. Simile is when one thing is compared to another using “like” or “as,” as is the case with line 1. Personification is when a nonhuman entity is given human qualities. Synecdoche is using a part of something to represent the whole. Alliteration is when multiple words in a row begin with the same letter. Onomatopoeia is when a word represents a sound.
2. A. *Detail*. If we trace “they” back to its antecedent, we find out that ten thousand refers to the daffodils. The other options are objects the author sees on his visit.
3. A. *Detail*. In context are words such as “glee” and “gay,” implying that jocund is likely “cheerful.” While jocund sounds like joking, there is nothing to suggest humor. This poem contains little irony. While the adjective modifies “company,” the context doesn’t suggest “jocund” is crowded; after all, the “company” refers to the flowers, which are described as plentiful, but not “crowded.” “Fetid” has a negative connotation unsupported by the passage.
4. D. *Inference*. The bliss of solitude describes the speaker’s state of reflection in the last stanza. There is nothing in the context to suggest home life. Individual liberty and being an individual in a crowd both are types of solitude, but neither has any support in context. We don’t read about the author’s work week.
5. D. *Tone/Mood/Style*. Waves cannot literally dance (something that humans do), so giving this ability to a thing like a wave is personification. The first choice is an example of a simile, and the third choice is an example of hyperbole (exaggeration). The remaining answer choices are not examples of figurative language.

### Passage #12

6. A. *Detail*. The word visage describes the face of the sculpture. Visage looks like vision but is unrelated in this context. The visage is a part of the sculpture. We’re told that the visage is that which has a “frown,” “wrinkled lip,” and “sneer.” These are things that a face has, not a sight. There is nothing to suggest visage is a statue, person, or landscape.
7. B. *Detail*. Line 6 describes the sculptor’s ability to convey Ozymandias’s “passions” in stone as “well read”. The other options describe the ruins but make no mention of the sculptor or his skill.
8. D. *Inference*. The final images convey the wreck of these monuments, or ruins. We don’t know or learn anything about the traveler, and just read about the setting. Additionally, there is little information about the sculptor.
9. C. *Inference*. The appearance of the sculpture, which we learn is of Ozymandias, conveys the features of a stern, powerful ruler. This is further supported by the proclamation on the pedestal. There is nothing to suggest Ozymandias was artistic (we should not confuse Ozymandias with the sculptor). While Ozymandias ruled an older civilization, his representation is not described as elderly. He does not seem to care for others, as he mocks others and declares his superiority to them.
10. A. *Tone/Mood/Style*. The sculpture appears to be a relic of a great civilization that has fallen. This is in sharp contrast to what is described on the pedestal, which proclaims power and might. There is no evidence of when the poem was written. The words on the pedestal have nothing to do with the narrator. The words are part of the traveler’s story and don’t cast doubt on the reliability of his storytelling. The poem never mentions museums.
11. E. *Main Idea*. The passage describes the ruins of a once great civilization, but one that is becoming lost and forgotten. There is nothing to imply that Ozymandias was the greatest king, just that he was a self-proclaimed powerful ruler. The sculptor’s feat was impressive but is not compared to contemporary sculptors. The statues decayed because of the desert, but this is not the main idea of the poem. Despite being large and impressive, this work of art clearly won’t remain forever.

## Non-Fiction

### Passage #1

1. B. *Tone/Mood/Style*. To say that one thing is another is to draw a comparison between those things for the sake of explanation. Here, the author uses an extended metaphor comparing life to a train, and beads as tunnels. Life moves through the beads, as trains would through tunnels.

2. *B. Detail.* The author mentions beads at the beginning and end of the passage. In the former, the “string of beads” is like a “train of moods.” Thus, we can infer that the beads are not temperament, but mood. The interpretation of a book is affected by mood, not the mood itself. The beads are not literal.
3. *C. Inference.* The author states that life, as it goes on, goes through lenses, and “each shows only what lies in its focus.” This can be interpreted to mean that as people experience events, be they positive or negative, they can only see the short-sightedness of the experience. Thus, we can infer that a person only feels “in the moment,” and does not adopt a “long-term point of view.”
4. *C. Tone/Mood/Style.* The author writes from his own point of view, and shares his personal thoughts about life with his reader. This is not structured like a historical novel, and includes no scientific information. He does not seek to convince the reader to visit national parks or to buy beads.
5. *C. Main Idea.* The author is preoccupied with describing the way in which a person views the world. He writes about mood and temperament; the latter is another way of saying “disposition”. The author’s main point isn’t to give specifics on where to go, or who needs to think about life, or when or where one should do it. He has already discussed how a person’s mood or emotions relate to things in life. Now, he will want to focus on temperament, which is how he concludes the passage. The author is not attempting to convince the reader of a “should” statement.

### Passage #2

1. *C. Detail.* In the passage, the author discusses how the purpose of an essay is to provide a point of view – an opinion based on an analysis of fact. This means we can rule out a simple statement of fact. While an essay may be a project, this is not what is stated. Instead, what is stated is a hypothesis, or premise.
2. *A. Tone/Mood/Style.* The author is not being spiteful, or particularly pious or serious. Instead, we can infer from the use of examples “Graces and Anxieties of Pig-Driving” or “Enjoyment of Unpleasant Places” that the author is poking fun at these titles as an example of his point: that the purpose of essays be conveyed in the title to the point that it is “frankly hinted” – a contradiction in itself.
3. *C. Main Idea.* The author mentions specific essays, but only as an example supporting an idea; he does not delve into a detailed critique or analysis. He mentions titles, but to a similar effect. The passage doesn’t detail specifically how to write the perfect essay, but does enumerate a particular point of view: that an essay should have certain qualities.
4. *B. Detail.* The author states that there must be a “proposition” and that “persuasion” is the goal. In addition, the essay should be “subjective” and “critical,” not “creative”. It should do more than the “mere marshaling of facts”; instead, it is the “meditating on facts” that “bring one to truth.” The author mentions titles, but only to convey what the essay should be about.
5. *D. Detail.* The author states that an essay should not be like that of “stream of consciousness” writing. It should be critical first, and creative second. We can infer that this means one should not be showcasing literary devices, but instead, focusing on delivering an interpretation.
6. *B. Detail.* The author uses the word “mere” to show that simply stating facts is not enough to qualify an essay. Instead, one must critique, analyze, evaluate, or assess those facts. The odd-choice is “statement,” which does not imply any of the critical thinking of the answer choices. Note that the first words in each pair are synonymous in context, and the second words are more important to decipher.

### Passage #3

1. *B. Main Idea.* The author never goes into great detail and doesn’t tell a story. Instead, he stays at a high level, sharing his point of view on the state of healthcare in the country. He has a solution for the problem of unequal access to healthcare.
2. *A. Detail.* The author’s primary concern is that not everyone who needs medicine can get it. He states that those who “live in rural areas do not get the same amount or quality of medical attention as those who live in our cities.” He also tells us that the poor are more often sick, but get less care. He sees this as unfair. It is true that some people still do die from curable diseases, but this isn’t the main concern.
3. *C. Detail.* From context, we can determine that the Economic Bill of Rights is intended to fix a problem “regardless” of “station.” Thus, we can infer that station is one’s economic or social standing, not creed or ethnicity (which would be race).
4. *B. Inference.* We can’t infer that the author thinks most people should move to cities, though we do know that he wishes that healthcare should be fair and equally accessible for all. Money is discussed here, but he does not comment on how spending money improves the quality of healthcare. The author would probably think that hospitals should be penalized for refusing to treat the poor, since he believes healthcare should be available to all. The author does advocate for government involvement in healthcare.
5. *D. Inference.* The focus of the passage is not on medicine in and of itself, but on reasons why the government should provide money for healthcare to everyone. He does not go into great detail here, and

merely states that fact, so we can expect him to go into more detail later on. He has already discussed the fact that poor people are unable to be treated, and that there are avoidable deaths. He would likely not revisit this, but instead build on the thoughts that most closely precede it.

#### Passage #4

1. D. *Main Idea*. While all of the answer choices contain references to points made in the passage, they are too specific in their scope. "A Necessary Change to America's Voting Calendar" encompasses the passage's emphasis on rescheduling Election Day.
2. E. *Inference*. Agrarian societies are depicted as accommodating farming schedules, a contrast with the "more industrialized America" in which a majority of the population is not employed in agriculture. An industrialized society is marked by widespread industry, meaning an agrarian society would be lacking said industries.
3. A. *Main Idea*. The author's main concern is low voter turnout and a possible solution to this trend. While the author does cite the social potential of Election Day, this is not the primary concern of the passage. The author does not speak about "obvious" voting habits, "copying" lifestyles, or "positive messaging" for young voters.
4. C. *Detail*. The author cites "interminable voting lines, long commutes to polling stations, or even the possibility of getting fired" as obstacles preventing citizens from voting. The passage goes on to discuss countries that have avoided these obstacles by scheduling Election Day on a holiday or a weekend.
5. A. *Detail*. The author claims that rescheduling Election Day might make it a "genuine cultural event." The author posits that scheduling Election Day on a weekend or holiday has the potential to increase turnout among busy workers, but does not state that this change would permanently decrease their business.
6. B. *Tone/Mood/Style*. An editorial is a place where one explains one's opinion in writing. The passage is not instructional, and it is certainly not a work of literary fiction. A movie script usually describes scenes, and includes dialogue. The passage is written for a wide audience and has a clear call to action.

#### Passage #5

1. C. *Tone/Mood/Style*. Anaphora is the repetition of a word or phrase at the beginning of successive sentences, and is used to emphasize the ideas that follow. Even if you don't know what anaphora is, you can eliminate all answer choices except for this one based on your knowledge of the other more common figurative language. We know that this is not a metaphor because the author is not comparing two different things.
2. A. *Inference*. We can infer that "these things four years ago" were what was previously listed – "burdens" and "despair." These are negative, not beneficial. The author doesn't suggest that they are needed or plain or unavoidable. In fact, he goes on to suggest that he himself could have avoided them.
3. C. *Detail*. In lines 17-22, the author describes a twelve-year period where the first nine were full of plenty the latter full of hardship. All of these are examples of a period of hardship: sweatshops, scourge, despair. If we don't know what "years at the ticker" are, we can infer based on the structure of the surrounding sentences that this is the period of plenty, and not the period of scarcity.
4. D. *Detail*. The author states that for 12 years, the Nation had a "do-nothing Government." This may suggest that the author felt that government was bad; however, he goes on to say that for almost four years the country had a government that "rolled up its sleeve". This tells us that government is not wholly bad, unlike the other choices, which the author states are the reason why a strong leader in government is necessary. The author refers to "financial monopoly," "organized money," and "reckless banking" as bad things.

#### Passage #6

1. C. *Inference*. The author tells us in the first paragraph that the *Haalve Maan* sailed "seeking a passage to Cathay." We can infer that this is a far-away land, and that the primary reason was not to find better fishing or hunting (they were happy byproducts).
2. B. *Main Idea*. The author goes into great detail to describe what Hudson saw when he sailed through the Narrows. The author doesn't get too much into Hudson's life, nor does he spend significant time comparing Hudson with Verrazano.
3. A. *Detail*. The third paragraph describes plants, fruits, and flowers that the men saw on land. The second paragraph details what they were able to fish out of the water. There is no disagreement mentioned in the passage, nor is there mention of meeting other people.
4. C. *Tone/Mood/Style*. The author keeps his opinion out of the passage, and goes only so far as to write about the facts. While imagery is a part of this, he uses quotes, and does not employ flowery or poetic words. Succinct and economical mean similar things when used to describe writing; they both mean "short and to the point," which this writing is not. This is not a conversation, but more like a description.

### Passage #7

1. D. *Inference*. The author makes clear that education is important because it enables people to think for themselves. The author states that “no matter how much women prefer to lean...” they should be educated in case of an emergency. The author never states that education should be controlled by women so that there is equal access.
2. D. *Tone/Mood/Style*. The author does not use the phrase literally. Instead, it is a metaphor for navigating a difficult time in life. This is another way of saying that a person must know how to survive and make good decisions. This is not specific knowledge needed for a trade, or literally a way to sail around the world on a boat.
3. E. *Tone/Mood/Style*. The author compares “craft” to an individual’s “life”, and uses an extended metaphor of sailing, crafts, and seas to make this comparison. The other choices are not literary devices.
4. E. *Main Idea*. The author does not discuss why women need men; instead, the author’s focus is on explaining why women need to be educated. The author tells us that because every person is a person (a “solitary voyager”), they are the same in that they need to be able to make their own way through life. We can infer that this is not a traditional point of view. While being able to navigate through life is an aspect of this, it is too detailed to be the main idea of the passage.
5. A. *Inference*. The author is an ardent supporter of women’s rights, and states that women, like men, must be educated and be able to live their own individual lives.

