Choices B and C are incorrect because placing a colon before or after “such as” would create an error in sentence structure: a colon must be preceded by an independent clause. Choice D is incorrect because no comma is necessary here.

QUESTION 43

Choice A is the best answer because the transitional phrase “for example” appropriately indicates that the Help Me Investigate project discussed in the sentence is an example of the use of social media mentioned in the previous sentence.

Choices B, C, and D are incorrect because neither “therefore,” “however,” nor “in any case” indicates the true relationship between this and the previous sentence. The Help Me Investigate project discussed in the current sentence is an example of the use of social media mentioned in the previous sentence.

QUESTION 44

Choice C is the best answer because the full subject of the independent clause, “the advent of the digital age,” directly follows the dependent clause that introduces it.

Choices A, B, and D are incorrect because the subjects of their independent clauses do not directly follow the introductory dependent clause. “Far from marking the end of investigative journalism” refers to the “advent of the digital age,” not to “cooperation among journalists” (choice A) or “the number of potential investigators” (choice B). In choice D, an interrupting phrase (“by facilitating cooperation among journalists and ordinary citizens”) separates the subject from the dependent clause that modifies it.

Section 3: Math Test - No Calculator

QUESTION 1

Choice D is correct. From the graph, the *y*-intercept of line ℓ is (0, 1). The line also passes through the point (1, 2). Therefore the slope of the line is $\frac{2-1}{1-0}=\frac{1}{1}=1$, and in slope-intercept form, the equation for line ℓ is $y = x + 1$.

Choice A is incorrect. It is the equation of the vertical line that passes through the point (1, 0). Choice B is incorrect. It is the equation of the horizontal line that passes through the point (0, 1). Choice C is incorrect. The line defined by this equation has *y*-intercept (0, 0), whereas line ℓ has *y*-intercept (0