### Passage #8

1. E. *Inference*. The author writes about the moon, calling Phoebe the “twin to Phoebus” who “comes “into a deserted court by night”. We are also told that she is the divinity of sprites and fairies, not a sprite or fairy herself. The sun is described separately, as are the stars.
2. E. *Detail*. The author uses the phrase “our cradle” to describe an earlier time in society (not any specific one) where people came up with various stories about the moon. This allusion to an earlier time should not be confused with a literal cradle for babies.
3. D. *Detail*. In this sentence, the author writes of the sun and how the moon “steal[s] the garb” of the sun’s splendor. This is not literally clothing, but instead, the sun’s light. This is stolen when he “lays it aside,” allowing the moon to “blaze forthwith.”
4. C. *Main Idea*. The author writes an ode to the moon. She celebrates the moon’s many virtues, describing the mystery of it and how it is often misunderstood. She does not appear to judge or criticize, or even to share a lesson per se. Her only goal in this passage is to talk about the moon.
5. A. *Tone/Mood/Style*. The author is reverent about the moon, speaking positively about it throughout. Though the author discusses misrepresentations, her tone is not one of confusion. She speaks to what she knows, even if these things are misrepresentations. She is not angry or offended or concerned, merely intrigued and wondering.

### Passage #9

1. C. *Detail*. The author refers to meter and goes on to say that it “makes music of the spoken world as it rhythmically sways.”
2. C. *Tone/Mood/Style*. A simile uses “as” and “like” to compare two dissimilar things in order to help the reader understand an idea or concept. Here, the author compares written words (poems) with sounds (symphony) to help the reader understand the “expressiveness” of the art. The other choices are merely descriptive phrases, or else represent other types of figurative language.
3. C. *Detail*. In place of “poems” or “poetry,” the author refers to “heavy ballads,” “epic yarns,” straightforward...verses,” and “monuments.” The author mentions nature as something affected by poems or poetry.
4. B. *Inference*. By analyzing the context of the usage of “wheat” and “chaff,” we can tell that the nouns are used to describe something that readers see when they “look within” and “confront...vexations and perplexities” and “deal with...dilemmas.” These are different ways of describing choices one can make in life in order to “deal with” life’s problems.
5. B. *Detail*. The author writes that poems are “monuments of unaging intellect” and tells us that there is much to be learned from reading poetry, including about people from the past. He also describes how poems help him examine his inner self. He does not suggest that reading poetry will make a person famous or immortal (though writing it can possibly lead to that outcome).
6. C. *Detail*. The author states that “in no form of expression is the choice of each word so important.” He also writes that “a talented poet can elicit tears with only a few lines of verse, while the novelist must reach for plot twists and character development to garner a similar response.” The author values simplicity to complexity. He never states that the passage is easy to read or widely read, only that it is

worth reading. While he states that there are musical elements to poems, he does not state that this is the superlative quality of poems.

#### Passage #10

1. B. *Detail*. We can infer that “this type of specific education” is essential. The author goes on to use the word “vital,” which is a synonym. This is the opposite of superfluous. The other words don’t make sense in context.
2. B. *Main Idea*. The author’s focus is not on the relationship between technology and trade, but on how vocational education is important and should play a more prominent role in society. The author draws parallels between vocational and technical careers, almost treating them as one. The focus is not on talking up white-collar careers, but technical ones.
3. E. *Main Idea*. The author offers a single solution, but does not delve into the specific things that can be done. Instead, he simply explains his point of view and what he believes to be true. He does not describe a personal experience or relate a story.
4. A. *Inference*. The author finds that white-collar careers are overrepresented and should not be the sole focus of students’ attention. He states that there are not enough students pursuing vocational careers, like electricians. He also states that these careers “pay well.” The cost of education is not mentioned, though it may be relevant.

#### Passage #11

1. D. *Main Idea*. The author’s primary purpose is to explain why the NEA and related initiatives need more funding (specific reasons are enumerated in the third paragraph). The author uses the evolution of music education as a hook. There are no other points or options considered.
2. C. *Detail*. The author lists all of these as benefits of music education except greater participation in the NEA. The author simply tells us that the NEA is beneficial because it is an example of a program that will “spark student interest in music.” In addition, the author indicates that children can learn about music-related careers “from their favorite musicians.”
3. E. *Detail*. The author states that she was “a former educator” and that that helps her “know that an important component to youth development...is access to art and music education.” She goes on to refer to figures provided by College Board, and even uses information about Ancient Greece to support her opinion. She does not cite the Challenge America motto (if there is a motto, it’s never mentioned).
4. C. *Inference*. The author speaks highly of Challenge America and suggests in the last paragraph that it has had success before. There is no connection drawn between the College Board and support for the NEA. While cultural education is important, we can infer that it is not equally available to all, and is not standardized. The purpose of the passage is to convince – something that would not be necessary if people were eager to provide money for arts education.
5. B. *Inference*. The author supports initiatives that are “important to forming a balanced individual.” The author uses the example of arts and music education to expand on this belief. We can infer that any extension of this philosophy would be something the author supports. While the SAT may be important, the author never suggests that every student be required to take it (or that they should be banned), only going so far as to say that those who do take it and receive cultural education score better than those who do not receive cultural education. The author writes that music education helps reduce violence, not that violent students be banned. Physical education would be another type of education that enriches the lives of students outside of the classroom.

#### Passage #12

1. E. *Detail*. The author gives all of these as benefits except for the fact that the parks are unchanging. The premise of the passage is about preserving the parks, implying that they do undergo changes (i.e. invasive species). The psychological benefits are listed as “places of continuous discovery, where we go to find ourselves, to uncover our history”.
2. C. *Main Idea*. The author never discusses the possibility of decreasing government regulation. He sets the stage for recognizing workers by describing why public lands are important, and how. He does not state that there should be an increase in the amount of public lands, nor is his focus on the day itself. There is no mention of a requirement that all people visit public lands.
3. B. *Tone/Mood/Style*. The style of this piece is most like that of a speech delivered by a politician. The passage is written in the first person, so it is as if someone is reading it aloud to someone. In addition, the author seems to be addressing a person or group of people.
4. D. *Detail*. While any of these may be true, the only one mentioned or hinted at in the passage are non-native species and how they threaten the land.
5. D. *Inference*. The author is a proponent of conservation, but never goes so far as to suggest that it be a first priority. While invasive weeds are a problem, there is no link made that they are brought in by

international travelers. The author believes in access for all to public lands, would likely disagree with charging money for access. Instead, he would likely agree with expanding the lands used for park space.

### Passage #13

1. D. *Detail*. The author writes that education is a “principal instrument” in awakening the child to cultural values, in preparing him for “later professional training.” He also writes that it is doubtful that a child can be expected to succeed without education. While providing children with education is a basic function of the government, it is not one of the positive effects of education.
2. A. *Inference*. The author refers to the cost of education in a monetary sense in two places: first, at the beginning in “great expenditures” (which are worthwhile), and second, at the end, when he indicates that the government should provide it to all. Thus, we can infer that he would be in favor of increasing a school’s budget, not against it. He believes that children will learn certain cultural values, part of which is ethical behavior. He would not support privatizing education as a family responsibility, since he thinks the government should do it. We cannot infer that education is so important that only people who are educated should be allowed to vote; the author only says that education is important to a good democracy and citizenship.
3. D. *Main Idea*. In the passage, the author discusses the various reasons why education is beneficial and positive, ultimately arguing that education is something that “should be made available to all on equal terms.” He writes that “compulsory” attendance is good for democracy, and that the government spending is a good thing.

## Practice Test (Form B)

### Section 1 – Quantitative

1. B. *Algebra – Linear Equations*. Distribute 3 over  $(1 - x)$  which yields  $17 + 3 - 3x = 26$ . Combine like terms which yields  $20 - 3x = 26$ . Subtract 20 from both sides of the equation which yields  $-3x = 6$ . Divide both sides by  $-3$  which results in  $x = -2$ .
2. D. *Data Analysis & Probability – Probability*. The total number of pencils is 25. The probability of selecting a red pencil is 6 out of 25, or  $\frac{6}{25}$ , while the probability of selecting a white pencil is 9 out of 25, or  $\frac{9}{25}$ . To find the probability of either of these events occurring, add the probabilities of each event.  $\frac{6}{25} + \frac{9}{25} = \frac{15}{25}$ , or  $\frac{3}{5}$ .
3. E. *Algebra – Ratios & Proportions*. Multiplying \$4.50 by 2 will give the price per pound. Multiplying that product by 4 will give the price for 4 pounds. Hence the multiplying factor is  $2 \times 4 = 8$ .
4. C. *Numbers – Fractions*. One method to subtract a mixed number from a whole number is to first subtract the integers.  $150 - 6 = 144$ . Then convert 144 into a mixed number using the same denominator as the fraction being subtracted.  $143\frac{7}{7} - \frac{2}{7} = 143\frac{5}{7}$ .
5. B. *Geometry & Measurements – Problems using Shapes & Angles*.  $\angle FBA$  and  $\angle DBC$  are opposite angles and are therefore congruent. Since  $EB$  is perpendicular to  $FC$ ,  $\angle EBC$  is a right angle. So, the measure of  $\angle EBD$  is equal to  $90 - 40 = 50^\circ$ .
6. A. *Algebra – Word Problems*. Let  $m$  represent Matt’s age and  $a$  represent Abby’s age.  $3m - a = 25$  and  $4m - 2a = 26$ .  $a = -25 + 3m$ , which we can substitute into the second equation.  $4m - 2(-25 + 3m) = 26$ , and  $52 - 2m = 26$ , so  $2m = 26$  and  $m = 13$ .  $a = -25 + 3m$ , so  $a = 14$ . Therefore, the difference in Abby’s and Matt’s ages is  $14 - 13 = 1$ .
7. A. *Numbers – Rules of Divisibility*. The shortcut to solving this problem is to notice that  $6Q$  is being divided by 3. Since 6 is divisible by 3,  $6Q$  is divisible by 3 regardless of what  $Q$  is. Try a number that makes the first statement work: let  $Q = 8$ .  $8 \div 3 = 2$  remainder 2.  $6(8) \div 3 = 6$  remainder 0.
8. E. *Geometry & Measurements – Coordinates*. The area of a parallelogram is length of base times distance from the base to the other base. (You are NOT to multiply the length of the base by the length of one of the non-parallel sides!) In this case, the base on the  $x$ -axis measure 6 units, and the distance to the higher base is 8 units. 48 is the correct answer.
9. D. *Algebra – Inequalities*. Simplifying the inequality yields  $10x - 14 < -12x - 3$ , or  $22x < 11$ . Dividing both sides by 22 yields  $x < \frac{1}{2}$ .
10. A. *Numbers – Order of Operations*. First, solve within the parentheses; remember to raise each number to its exponent before performing the operation. Then, multiply, and subtract.  $2(8 \times 3) - 3(5 + 9)$  simplifies to  $2(24) - 3(14)$  and finally  $48 - 42 = 6$ .

11. D. *Geometry & Measurements – Slope*. Use the slope formula  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$  to solve for the missing coordinates. Plug in the coordinates that are given, the variable  $k$  for the missing coordinates, and set it equal to the slope.  $\frac{k-5}{9-k} = \frac{1}{3}$ , so  $3(k-5) = 1(9-k)$ , or  $3k-15 = 9-k$ . Finally,  $4k-15 = 9$  and  $4k = 24$  so  $k = 6$ .
12. B. *Algebra – Equations Based on Illustrations*. Since  $AD = 18$ , we know that  $BC = 8$  (half of 18 is 9, and one less than this is 8). This means  $AB + CD = 10$ , since  $18 - 8 = 10$ . Since  $AB$  and  $CD$  are equal, each is 5 in length.
13. A. *Numbers – Unit Analysis*. There are 1,000 meters in 1 kilometer.  $26 \div 1000$  kilometers = 0.026 kilometers.
14. D. *Geometry & Measurements – Perimeter, Area, & Volume*. If the circumference of the circle is  $16\pi$ , then its diameter must be 16 and its radius must be 8, so its area is  $64\pi$ .
15. D. *Algebra – Common Factor*.  $6(x^2 - 16)$  factors out to  $6(x+4)(x-4)$  and  $9(3x^2 - 8x - 16)$  factors out to  $9(3x+4)(x-4)$ , so their common factors are 3 and  $(x-4)$ , which combines to make  $3x-12$ .
16. E. *Numbers – Time Money Concepts*. If gas costs \$2.50 per gallon, then Gabby can buy 10 gallons of gas with \$25. ( $2.50g = 25$ , and  $g = 10$ .) If Gabby's car gets 30 miles per gallon, then she can go  $(30)(10) = 300$  miles on \$25 worth of gas.
17. C. *Algebra – Interpreting Variables*. Each adult ticket costs \$12.50, so for the number of adult tickets Richard buys, the expression is 12.5 times  $a$ , or  $12.5a$ . Similarly, the expression for the number of child's tickets is  $8.75c$ .
18. A. *Data Analysis & Probability – Mean, Median, Mode*. In ascending order, the factors of 72 are  $\{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72\}$ . Since the middle numbers of this set are 8 and 9, we know that the median is the average of these numbers, or 8.5.
19. E. *Algebra – Word Problems*.  $x + y = 40$  and  $x - y = 8$ . Isolating  $x$  in the second equation yields  $x = 8 + y$ . Substitute  $x$  in the first equation:  $8 + y + y = 40$ . This simplifies to  $2y = 32$  and  $y = 16$ . This is the smaller number. The larger number is  $16 + 8 = 24$ .
20. A. *Algebra – Interpreting Variables*. Five times a number can be represented by  $5x$ . Six less than another number can be represented by  $(y - 6)$ . "Difference" indicates subtraction, and the difference between these two numbers is greater than or equal to 54. Therefore,  $5x - (y - 6) \geq 54$ .
21. B. *Numbers – Percents*. Find the total of the order first.  $(4)(12.5) + (3)(2.5) = 50 + 7.5 = \$57.50$  before tax. Multiply by 0.06 to find the sales tax:  $(57.50)(0.06) = 3.45$ .  $57.50 + 3.45 = \$60.95$  after tax.
22. E. *Algebra – Interpreting Variables*. Starting with the ones column, the sum of  $Z + Z$  must equal a number ending in 8, so it must be either 4 or 9. In the tens column, the sum of  $Y + Y$  must equal a number ending in 7, which is not possible, so there must be a 1 carried over from the ones column, meaning  $Z$  must be 9, and  $Y$  must be either 3 or 8. However,  $Y$  cannot be 3, because  $W$  and  $X$  must both be smaller than  $Y$ , so they would then have to be 1 and 2, which do not add up to 6, so  $Y$  must be 8. This means a 1 is carried over to the hundreds column, so the sum of  $W + X$  must equal 5. It does not matter what  $W$  and  $X$  are individually, as the problem is only asking for their sum. Therefore,  $(W + X) + Y + Z = (5) + 8 + 9 = 22$ .
23. D. *Algebra – Radical Expressions*. Because  $\sqrt[3]{x} = x^{\frac{1}{3}}$ , we can find the value of the innermost term by dividing the exponent by 2. So,  $\sqrt{x^{18}} = x^9$ . The same can be applied to the outermost radical.  $\sqrt[3]{x^9} = x^3$ .
24. E. *Data Analysis & Probability – Set Theory*. The correct answer is  $\{4, 5, 9, 12, 13, 18, 20\}$ . To find the union of two or more sets, write all the distinct numbers in both sets.
25. B. *Algebra – Exponential Expressions*. When we raise a base to an exponent, then raise that to another exponent, we are able to multiply the exponents. This gives us  $2^{-6}$ . We know that a negative exponent gives us a fraction, so we can rule out all other choices.  $2^6 = 64$ , so  $2^{-6}$  is the reciprocal.

## Section 2 – Reading

1. D. *Main Idea*. The passage discusses the ways in which plants have been used for medicinal purposes throughout history. While a scientific process (distillation) is explained, it is not the primary focus of the passage. The diseases and treatments are used as supporting examples of the idea that plants are useful in medicine. The author doesn't compare modern medicine with herbal remedies so much as show how plants can be used to create modern medicines.
2. A. *Detail*. The word "progenitors" includes the prefix "pro-" which means "before". The sentence describes "prescription medicines" and lists modern types of these medicines. These have little resemblance to early forms of medicine, which were just the plants themselves, or "herbal remedies".
3. C. *Detail*. The passage claims that "[t]hrough a complex process of distillation, scientists are able to isolate the rehabilitative chemical compounds found in plants." Those isolated compounds are then used for

health purposes, making this choice correct. While distillation may have led to cures for life-threatening diseases, it is not the main purpose of distillation.

4. D. *Detail*. Close reading tells us that cinchona tree bark is used to fight malaria. It also tells us that ginger, aloe, and garlic can be “utilized in their unadulterated forms,” which can be inferred to be their raw form. The author also writes that plants have developed chemicals to help them survive, not to primarily benefit humans. The definition of extracts is provided in the second paragraph.
5. E. *Inference*. The passage claims that prescription medications are used to treat a host of diseases, while also claiming that herbal remedies continue to line the shelves of drugstores. The reader can thus assume that both herbal remedies and prescription medications are viable treatments for illness. Because only 40 percent of prescription medications utilize plant extracts, it can be inferred that plants are not required for developing all cures for disease. Nor does the passage claim that distillation is the only way in which prescription medication can be created. While Salicin is produced through the distillation of willow bark, the passage does not claim that Salicin cannot be cultivated through other means.
6. B. *Inference*. The passage argues that sampling without proper clearance is a form of thievery, both immoral and illegal. While the author suggests that stealing can occur in music and visual art, he does not claim that a distinction can be easily made in all art forms.
7. C. *Inference*. In context, the term “sample clearance” is described as an alternative to “failing to gain permission to use the sampled recording” and choosing “to buck copyright law.” Thus, it can be inferred that “sample clearance” is a process of receiving legal authority.
8. C. *Main Idea*. The passage begins by comparing inspiration and theft and identifies music sampling without proper clearance as a clear form of theft. The passage describes a difference between inspiration and thievery. While it uses hip hop as an example of how sampling came about, and discusses the legal consequences of sampling, its primary focus is to describe how sampling without clearance is theft.
9. E. *Detail*. The passage asserts that “proponents of sampling claim that their work not only seeks to flatter the original musician, but may even drive contemporary audiences to purchase the original recording.”
10. A. *Detail*. In context, the author is describing “self-interested artists” who do not obey copyright law. Answer D is incorrect because these musicians not only “question” copyright law, but actively disobey it.
11. E. *Detail*. The passage describes how recent lawsuits over sampling have resulted in musicians forfeiting millions of dollars in profits to owners of the original samples. Answers A and B are incorrect because they are not cited as directly resulting from lawsuits.
12. D. *Main Idea*. The speaker, encouraged by his country, places his faith in it to guide his fellow citizens. The ship is a metaphor for the State, or Union, so the answer choices literally related to ships do not describe the main idea. While it may be true that life is full of hardships (which are described in the latter half of the passage), this does not capture the fact that this passage analogizes the country to a ship.
13. E. *Tone/Mood/Style*. The “false lights on the shore” represent the difficulties a group of people (the ship, or country) must face. The rock, the gale, the tempest’s roar, and false lights, are all nautical challenges that represent challenges in this context. This passage is not about growing older and losing innocence.
14. E. *Inference*. The author uses the metaphor of the anchor to describe hope, not to warn about difficulties or provide a solution. In this case, the forge and the heat are things that make the anchor (hope), so these are not metaphors for hope itself, rather that which has strengthened hope and the country in general. These can be inferred to be the events from the past done to create the hope. The warnings are given later (the gale, tempest, false lights, etc).
15. D. *Tone/Mood/Style*. The author is encouraged by his country and writes in a very patriotic manner. He seems unafraid because he can rely on his country. The poem is the opposite of soothing; it is full of energy and encouragement.
16. A. *Detail*. We are told that Billy went to town, and can infer from his deliberations that this is Ballarat. We don’t know where he’s from, if he’s meeting a particular person, how he came the coat, or why he has a high hat. All we know is that he is heading into town.
17. C. *Inference*. The narrator tells us that Billy sees the coat and says that it is “insufficient for civilization” but that it “might do” in a “corroborree.” He also states that he will “reserve it for parties in the seclusion of the bush”.
18. D. *Detail*. At the end of the passage, we are told that Billy “wandered off into the town,” which we can infer is Ballarat. This rules out the choices stating that he goes back into the bush or the wild. The passage never states that he ripped up his frock-coat; in fact, he “inserted himself...into his discarded rags.” He does not put his dress-coat on.
19. E. *Tone/Mood/Style*. Billy is very concerned with how others will see him, so we cannot say that he is “poised” or “confident.” Instead, he is nervous about how he will appear if he puts the dress-coat on, and

is disappointed that he can't wear it into town. He may be eager to wear it (since he saves it), but we don't know whether or not he is respected or powerful (even though his title is "King").

20. A. *Tone/Mood/Style*. The title "king" has a very positive connotation, usually associated with a wise, powerful, and respected person. However, this is in sharp contrast to what Billy does in the passage. He roots around the wild in "rags" and is deciding whether or not he can put on a dress-coat. These actions are unbecoming of a "King", so the title is used ironically.
21. D. *Main Idea*. The passage begins by describing classical conditioning as a learning procedure and defining its components. It goes on to detail the procedure through the historical context of Pavlov's experiment, and then the implications of the procedure through modern psychological applications. While the passage does clarify the relationship between biological and neutral stimuli, the passage is not solely about defining this relationship. Pavlov is a big part of this passage, but the author does not go into detail about his life/work.
22. D. *Detail*. The desire to snack has been paired with a negative stimulant, meaning that any desire to snack should incite, or give rise to, a negative response.
23. C. *Detail*. In Pavlov's experiment, dogs salivated in the presence of food, making the smell of food the biological stimulant. It can thus be deduced that the metronome was the neutral stimulant, as it led to salivation only after being paired with food. The other choices were not involved in Pavlov's experiment, though they were mentioned in other parts of the passage.
24. D. *Inference*. Classical conditioning is the learning procedure that results in a neutral stimulant inducing a biological reaction. A bird chirping at a chime is representative of a neutral stimulant (the chime) provoking a biological response (chirping). All other answer choices represent typical reactions to biological stimulants.
25. E. *Inference*. Pavlov's experiment was significant because it generated biological responses from a neutral stimulant (the metronome). In this case, dogs came to salivate when hearing the sound of a metronome, even when food was not present. It can thus be inferred that dogs do not typically have a biological reaction to metronomes.
26. C. *Mood/Tone*. The primary purpose of the passage is to inform the reader about classical conditioning, so the author is writing without partiality or bias. The author is not skeptical, defiant, conflicted, or outraged.
27. E. *Inference*. There is no text to support the idea that the wife was unlucky. We are told that she "worked hard for very poor pay" and that her "bills for dress" were "uncommonly small." This suggests that she was frugal, so she would not throw "lavish" parties or spend on luxuries.
28. A. *Detail*. We know that the son did not live with Squire Green for "several years" and that "as soon as" he grew up, he left the homestead. This does not suggest that he got married or found his fortune or inherited anything, nor that he was in debt. It suggests only that he moved away to find his fortune when he was old enough.
29. A. *Detail*. We must use context clues. The word describes the "ways of the squire," the son's father. What we are told is that the "old man...had his gold, and that was company enough." He does not exhibit loving or generous behavior. We also know, from the previous paragraph, that every year he grew more and economical.
30. B. *Inference*. There's no evidence to suggest that Squire Green is condescending. While he makes money from his community lending money, we don't know that he is respected for doing so. He's not altruistic, since his motivation is to make money by lending money. If he cared more for personal relationships, then he would value more his family than his money (and would feel sad to be alone).
31. E. *Main Idea*. While the narrator does describe how Squire Green made his money, that's not the primary focus. Instead, it is to describe Squire Green as a person, and why he is the way he is. Be careful of words like "always" and "will", as they are strong absolutes and not something that can be inferred from the passage.
32. B. *Main idea*. The author discusses the cultural phenomenon of "bingeing," which is deemed to be detrimental to television viewers. The author criticizes viewers, not writers (the last paragraph seems to absolve writers). The passage doesn't recommend bingeing, nor does it go into detail about the positive aspects of bingeing. Instead, it describes a phenomenon that "afflicts millions" – a negative attribution mirrored by "pitfalls."
33. C. *Detail*. The author feels that binge-watching prevents viewers from enjoying the unique assets of a long-form medium. Bingeing is thus contradictory to, or the opposite of, the medium. It doesn't make sense to compare binge-watching with the thing that is watched (the medium) by saying that the former is indifferent or not as important to the latter.

34. E. *Detail*. In the last sentence, the author writes that bingeing a “particularly dramatic series” could lead to “emotional exhaustion” and “confusion.” This is another way of saying that there isn’t an ability to “properly empathize with characters and understand subtle plot-points.” These are examples of processing and absorbing content. The author doesn’t draw conclusions about how it will affect writers, or suggest that it will lead to better planned shows.
35. B. *Inference*. The passage claims that bingeing offers an antidote to the frustrations of cliffhangers. However, the instant gratification that comes with bingeing is seen as negating the possibility of community-building. The author sees this as a pitfall of binge-watching. The author does not make any mention of how bingeing could be dangerous for “reckless viewers.”
36. B. *Inference*. The passage indicates that binge-watchers have sacrificed the community of television for instant gratification “without realizing it.” While the author does suggest that bingeing can lead to confusion, there is no indication that viewers are “incapable” of understanding plotlines. While the passage suggests that bingeing leads to solitary viewing, it does not claim that viewers prefer watching in isolation.
37. E. *Detail*. “Jealousy” has two meanings: the state of being envious, covetous, desirous, bitter, or resentful, and the state of being protective and suspicious. From context, we can tell that the author is encouraging his fellow citizens “to be constantly awake” against outside influences. In addition, the other choices are synonymous, and can be ruled out immediately.
38. E. *Detail*. The author says that jealousy must be impartial, or else that jealousy will become the instrument “of the very influence to be avoided.” The “it” in line 5 refers to the “influence to be avoided.” Thus, it is the foreign influence, not jealousy itself, that is being referred to.
39. A. *Tone/Mood/Style*. The author provides a warning throughout the entire passage. He highlights a problem that he “conjures” the reader to believe. He does not adopt a condescending tone, as he does not appear to look down on the reader. The matter is serious, and he is not angry.
40. E. *Main Idea*. The passage consists of a problem (foreign influence) and a solution (vigilance and impartiality). There is talk of allies, enemies, patriots, and usurpers (ones who wish to undermine and overthrow), but the passage is primarily about what people can do to preserve a country.

## Section 3 – Verbal

1. A. An “antidote” is used as a cure for any sort of malady, like an illness, or being poisoned. A “remedy” is similarly any solution to a problem.
2. C. “Custodian” has the root word “custody” which means to look after something. “Custodian” means to guard or maintain a property. A “groundskeeper” is the “keeper” of the “grounds,” or looks after any sort of establishment.
3. E. To “manufacture” is to create. The prefix “manu-” pertains to hands – think “manual” or “manuscript.” Assemble has the same connotation of creation with the hands.
4. B. To “cower” is to retreat into a fearful position, not to maintain one’s position. Those who tremble are also considered scared.
5. A. Someone who is “credible” is believable, since the prefix “cred-” itself has to do with believing. “Trustworthy” denotes a similar degree of expected honesty.
6. E. “Outrageous” denotes something that is out of the ordinary. Something that is “shocking” can also be assumed to be out of the ordinary. One might angrily say that something is outrageous, but that does not make them the same thing.
7. D. “Characterize” includes the word “character”; when we talk about someone’s character, we describe a person’s traits. To characterize thus means to “describe as.”
8. A. To “modify” is to make a change. “Adjust” also means to change.
9. B. Something that is “relevant” is significant. “Important” is the best synonym; something interesting might not be relevant (in fact, many times, it is the irrelevant that is interesting).
10. D. To “verify” is to use evidence to prove the truth; the word derives from “verus,” meaning “true.” “Confirm” best captures this meaning.
11. C. To “adhere” is to hold closely to. The prefix “ad-” means “toward” or “with,” so, we can surmise that “ad” and “here” means “toward here.” Someone who adheres to the rules, for instance, follows them closely.
12. B. “Gargantuan” signifies something that is massive in size. “Enormous” is the best answer.
13. A. “Audible” uses the root word “audio” and describes something pertaining to sound. “Perceptible” means noticeable and thus is the best answer. While “melodious” relates to noise, it is too specific, as something melodious may or may not be audible.

14. E. "Vacuous" shares the same root word as does "vacuum," which can mean an unfilled space. "Empty" best captures this meaning, since something empty may or may not be unlimited.
15. A. "Virtuoso" stems from the root word "virtue," which can mean excellence. A "virtuoso" is someone who demonstrates excellence. "Expert" is the best answer.
16. D. "Succinct" describes something that is short and to the point. "Brief" is the best synonym.
17. A. "Boisterous" describes people or things that are energetic and noisy. "Rowdy" denotes a similar meaning.
18. C. A "fallacy" is something that is misunderstood, often on a wide scale. "Common misconception" is thus the best answer.
19. D. "Abstain" is to hold oneself back. "Refrain" means to avoid or hold back.
20. D. To "laud" something is to celebrate or commend it (think "applause", which shares the same root word for "laud"). "Praise" is the best choice, though clapping is something we do to specifically praise something else.
21. A. "Anterior" describes a position towards the front. We know this because the prefix "ante-" pertains to the front of things – think "antecedent" or "antechamber."
22. C. "Cognizance" shares the same root word as "cognition," which both relate to the mind, or thinking. "Cognizance" is similarly defined by "knowledge."
23. C. "Autonomy" is derived from the root word "auto-" which relates to the self. "Autonomy" has to do with the ability to govern one's self, otherwise known as one's independence. "Sovereignty," often used to describe self-governed nations, also denotes independence. Motion sensing doors move on their own, but we should not confuse automation with autonomy.
24. B. Someone who is "bellicose" is hostile, deriving from the word "bell/belli-" (think "belligerent" or "antebellum"). "Argumentative" people are often hostile, making it a synonym for "bellicose."
25. C. "Fatuous" means silly or foolish. "Meaningless" means something without meaning, or something that is without purpose. "Hilarious" has too much of a comedic, emotional connotation.
26. D. A "paradigm" describes something that sets the norm. It can often denote the best possible example of that norm. "Highest standard" fits this definition. A strange inconsistency would be a paradox.
27. A. "Covert" describes something that is hidden or not readily displayed. "Clandestine" also can be defined as something that is secret or not easily witnessed.
28. A. "Credulous" derives from the root word "credere" which means "believe" (think "credible"). If we believe something, we can depend on it. The thing we believe may or may not be obvious, as "conspicuous" and "innocuous" alternately suggest.
29. E. To "acquiesce" means to follow. "Abide by" similarly means to obey, as in to obey instructions or rules.
30. E. "Portend" means to anticipate or predict a future event. "Foreshadow" also means a warning or indication of a future event.
31. A. A carpenter creates furniture, so this is a cause/effect analogy. A tailor creates or makes adjustments to clothing.
32. D. Magnificent is the opposite of ordinary, so this is an antonym analogy. Maternal, which denotes loving, is the opposite of heartless.
33. A. A lamp emits light, so this is a defining analogy. The sun emits heat. Bright is incorrect because it is an adjective, whereas the question stem has a noun-to-noun structure (though "light" can, as an adjective, also mean "not heavy", this does not make sense in context; neither does "light" as a verb make sense).
34. E. A tripod stabilizes something (usually a camera), so this is a function/object analogy. An extinguisher douses, or puts out, flames.
35. D. Fragile is the opposite of sturdy, so this is an antonym analogy. Bizarre, which means unusual, is the opposite of normal.
36. A. Music is made by a musician, so this is a cause/effect relationship. A painting is made by a painter. "Paint" is incorrect because the question stem includes a person doing an action to create something. As a painting is made up of paint, so too might music be made up of beats, notes, etc.
37. C. "Peaches and cream" is a common expression, so this is an association analogy. Lightbulbs are powered by electricity, but peaches are not "powered" by cream. Dawn and daybreak are synonyms, so this is not the correct answer. Sing and sung are different tenses of the same word, and color and colorful are a noun and adjective pair. While "night" and "day" are opposites, they are usually used in a phrase together, like "peaches and cream."
38. A. A chef makes a meal, so this is a defining relationship. A builder makes a house.
39. A. Starved is a more extreme version than hungry, so this is a degree/intensity analogy. Burned is a more extreme version of toasted.

40. E. A designer uses fabric to make clothes, so this is an individual/object analogy. A barber uses scissors to cut hair.
41. A. A sedan is a compact type of car, so this is a type/kind analogy. A yacht is a type of boat. Vehicle and van as well as candy and taffy also have a type/kind relationship, but they do not maintain the order of the question stem.
42. B. One uses a keyboard on a computer, so this is a purpose/object analogy. Similarly, one uses chalk on a blackboard. Mouse and select is incorrect because it contains a noun-to-verb relationship, not a noun-to-noun relationship.
43. A. A mile can be broken down into feet, so this is a whole/part analogy. A pound can be broken down into ounces. Liter and gram is incorrect because a liter is broken down into milliliters, not grams.
44. A. To correspond, which means to match, is similar in meaning to resemble, so this is a synonym analogy. Aggregate, which means to bring together, is a synonym of collect.
45. B. A knife is used to cut, so this is a function/object analogy. A telephone is used to converse.
46. E. Trees make up a grove, so this is a whole/part analogy. Islands make up an archipelago, which is a grouping of islands. Stalagmite (a rock pillar often found in caves) and cave also has a whole/part relationship but does not mimic the structure of the question stem.
47. E. Volume is a specific type of measurement, so this is a type/kind analogy. Regicide, which is the killing of royalty, is a specific type of murder. Both oak and pine are types of trees.
48. B. A cowboy wrangles cattle, so this is a noun/verb analogy. A fan circulates when it is on.
49. D. Resemblance and parallel, which means similar, have the same meaning, so this is a synonym analogy. An ultimatum, which is a stipulation or firm demand, is similar in meaning to requirement.
50. D. A bricklayer uses cement during work, so this is an individual/object analogy. A judge uses a gavel in the courtroom.
51. A. Many atoms comprise matter, so this is a part/whole analogy. Many fibers make up cloth. Pride and lion is not correct because it does not match the structure of the question stem.
52. D. Began is the past tense of begin, and begun is the past participle of begin, so this is a grammar (tense) analogy. Bit is the past tense of bite and bitten is the past participle of bite. While other answers contain tense changes, they do not mimic the question stem structure of past tense-to-past participle tense.
53. C. Ubiquitous, which means universal, is a more extreme version of plentiful, so this is a degree/intensity analogy. Inevitable, which means bound to happen, is a more extreme version of likely.
54. B. A kernel is part of a corn cob, so this is a part/whole analogy. A trunk is a part of a tree. Outlet and socket has a part/whole relationship but does not match the structure of the question stem.
55. B. A needle is used to thread yarn or fabric, so this is a purpose/object analogy. A megaphone is used to amplify sound, but “amplify” is a verb, not a noun, like “yarn.” A hammer is used to drive a nail (which is also a verb). Scissors are used to cut hair, but this relationship is the opposite of the question stem.
56. E. The Abominable Snowman is a mythic creature, so this is an association analogy. Eager and beaver are also associated in the term eager beaver, which is used to describe someone who is incredibly enthusiastic. Cavities appear on teeth, but this doesn’t mean they are related to the tooth fairy.
57. A. A magician performs, so this is a noun/verb analogy. A philosopher contemplates different theories of things.
58. A. Thrown is the past participle of throw, so this is a grammar (tense) analogy. Worn is the past participle of wear.
59. E. Meager, which means a small amount, is the opposite of copious, which means a large amount, so this is an antonym analogy. Clandestine, which means secretive, is the opposite of exposed.
60. A. Figment and imagination are associated in the phrase, “a figment of one’s imagination,” so this is an association analogy. Virtue and paragon, which means epitome, are associated via the phrase, “a paragon of virtue.”

## Section 4 – Quantitative

1. B. *Data Analysis & Probability – Probability*. There are 13 integers in total that are greater than 1 and less than 15. Of these, 4 are divisible by 3 (3, 6, 9, and 12); of this subset, only 3 and 9 are NOT also divisible by 2. This means there are 2 possibilities out of a total of 13, or  $\frac{2}{13}$ .
2. D. *Numbers – Decimals*. The quotient of two numbers is found by dividing the first number by the second number. An easy way to divide decimals is to first turn everything into whole numbers. Multiply 8.1 by 10 to get 81 and multiply 9 by 10 to get 90. Divide 81 by 90 to get 0.9.
3. B. *Algebra – Scientific Notation*. 0.7% means 0.7 divided by 100, or 0.007. Since you are moving the decimal to the right from 0.007 to 7, it indicates a power of  $-3$ .

4. B. *Geometry & Measurements – Perimeter, Area, & Volume*. It does not say that the hexagon is regular or equilateral, so we do not know what each side length is, but it doesn't matter. If all 6 sides have their side lengths decreased by 2, that is a total decrease in perimeter of 12, so the new perimeter is  $21 - 12 = 9$ .
5. B. *Algebra – Linear Equations*. We must isolate  $x$ . Add  $y$  to both sides of the equation which yields  $2x = y + 9$ . Divide both sides by 2 which results in  $x = \frac{y+9}{2}$ .
6. D. *Numbers – Percents*. First, find the value of  $t$ :  $0.4t = 14$ , so  $t = 35$ .  $2t = 70$ . 60 percent of 70 is  $(0.6)(70) = 42$ .
7. D. *Data Analysis & Probability – Counting Principle*. 5 appetizers, 4 main courses, and 5 desserts would yield  $(5)(4)(5) = 100$  possible meal combinations.
8. C. *Numbers – Place Value*. The standard form of  $1.0258 \times 10^4$  is 10,258. Since 2 is in the hundreds place, its value is 2 hundred.
9. B. *Algebra – Word Problems*. Joe paints  $\frac{1}{8}$  room per hour and Frank paints  $\frac{1}{6}$  room per hour, so together they paint  $\frac{1}{8} + \frac{1}{6} = \frac{7}{24}$  house per hour.
10. D. *Numbers – Estimation*. The square root of 900 is exactly 30. The square root of 10 is slightly more than 3, so their sum is slightly more than 33.
11. A. *Algebra – Polynomial Expressions*. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $3x^2 + 2x - 1 - x^2 - 2x$ , and then like terms can be combined to yield:  $2x^2 - 1$  (since  $2x - 2x = 0$ ).
12. E. *Geometry & Measurements – Transformations*. Reflecting across both axes is the same as rotating about the origin  $180^\circ$ . The answer is the negation of both coordinates of  $(4, 3)$ , so it's  $(-4, -3)$ .
13. E. *Data Analysis & Probability – Reading Charts & Graphs*. There are 60 students with 2 siblings, 15 students with 3 siblings, and 10 students with 4 siblings. Therefore, the students with at least 2 siblings is the sum of all the students with 2 or more siblings:  $60 + 15 + 10$ .
14. B. *Numbers – Computational Clue*. One third of  $15\frac{1}{2}$  feet is  $5\frac{1}{6}$  feet.  $5\frac{1}{6} \times 12$  inches = 62 inches.
15. C. *Algebra – Word Problems*. When graphed, the equation shows a parabola. The height is equal to the maximum value of  $y$ , or the vertex of this parabola. Recall that a quadratic function has the format  $ax^2 + bx + c$ . The value of  $x$  at the vertex of the parabola is equal to  $-\frac{b}{2a}$ , or in this case  $-\frac{2}{2(-2)} = \frac{1}{2}$ . We can put this back into the original equation to find the value of  $y$  at the vertex of the parabola:  $y = -2\left(\frac{1}{2}\right)^2 + 2\left(\frac{1}{2}\right) + 16 = -\frac{1}{2} + 1 + 16$ , or  $16\frac{1}{2}$ .
16. C. *Numbers – Sequences, Patterns, Logic*. The sum of the integers from 1 through 30 is  $\frac{30(31)}{2}$  which equals 465. The sum of the integers from 1 through 19 is  $\frac{19(20)}{2}$  which equals 190. Subtract the latter from the former to get 275.
17. A. *Algebra – Common Factor*.  $8 = 2 \times 2 \times 2$ .  $10 = 2 \times 5$ .  $12 = 2 \times 2 \times 3$ . So, the LCM is equal to  $2^3 \times 5 \times 3 \times m^4 \times n^8 = 120m^4n^8$ .
18. A. *Geometry & Measurements – Pythagorean Theorem*. Since this triangle has two equal sides, it is an isosceles triangle. It is not a right triangle, but we can use a right triangle to find the height of the triangle by drawing a line from the top vertex to the base. This creates two right triangles with bases of 12 and hypotenuses of 15. (The new line would divide the base in half.) The height is the missing side of the right triangle, so we can represent this using  $12^2 + b^2 = 15^2$ .  $b^2 = 225 - 144 = 81$ . So,  $b = 9$ .
19. D. *Algebra – Interpreting Variables*. If Sheldon has  $b$  socks, then two times as many equals  $2b$  socks. Rachel has 9 more than  $2b$ , or  $2b + 9$ . Therefore, they have  $b + 2b + 9 = 3b + 9$  socks altogether.
20. C. *Data Analysis & Probability – Mean, Median, Mode*. If the first integer of this set is  $x$ , then the consecutive integers are  $(x + 1)$  and  $(x + 2)$ . First solve for  $x$  by setting up an equation that shows the average of these integers equal to 23.  $\frac{x+(x+1)+(x+2)}{3} = 23$ , which simplifies to  $\frac{3x+3}{3} = 23$ . This gives us  $x + 1 = 23$ , or  $x = 22$ . Since we are looking for the largest number, plug 22 into  $(x + 2)$  to find 24.
21. C. *Algebra – Quadratic Equations*. This equation can be rewritten as  $x^2 - 12x + 11 = 0$ , which factors into  $(x - 11)(x - 1) = 0$ , so  $x = 11$  or  $x = 1$ .
22. B. *Geometry & Measurements – Problems using Shapes & Angles*. The radius of both containers is equal to half the diameter, or  $8 \div 2 = 4$ . The volume of the can is  $V = \pi r^2 h = \pi(4)^2(5) = 80\pi$  cm<sup>3</sup>. The volume of the jar is twice the area of the can, or  $80\pi \times 2 = 160\pi$ . We can find the height by applying the volume formula again:  $160\pi = \pi(4)^2 h$ , which simplifies to  $h = 10$ .

23. C. *Algebra – Radical Expressions*. Substitute 18 for  $x$  first and multiply to yield  $\sqrt{\frac{36}{144}} \cdot \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$  so we can find the square root of each number within the radical to find the equivalent expression.  $\frac{\sqrt{36}}{\sqrt{144}} = \frac{6}{12} = \frac{1}{2}$ .
24. B. *Data Analysis & Probability – Mean, Median, Mode*. The range of this number set is  $9 - 1 = 8$ . To add a number that will not affect the range, it must be more than 1, and less than 9.
25. E. *Algebra – Rational Expressions*. In order to add fractions, they must have like denominators. So, the expression can be rewritten as  $\frac{1 \times b}{a \times b} - \frac{2 \times a}{b \times a}$  or  $\frac{b}{ab} - \frac{2a}{ab} = \frac{b - 2a}{ab}$ .

## Section 5 – “Experimental”

1. E. *Detail*. The passage explains that the Agricultural Revolution was marked by humans cultivating “certain grains in greater quantities than ever before.” While farming led to the creation of civilization and subsequent religions and customs, this was not a what set the Agricultural Revolution in motion. The passage never implies that widespread starvation was the reason for the Revolution.
2. D. *Main Idea*. While the passage does talk about farming, new eating habits, and new lifestyles, it is primarily concerned with weighing the pros and cons of the Agricultural Revolution.
3. C. *Mood/Tone*. The author is informative about the given topic and maintains a formal tone, making “analytical” the best answer. The author doesn’t seek to inspire, nor recall a “better” time; neither is the author taking sides, or being overly submissive or groveling in his word choice.
4. E. *Detail*. The passage claims that “environmental and technological developments” allowed humans to farm certain grains during the Agricultural Revolution. The passage does not provide an answer to whether the Agricultural Revolution was a sign of progress, claiming only that it was “revolutionary.”
5. C. *Inference*. The passage states that prior to the Agricultural Revolution, humans foraged for their food by hunting animals and collecting grains and vegetables. It can be inferred, then, that their bodies evolved to complement their foraging lifestyle, which was at odds with the bodily demands of farming.
6. C. “Exaggerate” comes from “exaggeration,” which is an overstatement of fact, or a magnification of something. To “embellish” is to overdo or enhance something.
7. D. To be “cosmopolitan” is to be worldly or sophisticated. Someone who is “cultured” is refined.
8. E. A “boor” is someone is rude and bad-mannered. Someone who is “uncivilized” is typically unrefined and impolite.
9. C. This is a whole/part analogy. A juror serves as part of a jury, while a piece is part of a whole.
10. E. This is a grammar analogy. Snowed is the past tense of snow, and snows is the present tense of snow, while plowed is the past tense of plow, and plows is the present tense of plow. Notice that order matters in this case.
11. D. This is a purpose/object analogy. A nose allows a person to breathe, as an eye allows a person to see. Notice that vision and see are different parts of speech (a noun and a verb, respectively).
12. B. This is a purpose/object analogy. A parachute is used to save or rescue someone, while a shovel is used to dig.
13. B. *Numbers – Common Factor*. From 30 to 60 inclusive there are 31 integers. 16 are even, leaving 15 integers that are not multiples of 2. There are then 5 odd multiples of 3, leaving 10 integers that are multiples of neither 2 nor 3.
14. A. The product of  $x$  and  $y$  will be a factor of  $ab$ , so  $ab$  is a multiple of  $xy$ .
15. D.  $(x + y)^2 = x^2 + 2xy + y^2$ , so  $(x + y)^2 = 80 + 64 = 144$ .
16. D. The total degree measure of any polygon is  $180(n - 2)$ , so an octagon has  $180(8 - 2) = 1,080$  degrees. A regular polygon has all equal sides and angles, so each angle of a regular octagon has  $1,080 \div 8 = 135$  degrees.

## Final Practice Test (Form C)

### Section 1 – Quantitative

1. D. *Numbers – Fractions*. The product of all of these expressions is  $\frac{2}{3}$ , except  $4 \times \frac{1}{3}$ , which equals  $\frac{4}{3}$ , or  $1 \frac{1}{3}$ .
2. A. *Algebra – Word Problems*. Let  $x$  equal the number of gallons of the 20% solution and  $y$  equal the number of gallons of the 15% solution. There are 10 gallons in total, so  $x + y = 10$ . We know from the problem that  $x$  gallons of the 0.2 solution and  $y$  gallons of the 0.15 solution are equal to 10 gallons of the 0.16 solution, so  $0.2x + 0.15y = 0.16(10)$ , or  $0.2x + 0.15y = 1.6$ .
3. C. *Numbers – Percents*. The percent of free throws made is equal to the number Jordan made divided by the total attempts.  $13 \div 20 = 0.65$ , or 65%

4. *D. Algebra – Interpreting Variables.* A 175% price increase means that the coffee, per pound, is now 2.75 times its original price. 1 must be added to 1.75 to indicate the 100% of the original price plus the increase.
5. *A. Data Analysis & Probability – Mean, Median, Mode.* In the given set, the mode is 16, as it appears 3 times. In order for the mode to remain 16, no other number can appear 3 times (otherwise, the set would be bimodal). 14, 15, 17, and 18 all appear 2 times, so we cannot add any of these numbers.
6. *B. Algebra – Word Problems.* The height after 1 second is the value of  $y$  when  $x = 1$ . So,  $y = -3(1) + 12(1) + 8 = 17$  meters.
7. *A. Data Analysis & Probability – Set Theory.* The correct answer is  $\{7, 14\}$ . To find the intersection of two or more sets, determine which numbers the sets have in common. Here, both Set A and Set B contain the numbers 7 and 14, so this is the intersection of these two sets.
8. *C. Algebra – Ratios & Proportions.* We can solve by using a proportion. First, determine which values will be in the numerators and denominators of your ratios. For example:  $\frac{\text{toothpicks}}{\text{minutes}}$ . Next set up your proportion:  $\frac{80}{3} = \frac{x}{60}$ . Find the cross products:  $80 \times 60 = 3 \times x$ , simplify:  $4,800 = 3x$ , and solve:  $x = 1,600$  toothpicks.
9. *B. Geometry & Measurements – Perimeter, Area, & Volume.* Since square  $ABCD$  has an area of 49, its side lengths must be 7. Since a diagonal creates two right triangles, we can use the Pythagorean Theorem to find the length of  $AC$ :  $7^2 + 7^2 = c^2$ , or  $c =$  the square root of 98, which simplifies to  $7\sqrt{2}$ .
10. *E. Data Analysis & Probability – Probability.* To find the probability of one outcome OR another outcome happening, add the probabilities of the individual outcomes. There are 20 markers in total. The probability of selecting a red marker is 7 out of 20, or  $\frac{7}{20}$ . The probability of selecting a yellow marker is 2 out of 20, or  $\frac{2}{20}$ .  $\frac{7}{20} + \frac{2}{20} = \frac{9}{20}$ .
11. *B. Algebra – Radical Expressions.* Because  $\sqrt{x} = x^{\frac{1}{2}}$ , we can find the value of the innermost term by dividing the exponent by 2.  $\sqrt{x^{72}} = x^{36}$ . Apply to the middle radical:  $\sqrt{x^{36}} = x^{18}$ . The same can be applied to the outermost radical.  $\sqrt{x^{18}} = x^9$ .
12. *C. Geometry & Measurements – Problems using Shapes & Angles.* The sum of angles in a quadrilateral is  $360^\circ$  and the two adjacent angles in a parallelogram are supplementary. So  $4x + 6x = 180$ . We can solve for  $x$ :  $10x = 180$ , so  $x = 18$ .
13. *D. Algebra – Quadratic Equations.* If you picture the arc of the ball as the curve of a parabola on a graph, and the ground as the  $x$ -axis, then the place on the graph where the ball hits the ground is the intercept with the  $x$ -axis. The parabola intercepts the  $x$ -axis when  $y = 0$ , so we can find the answer by using the equation  $0 = -x^2 + 4x + 5$  or  $x^2 - 4x - 5 = 0$ . This can be factored as  $(x + 1)(x - 5) = 0$ , so the possible solutions are  $-1$  and  $5$ . Since the intercept at  $-1$  represents 1 second before the ball was kicked, only  $5$  makes sense in context. Therefore, the time from when Jane kicks the ball to when it hits the ground is 5 seconds.
14. *E. Numbers – Percents.* You can solve using an equation  $18 = 0.05x$ .  $x = 360$ .
15. *E. Numbers – Computational Clue.*  $\frac{13.6 \text{ liters}}{4} = 3.4$  liters.  $3.4$  liters = 3,400 milliliters.
16. *B. Numbers – Sequences, Patterns, Logic.* The pattern of 6 digits will repeat fully 16 times for a total of 96 decimal places, meaning the 100<sup>th</sup> digit will be the 4<sup>th</sup> digit in the pattern, or 2.
17. *D. Algebra – Common Factor.* To find the least common multiple, first find the prime factors of each number.  $16y^3 = 2 \times 2 \times 2 \times 2 \times y \times y \times y$ .  $24y^4 = 2 \times 2 \times 2 \times 3 \times y \times y \times y \times y$ . Multiply each factor the greatest number of times it occurs: 2 occurs 4 times in  $16y^3$ , 3 occurs once in  $24y^4$ , and  $y$  occurs 4 times in  $24y^4$ , so the LCM is equal to  $2 \times 2 \times 2 \times 2 \times 3 \times y \times y \times y \times y = 48y^4$ .
18. *B. Numbers – Estimation.* The subtrahend is nearly  $\frac{1}{3}$ . The subtractor is nearly  $\frac{1}{12}$ .  $\frac{1}{3} - \frac{1}{12} = \frac{4}{12} - \frac{1}{12} = \frac{3}{12}$ , or  $\frac{1}{4} = 0.25$ .
19. *D. Algebra – Equations Based on Illustrations.* Choice A can be true since quantity C is positive and squares are always positive. Choice B can be true since if quantity B is less than  $-1$ , quantity A will be more negative than quantity B. Choice C can be true, since the average of any two numbers lies between them. Choice E can be true if quantity A is between  $-1$  and  $0$ . In that case, cubing the negative fraction will make the fraction less negative and closer to zero. But choice D is always false, since quantity A is negative, and the cube of a negative (or a negative to any odd power) is also negative.
20. *E. Algebra – Rational Expressions.* In order to add fractions, they must have like denominators. So, the expression can be rewritten as  $\frac{2(x-4)}{(x+2)(x-4)} + \frac{6(x+2)}{(x-4)(x+2)} = \frac{2x-8}{x^2-2x-8} + \frac{6x+12}{x^2-2x-8} = \frac{8x+4}{x^2-2x-8}$ .

21. C. *Geometry & Measurements – Slope*. Use the slope formula  $\left(\frac{y_2-y_1}{x_2-x_1}\right)$  and plug in the coordinates to find the slope.  $\frac{0-5}{-2-4} = \frac{-5}{-6} = \frac{5}{6}$ .
22. B. *Geometry & Measurements – Pythagorean Theorem*. We know the length of the base and we know the area of the triangle, but we don't know the height. We can find the height with the equation for the area of a triangle  $\left(\frac{1}{2}bh\right)$ , or half the base times the height. This is  $30 = \frac{1}{2}(6)h$ . This simplifies to  $h = 10$ . Use the Pythagorean Theorem to find the length of the hypotenuse,  $c$ .  $c^2 = 10^2 + 6^2 = 100 + 36 = 136$ . Therefore,  $c = \sqrt{136} = 2\sqrt{34}$ .
23. D. *Algebra – Exponential Expressions*. The key to solving rational exponents is to match up like variables in the numerator and denominator, and then subtracting the exponent in the numerator by the exponent in the denominator:  $a^{3-4}b^{5-(-4)}c^{7-6} \rightarrow a^{-1}b^9c^1$ . The final answer should have no negative exponents, so any negative exponents in the numerator should go to the denominator, and vice-versa:  $\frac{b^9c}{a}$ .
24. C. *Algebra – Inequalities*. Simplifying the inequality yields  $24x - 24x - 6 > -2x - 10$ , or  $-6 > -2x - 10$ . Therefore  $4 > -2x$  or  $-2 < x$ . Dividing both sides by a negative requires flipping the inequality sign.
25. E. *Geometry & Measurements – Spatial Reasoning*. There are nine  $1 \times 1$  rectangles, four  $2 \times 2$  rectangles, and one  $3 \times 3$  rectangle. There are also twelve  $1 \times 2$  rectangles, six  $1 \times 3$  rectangles, and four  $2 \times 3$  rectangles.  $9 + 4 + 1 + 12 + 6 + 4 = 36$ .

## Section 2 – Reading

1. E. *Detail*. The author writes that the larger spider had “exhausted all its stock.” In context, the only thing it could possibly mean is an amount of material, most probably for building a web.
2. D. *Detail*. In the middle of the passage, the author tells us that the invader attacks, wins, forces the smaller spider into a hole, comes and goes, and then finally is defeated when it starts tearing up the web. The smaller spider retreats into a hole before the larger begins to destroy the web.
3. B. *Inference*. The author's neutrality tells us that he is neither disillusioned nor compassionate. He's not impatient, either. In fact, while he is curious enough about the spider's activities to record them, he is more fascinated by what he sees. He uses words and phrases like “utmost patience,” “taking no sustenance that I could perceive,” and “fitted it for such a life” to tell us about this fascination.
4. C. *Main Idea*. The author simply describes and records his observations. While the fight between spiders is a part of the story, it is not the only focus, or general idea. The author never tells us why spiders are good, or why they do what they do. The author simply reports.
5. C. *Tone/Mood/Style*. The author's style is very informal. The form of the passage is not a poem, and it does not give data or facts as an encyclopedia entry would. A newspaper editorial would contain more of an opinion or bias.
6. B. *Detail*. The trees were bending and swaying, but because the gusts were blowing through them. In this case, the verb “smote” means to strike. So, the trees are swaying because the gusts were blowing through them.
7. A. *Detail*. Earlier in the passage, the narrator states that he was sleeping in a tent and that it was made of canvas.
8. D. *Inference*. We can infer that the narrator is terrified by what he sees. He describes the visions as “monstrous”. He states that he was “not dreaming,” and is not selfish about sharing. Rather, his concern for waking someone up is not about been seen as afraid, but about confirmation of what he sees.
9. E. *Tone/Mood/Style*. The passage describes mounting nervousness, building into terror and fear. The narrator uses the phrase “curious excitement” and “feeling of disquietude”.
10. B. *Tone/Mood/Style*. The narrator doesn't describe the smell or temperature or sound. Instead, he describes the appearance of the tent and what he sees in the trees. The most important of these is the latter, which is the crux of the passage.
11. C. *Detail*. The sentence claims that cigarettes may look “innocuous” but are in fact incredibly deadly. Thus, “innocuous” must mean the opposite of deadly. “Harmless” is the best answer.
12. E. *Main Idea*. The author is in favor of limiting people's ability to smoke cigarettes. He never mentions when or how smokers quit, nor does he believe that the effects of smoking are disputed (he never presents a point of view other than his own). Because the author believes that smoking is bad, he would not agree that taxes should not be used to dissuade people, or that personal freedoms are more important than public health. Instead, he would support prohibiting smoking, something he views as unhealthy.
13. B. *Detail*. The author mentions the elimination of asbestos as something that rid the world of a dangerous substance. This did not happen because of or as a result of smoking.

14. E. *Inference*. The author claims that despite the prevalence of anti-smoking campaigns, millions of Americans still smoke. It can thus be inferred the author sees these campaigns as ineffective. None of the other answers are supported by the passage.
15. E. *Inference*. The speaker describes how he will take charge of his life and not let hardships prevent him from living. Chance is described as violent, but this is a supporting detail. Wrath and tears describe the speaker's surroundings, but he is unaffected by them. The speaker writes that despite death, he will continue living to the fullest.
16. D. *Tone/Mood/Style*. The author uses bludgeoning as a metaphor to describe the effects of chance. He clarifies this metaphor in the following line where he describes the effects of chance's violence. In this case, he writes how chance has not been positive to him, much like a bludgeoning. An allusion is a reference to another work of literature. A simile requires the words "like" or "as." A hyperbole is an exaggeration. Paradox is a phrase that combines contradictory features.
17. B. *Inference*. The following line describes the Horror of the Shade as "the menace of the years." The speaker here is referring to people's fears of death, or the shade. There is nothing to imply the shade is literally a shadow. Nothing in the surrounding lines suggests light. The Horror of the Shade is "beyond this place of wrath and tears."
18. C. *Tone/Mood/Style*. The speaker presents frightening imagery but writes how he will overcome these things. His assertiveness implies a confident tone. He overcomes the things that may cause him to be fearful. Even though he describes scenes that would make someone anxious, there is nothing to suggest the speaker is anxious. The imagery too may be dreary, but this is not the tone of the author. The author in fact seems eager to live, not doubtful.
19. A. *Main Idea*. The poem offers encouragement, first describing "the night that covers me" and "the bludgeonings of chance" – all negative things. The author concludes by saying that he is "unafraid" and that he is "the master of [his] fate..." There is no warning here or intention to scare. Instead, the author seeks to encourage, and not to instruct.
20. A. *Main Idea*. The passage begins by detailing the historic success of soap operas, but then goes on to describe the genre's inability to remain popular among changing viewing habits. The passage tells us that reality television still gives people the drama that they want. The last paragraph tells us that young people no longer care, and that there are many other reasons for changing tastes.
21. B. *Detail*. In context, the word "eclipsed" is used to describe how reality television has given viewers an alternative to soap operas. Soap operas have been overshadowed by reality television, meaning that the former genre has become less significant.
22. E. *Detail*. The passage indicates that select soap operas have aired thousands of episodes, but does not claim this to be true of all successful television shows. It states specifically that shows most "other" shows are considered "highly successful" if they air 100 episodes.
23. D. *Inference*. The passage cites "bite-sized, viral video clips" as being of more interest to younger viewers than soap operas. It can thus be inferred that younger viewers may find soap operas to be too long in format. While younger viewers may not appreciate soap operas as much as their parents, there is nothing to indicate that they do not appreciate the storylines or that they generally cannot connect with older people. Younger people, as well as older people, may be the target for reality television – we don't have enough information to say for sure.
24. D. *Inference*. The passage indicates that despite a historic run, *Guiding Light* was cancelled in 2009. Given that 11 soap operas were in circulation as of 1998 and only 4 remain on air today, it can be inferred that *Guiding Light* suffered from the changing viewing habits discussed throughout the passage. The word "never" in the first choice is too strong – we don't know for sure that no young person watches soaps. We're not told how soaps can be viewed, whether on smartphones or otherwise. We aren't told that soap operas were too expensive, or that they're only unpopular in the United States.
25. A. *Inference*. The narrator says he went "partly to punish" his acquaintance because he believed it to be "hollow and insincere." He also tells us that he went "just to teach" a "valuable lesson." This is not the sign of curiosity, friendship, or generosity. Neither is this cruel – it is only mean-spirited.
26. E. *Tone/Mood/Style*. Throughout the passage, the narrator looks down on his acquaintance, and doesn't take him seriously. The fact that he is out to teach his acquaintance a "lesson" suggests that he does not admire his acquaintance, but rather finds his acquaintance ridiculous for being haughty.
27. E. *Detail*. The fact that the townspeople know nothing of a place called "The Elms" and only knows the acquaintance by appearance and reputation suggest that the author is correct in assuming that "The Elms" is more like "The Shagbark." The winks and wagging of heads also supports this fact. Therefore, the townspeople do not think positively of the acquaintance, and would not use positive words to describe him/her.

28. E. *Inference*. The narrator describes what “The Elms” is not because he calls it a “misnomer.”
29. D. *Tone/Mood/Style*. The author does not think positively about his acquaintance, ruling out “proudly” and “reverently.” He may be embarrassed, but he is not forced to say it, nor is he serious. Instead, he is sarcastic, saying it to demean his acquaintance.
30. C. *Detail*. In context, we can tell that since “knowledge is power,” “mental faculties” relate positive to power. Since the rest of the sentence describes this as “cruel” and “unwise,” we can infer that this phrase could be replaced by “restrict,” not “liberate.”
31. E. *Detail*. The author believes that everyone should be free and given opportunity, which is what will increase “industry, skill, invention” and allow the country to utilize the largest possible number of “intelligent men.” The author never mentions eliminating all malice and cruelty (just slavery) and certainly does not want to enslave more people. He refers to Czar Nicholas as an example of what not to do, and does not describe the unification of the North and South.
32. C. *Inference*. The author states that slavery results in a “loss to industry, skill, invention,” which are positive contributions to society and a waste of human potential. Toward the end of the passage, the author writes that this is a “peculiar weakness” and “peculiar crime” of America.
33. C. *Main Idea*. The passage is primarily about the evils of slavery in the United States. The author does discuss education, but only as it relates to the fact that slavery prevents people from achieving their full potential. Nicholas doesn’t actually make the order described, as it is a supposition that the author creates to illustrate his point. While it is true that America must face difficult truths, this is too general of a statement.
34. D. *Tone/Mood/Style*. Allusion is a short reference to a specific thing that is “common knowledge” and has some historical or cultural significance. Allusions do not describe the thing in detail, since the author expects the reader to know enough about it to understand its relevance in the text. In this case, the author supposes that the reader knows who Czar Nicholas is and what the significance of the supposed action would be. The other choices are either not literary devices (for example, simply adjectives), or are other forms of literary device.
35. B. *Tone/Mood/Style*. The author is very passionate about his beliefs, and feels very strongly about them. This is the opposite of “dispassionate.” While the author does not agree with other people, he does not adopt a judgmental or patronizing tone (either way, the two are almost synonymous, so we can rule out both choices).
36. B. *Main Idea*. The author mentions despots and tyrants in context as the end result of some behavior. This behavior – a lack of balance in government – can lead to a dire situation. Therefore, people must be well-informed enough to make their own decisions. This constitutes a warning, not an endorsement of a particular form of government, or even a comparison of forms.
37. E. *Detail*. The text is challenging to read. First, find the quoted text. Then, eliminate phrases book-ended by commas. We can shorten the sentence to be: “An over-scrupulous jealousy of danger to the rights of the people will be represented as mere pretense and artifice, the stale bait for popularity at the expense of the public good.” The idea of “popularity at the expense of the public good” is one that mirrors the idea of demagogues and tyrants, or people who would rule over others and limit their freedom.
38. B. *Inference*. “Obsequious” means “fawning,” or “excessively attentive.” As used in this sentence, “court” means to “woo,” or “going to great lengths to win favor.” Together, we can tell that this means that demagogues start off winning the favor of the people, but end up as tyrants, and that they start off telling people what they want to hear for the sake of popularity.
39. A. *Inference*. From context, we can tell that the author is describing the need to be vigilant of attempts to influence opinions (“guard against all attempts...to influence your decision in a matter of the utmost moment to your welfare”). He goes on to say that these are “impressions other than those which may result from...truth.” Said differently, the author warns us to be aware of lies masked as truths, be it from a place, group of people, or government.
40. B. *Inference*. The author tells us that “opposite parties” attempt to “increase the number of their converts” by how loudly they speak and how harshly they condemn. He does not say that they seek to reason and convince through facts and good arguments, which would be substantive. Instead, he believes that they are superficial, relying not on reasoning, but on optics and popularity. The truth is important to making up one’s own mind, but the author doesn’t imply that this will end disagreements. Despotism is created not by disagreements, but by how the different sides act and argue.

## Section 3 – Verbal

1. E. “Defect” has the prefix “de,” which denotes a reduction. “Defect also contains “efect,” which is very close to “effect.” Taken together, this can mean a reduction in something effect, which could be considered a fault. A “flaw” is an error or a mistake.
2. A. “Observant” draws from the root word “observe,” which means to witness. To be “attentive” means to be aware of one’s surroundings. This is not necessarily to be distracted, which has the opposite meaning of “focused” and “aware.”
3. C. To “vouch,” or rather, to “vouch for,” is to support something, or proclaim something as true and reliable. To “recommend for” denotes a similar trust and certainty.
4. B. “Labyrinth” has the prefix “lab,” which means to work. A labyrinth, which is often a complex series of paths or passages, can be difficult work to navigate. A “maze” is a similarly confusing puzzle that requires work to escape.
5. D. “Discriminate” has the prefix “dis” which denotes a sense of being separate, or apart. To “differentiate” is to distinguish between two things, to categorize two things as different.
6. C. “Recede” has the root word “cede,” which means to yield, or give up control. “Withdraw” means to relinquish or discontinue occupying space. Think of the tide receding, or withdrawing from shore.
7. D. “Criterion” has the root word “criteria,” which are the standards by which something is judged. A “benchmark” is a set precedent by which all criticism follows. An “appraisal” or “review” is the act of judging something, not the standards that set the foundation for judgement.
8. E. “Perspective” has the root word “spec” which means “to see” (think “spectacles”). A “point of view” is somebody’s unique outlook, or rather, they way they see something. One’s perspective might be to be cautious, but it might not be. Don’t confuse “prospective” (potential) with perspective.
9. E. A “trait” is a characteristic of something, an aspect of something that makes it unique. An “attribute” is quality of something or a designation that is “attributed” to something; think of a “character trait.”
10. C. To “plummet” is to fall swiftly, often from a height. To “plunge” also has a connotation of a rapid descent from a high point.
11. A. “Autonomous” has the prefix “auto” which means self. To be autonomous is to self-directed (think “automatic”). To be “independent” is to act on one’s own without the influence of others (like an automatic door, for example).
12. D. “Cultivate” nearly possesses the word “cull,” which means “to gather” or “select.” “Cultivation” is the practice of choosing something specific to promote or grow. To “work on” something is to develop or improve something.
13. A. To be “civil” is to behave in a way that is good-mannered and consistent with social norms. To be “polite” is to be well-behaved in one’s manners.
14. A. Someone who is “despondent” is seriously hopeless and gloomy. To be “miserable” is to be extremely sad. In this case, use the connotation of the word to help; “miserable” is the intensely negative word aside from “miserable.”
15. E. “Voracious” has the prefix “vor,” which means “eat.” To be “voracious” is to have a large appetite, especially for food. “Ravenous” means having an intense hunger.
16. B. Something that is “evanescent” is here for only a short period of time. The two are not directly related, but “evanescent” reminds one of “effervescent,” which describes something that gives off bubbles; bubbles things tend to disappear quickly. “Fleeting” describes something that is here one moment and gone the next, or something that passes swiftly.
17. A. To “divulge” is to reveal or disclose something. The prefix “di-” can mean “widely”. Thus, To “make known” is to make others aware of something previously unknown (to make it widely known).
18. C. An “inference” is a logical conclusion from something that is not explicitly stated. An “interpretation,” which draws on the root word “interpret,” is an analysis of something whose meaning is not immediately obvious.
19. E. “Rescind” has the prefix “re” which can mean “away” or “backwards.” To “rescind” is to overturn or cancel, so think about it as taking something away or going backwards. To make something “null and void” is to make something invalid, or ineffective.
20. D. “Adversity” has the root word “adverse,” which means to feel hostile towards something, or to have a difficult relationship with something. A “hardship” is something one finds trying or painful.
21. B. “Circumspect” has the prefix “circum,” which means “around,” and the suffix “spect,” which means to see. In other words, circumspect means “to look around.” Someone who looks around and is aware of their surroundings can be said to be cautious. Someone who is “suspicious” is wary of their environment.

22. B. "Eminence" means high station or rank. "Prestige" denotes a certain high stature or regard bred of achievement.
23. C. "Benevolent" has the root word "bene" which means "good." "Benevolent" thus means kind or caring. To be "compassionate" is to care for someone or something.
24. B. "Deleterious" has the prefix "de," which means to remove (think "delete"). In the case of "deleterious," which means injurious, we can think of the word as "removing health." Something that is "harmful" causes hurt or pain in some way.
25. D. "Loquacious" has the prefix "loqu," which means "to speak." Someone who is "loquacious" talks a lot. Someone who is "talkative" speaks incessantly. (An "interlocutor" is a speaker, or one who takes part in a conversation.)
26. D. To be "laconic" is to use very few words. To be "curt" is to be brief and to the point in one's speech.
27. C. To "enhance" is to raise something to a higher degree, or to intensify something. "Augment" means to increase in size, number, or extent.
28. C. To "repudiate" is to cast off, disown, or deny. To "reject" means to turn down or discard.
29. A. Something that is "acrid" is irritating to the senses, especially taste and smell. "Unpleasant" is something that is disagreeable or unlikable.
30. D. "Deference" has the root word "defer" which means to yield to something. A "humble submission" describes the act of willingly obeying or complying with something.
31. C. Motive and ulterior are associated via the term "ulterior motive," which means having a hidden motivation, so this is an association analogy. Holidays and happy are associated via the phrase "happy holidays," which is a remark used during the holiday season.
32. E. Lipstick is a type of makeup, so this is a type/kind analogy. A dagger is a type of weapon. A peanut has a shell or is inside of a shell. A copy can be made of a template. A canteen is a type of bottle, but this does not match the order of the question stem.
33. E. Quiet is a less extreme version of mute, which means to make no sound at all, so this is a degree/intensity analogy. Loud is a less extreme version of deafening.
34. D. Consistent is the opposite of erratic, which means unpredictable, so this is an antonym analogy. Something crucial is vital, or absolutely important, which is the opposite of trivial, or completely unimportant.
35. A. Catastrophe and disaster have similar meanings, so this is a synonym analogy. Dearth, which means shortage, has a similar meaning to lack. Note that a mandate describes something mandatory, but they are different parts of speech (a noun and an adjective, respectively).
36. D. Sent is both the past tense and past participle tense of send, so this is a grammar(tense) analogy. Shone is the past tense and past participle tense of shine.
37. B. A chapter is part of a novel, so this is a part/whole analogy. Fabric is part of a sofa. Chair is to leg is incorrect because it does not follow the structure of the question stem. A dish can go in a sink but is not the same as a chapter being the smaller parts of a larger whole. A dish is a dish, and a sink is a sink; a dish might be stacked into a stack of dishes, but as is, the sink is not "made up of" many dishes (like a novel is "made up of" many chapters).
38. A. A calendar is used to log events, so this is a purpose/object analogy. A journal is used to log memories. Chair and sit is incorrect because sit is a verb, and the question stem has a noun-to-noun structure.
39. E. A sheet is one part of a notebook, so this is a whole/part analogy. A key is one part of a keyboard.
40. C. Practice leads to perfection, so this is a cause/effect analogy. Carelessness leads to accidents. Ecstasy is a synonym for elation.
41. C. A cyclone, which is an extreme weather pattern, is a more extreme version of wind, so this is a degree/intensity analogy. A boulder is a more extreme version of a pebble. A tornado is a type of vortex, and even if it were a more extreme version of a vortex, it does not match the same order of the question stem.
42. E. A ledger is made up many different entries, so this is a whole/part analogy. Language is made up of words. Advice and help is incorrect because it does not follow the structure of the question stem.
43. C. A fireplace is used to generate or provide heat, so this is a function/object analogy. A refrigerator is used to preserve food. A lighter is used to provide flame, but the order does not match that of the question stem.
44. E. Freefall is caused by gravity, so this is cause/effect analogy. Shocks are caused by electricity.
45. A. A singer is one part of a choir, so this is a part/whole analogy. A brick is one part of a wall. Band and drummer is incorrect because it does not follow the structure of the question stem.

46. B. Stunt and publicity are associated via the term “publicity stunt,” which is a planned event designed to attract attention, so this is an association analogy. Breath and bated are associated via the term “bated breath,” which means holding one’s breath due to intense circumstances.
47. E. Collusion, which means a secret cooperation or conspiracy to accomplish something, has a similar meaning to complicity, which means being knowledgeable or involved in something secretive. This is a synonym analogy. Something consistent happens regularly or is said to be stable.
48. A. An employee makes or earns a salary, while savings earns or makes interest. A supervisor is one who gives a bonus or may earn one himself/herself (but this is in the wrong order). A gift could be money, or it could not be. A promotion is the opposite of a demotion, and may not lead to a raise.
49. A. A thief pilfers, or steals, so this is a noun/verb analogy. An witness is someone who tells about what he saw or experienced, which is similar to the word attest, which means to verify or confirm. An armada may ambush, but this is the opposite order of the question stem. A surgeon works in a hospital, but the second word in the stem pair is a verb, not a noun.
50. D. A benefactor, or a helper, bestows alms, or charity, so this is a definition analogy. A philanthropist, or donor, gives donations. Notice that maleficent is an adjective, while malefactor is a noun. The question stem relates two nouns together.
51. E. An ox is used to plow fields, so this is a purpose/object analogy. A sponge is used to clean a dish. An arrowhead is part of an arrow, as a blade is part of a machete. A clock is used to tell the hour, but this is in the opposite order of the question stem.
52. C. Sheep are used to produce wool, so this is a cause/effect analogy. Cows are used to produce leather.
53. E. A raptor is a type of dinosaur, so this is a type/kind analogy. A giraffe is a type of herbivore. Government is to monarchy is incorrect because it does not follow the structure of the question stem, though a monarchy is a type of government.
54. B. Smallpox is a type of disease, so this is a type/kind analogy. Geometry is a type of math.
55. E. Docile, which means calm or tame, is the opposite of wild, so this is an antonym analogy. Mundane, which means ordinary, is the opposite of exotic, which means extraordinary.
56. E. A logo identifies something, so this is a function/object analogy. A cipher, or secret code, is used to befuddle or confuse someone. An antidote is used to solve/cure a poison, but this is not in the correct order. To substantiate something is more than just making a claim. A claim can be substantiated, but it is not the function of a claim to substantiate, or the function of substantiation to claim.
57. B. Catholicism is a type of religion, so this is a type/kind analogy. A biography is a type of nonfiction writing. A surgeon is a type of doctor, but this is in the opposite order of the question stem.
58. C. Hypotheses is the plural form of hypothesis, so this is a grammar(tense) analogy. Crises is the plural form of crisis. All other choices are with plural first, followed by singular.
59. B. A fencer uses a saber, which is a type of sword, so this is an individual/object analogy. A knitter uses a needle. Earthenware is to potter and horse is to equestrian do not follow the structure of the question stem.
60. D. A chameleon adapts, so this is a noun/verb analogy. An eagle soars.

## Section 4 – Quantitative

1. D. *Numbers – Decimals*. Notice that there is no need to solve this – simply count the number of place values. We know that anything multiplied by 1 is itself, so we end up with  $0.01^2$ . A decimal multiplied by itself will end up even smaller, so we are only left with two possible choices. Since  $0.01 \times 0.01$  has a total of four place values after the decimal, we know we are looking for a choice with that same number of place values.
2. B. *Data Analysis & Probability – Reading Charts & Graphs*. The number of students who scored between a 90 and 100 is 4 and the total number of students is 30. The fraction of students who scored between a 90 and 100 is  $\frac{4}{30}$ , which simplifies to  $\frac{2}{15}$ .
3. D. *Algebra – Factoring*. All three terms have a common factor of 4, which can be factored out to yield  $4(x^2 - 8x - 12)$ . Find numbers that add to  $-8$  and multiply to  $12$  ( $-6$  and  $-2$ ). The equivalent expression is  $4(x - 2)(x - 6)$ .
4. E. *Numbers – Percents*. If there was a 40% discount, then the sale price is 60% of the original. Consider an item that costs \$100. After the discount is applied, the item costs \$60. When the sale ends, the price increases by \$40. The fraction of the discounted price that the item increases is  $\frac{40}{60} = \frac{2}{3}$ .
5. E. *Algebra – Polynomial Expressions*. Be careful with signs when you add and subtract polynomials. This expression can be rewritten as  $x^2 - 3x - 7 + x^2 - 4x - 9$ , and then like terms can be combined to yield:  $2x^2 - 7x - 16$ .

6. **B. Numbers – Integers.** Addition and subtraction expressions can be solved from left to right.  $-15 + 48 = 33$ . The expression then becomes  $33 - 31 = 2$ , and finally  $2 + 17 = 19$ .
7. **B. Algebra – Word Problems.** If the velocity against the wind is  $x$ , then  $2x = 600$  and  $x = 300$ . If the velocity with the wind is equal to  $y$ , then  $5y = 3,200$  and  $y = 640$ . So, the speed of the plane against the wind ( $v - w$ ) and the speed of the train with the wind ( $v + w$ ) can be shown by  $v - w = 300$  and  $v + w = 640$ .  $w = 640 - v$ , so  $v - (640 - v) = 300$  and  $v = 470$ . To find the time it takes to travel 1,100 miles, we can use the equation  $470t = 1,880$ , so  $t = 4$ .
8. **E. Numbers – Rules of Divisibility.** Given that  $\frac{a}{b}$  is negative, either  $a$  or  $b$  is negative but it's IMPOSSIBLE to know which it is. We also know that the absolute value of  $a$  is greater than that of  $b$ . The best way to answer this question is to find examples of  $a$  and  $b$  for which the answer choice IS NOT true (For example, in (A), we can say  $a$  is  $-2$  and  $b$  is  $1$ , so the sum of  $a$  and  $b$  is  $-1$ ). After elimination we end up with the final answer.
9. **A. Algebra – Interpreting Variables.** One penny is one cent. One nickel is 5 cents. One dime is 10 cents. Therefore, to calculate the number of cents in  $x$  pennies,  $y$  nickels, and  $z$  dimes, use the expression  $x + 5y + 10z$ .
10. **C. Numbers – Basic Number Theory.** The prime factorization of 18 is  $2 \times 3^2$  and the prime factorization of 24 is  $2^3 \times 3$ , thus the greatest common factor is the combination of the common factors of the two numbers, or  $2 \times 3$ .
11. **D. Algebra – Equations Based on Word Problems.** Subtract 32 from both sides. To eliminate the fraction, multiply both sides by  $\frac{5}{9}$ .
12. **E. Data Analysis & Probability – Mean, Median, Mode.** If the first integer of this set is  $x$ , then the consecutive odd integers are  $(x + 2)$ ,  $(x + 4)$ ,  $(x + 6)$ ,  $(x + 8)$ , and  $(x + 10)$ . First solve for  $x$  by setting up an equation that shows the average of these integers equal to 32.  $\frac{x + (x + 2) + (x + 4) + (x + 6) + (x + 8) + (x + 10)}{6} = 32$  or  $\frac{6x + 30}{6} = 32$ . This gives  $x + 5 = 32$  and  $x = 27$ . Since we looking for the largest number, plug 27 into  $(x + 10)$  to find 37.
13. **D. Numbers – Order of Operations.** First solve within the parentheses, then multiply and divide from left to right.  $30 \div 6 \times (12)$  simplifies to  $5 \times 12 = 60$ .
14. **E. Algebra – Linear Equations.** Identify the  $y$ -intercept ( $b$ ) of the line which yields  $b = 2$ . Identify the slope ( $m$ ) of the line which yields  $m = -2$ . Write the equation of the line by substituting  $b$  and  $m$  into  $y = mx + b$  which results in  $y = -2x + 2$ .
15. **B. Geometry & Measurements – Problems using Shapes & Angles.** This cross-section goes through the cone at a slight angle, and the resulting shape is not a perfect circle, but rather an ellipse.
16. **E. Algebra – Quadratic Equations.** One way to solve is to use the quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . The coefficients are  $a = 3$ ,  $b = 4$ , and  $c = 1$ . So,  $x = \frac{-4 \pm \sqrt{(4)^2 - 4(3)(1)}}{2(3)}$  which can be simplified as  $x = \frac{-4 \pm 2}{6}$ . Therefore, the possible solutions are  $\frac{-2}{6} = -\frac{1}{3}$  and  $\frac{-6}{6} = -1$ .
17. **E. Geometry & Measurements – Coordinates.** Only parallel lines have no points in common. The correct answer must have the same slope and a different  $y$ -intercept. Only one choice has a slope of 2.
18. **A. Algebra – Radical Expressions.** Substitute 3 for  $x$  first and multiply to yield  $\sqrt[3]{\frac{27}{216}} \cdot \sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$ , so we can find the cubed root of each number within the radical to find the equivalent expression.  $\frac{\sqrt[3]{27}}{\sqrt[3]{216}} = \frac{3}{6} = \frac{1}{2}$ .
19. **C. Geometry & Measurements – Transformations.** The first reflection adds 8 to the  $y$ -coordinate, then the second reflection adds 6 to the  $x$ -coordinate. Therefore,  $(2, 3)$  becomes  $(2 + 6, 3 + 8)$  or  $(8, 11)$ .
20. **E. Algebra – Ratios & Proportions.** The average speed, in miles per hour, for a 15-mile trip in 50 minutes is:  $\frac{15}{\frac{50}{60}} = 18$  miles per hour. The average speed, in miles per hour, for a 15-mile trip in 45 minutes is:  $\frac{15}{\frac{45}{60}} = 20$  miles per hour. Therefore, the average speed, in miles per hour, must be between 18 and 20.
21. **E. Data Analysis & Probability – Probability.** To find the probability of 2 independent events both occurring, multiply the probability of each event. Since the probability of it raining on Monday is 0.55, there is a 0.45 chance that it will NOT rain; similarly, there is a 0.3 chance that it will NOT rain on Thursday.  $0.45 \times 0.3 = 0.135$ .
22. **B. Geometry & Measurements – Perimeter, Area, & Volume.** The product of all three sides must be 252, so the area of the base must be 36. Since the base is a square, the length and width are equal, so each side length is 6.
23. **C. Algebra – Word Problems.**  $x + y = 78$  and  $x - y = 6$ . Isolating  $x$  in the first equation yields  $x = 78 - y$ . Substitute this into the second equation:  $78 - y - y = 6$ . So,  $2y = 72$  and  $y = 36$ . This is the smaller number.

24. C. *Data Analysis & Probability – Counting Principle*. If there are 10 games and 4 teams, and each game involves two teams, there are  $(10)(4) \div 2 = 20$  total games to be played during the season.
25. C. *Geometry & Measurements – Perimeter, Area, & Volume*. If the right triangle has an area of 12 and one leg of 4, then the other leg can be found using the equation  $\frac{1}{2}(4)(x) = 12$ , so  $x = 6$ . The hypotenuse can be found using the Pythagorean Theorem:  $4^2 + 6^2 = c^2$ , so  $c = \sqrt{52}$  which simplifies to  $2\sqrt{13}$ . Therefore, the perimeter is  $4 + 6 + 2\sqrt{13} = 10 + 2\sqrt{13}$ .

## Section 5 – “Experimental”

1. C. To “emphasize” is to highlight or stress. “To call attention to” is to bring awareness to.
2. B. To be “adamant” is to be inflexible about something. “Stubborn” means unwilling to change. “Pugnacious” has too negative of a charge to be a fitting synonym.
3. B. Something that is “odious” is detestable and worthy of scorn. “Hateful” means vile and unbearable.
4. C. This is an antonym analogy. Listless (tired, low energy) is the opposite of spirited (energetic), and decent is the opposite of evil.
5. E. This is a degree/intensity analogy. Something miniscule is very, very small. Something colossal is very, very big.
6. A. This is a noun/verb analogy. A sire wails, and a horn blares. A horn is used by a driver, who may or may not be angry.
7. D. This is a type/kind analogy. A rooster is a type of chicken (a male chicken) and a stag is a male deer.
8. C.  $5.6 \div 7.0 = 0.8$ , and  $10^4 \div 10^{-3} = 10^7$ , so the quotient is  $0.8 \times 10^7$ , which in scientific notation is  $8.0 \times 10^6$ .
9. D. Adding 7 and then dividing by 4 to both sides results in  $|3x - 5| < 2$ . This becomes  $-2 < 3x - 5 < 2$ .  
Adding 5 and then dividing by 3 to both sides results in  $1 < x < \frac{7}{3}$ .
10. E. This describes a function whereby we simply plug 10 in for  $x$ , giving us  $5(10) - 6 = 44$ .
11. B. The square root of 36 is 6. To find the square root of a variable, cut the exponent in half. Here, the square root of  $x^{36}$  is  $x^{18}$ .
12. D. *Main Idea*. This passage is primarily about the ineffective and often cruel nature of animal testing. While the author mentions that animals have few legal protections and suggests that the scientific community may be acting unethically, these sentiments do not fully encapsulate the passage as a whole.
13. B. *Inference*. The author states that “As scientists race to create remedies for human ailments... animal testing has become an unfortunate and immoral byproduct.” This suggests that animal testing is a direct result of a drive to cure human disease. The author mentions that there are few laws protecting animals, not that there are laws against human testing (there are “human trials”, as mentioned in the second paragraph). The passage states that animal testing causes suffering in animals, and doesn’t prevent it. Other medicines like penicillin are used to show how testing does not help, not to show how it is a reason for animal testing.
14. E. *Detail*. The author is citing a study that questions the effectiveness of animal testing, pointing to the fact that only 19% of human side-effects could be predicted. “Practice” may be an enticing choice, but the sentence is more specifically referring to the effectiveness of testing, not just the act of it. Similarly, the “frequency,” “stress,” and “duress” of the testing are aspects of the act itself, not a commentary on the effectiveness.
15. E. *Detail*. The author explains that animal testing “consistently fails to predict human reactions” for a variety of reasons. The fact that there are not many laws means that animals can be mistreated, not that testing is ineffective. People’s lack of awareness on the treatment of animal is not a reason why such testing is ineffective, even if it is true. While some medicines were developed without animal testing, like penicillin, this doesn’t make animal testing ineffective.
16. E. *Tone/Mood/Style*. The author claims that in trying to preserve humanity, animal testing actually lacks any humanity, which is to say that it does not view animals sympathetically. The question thus serves to point out the hypocrisy, or contradiction of animal testing. This is a central idea of the passage.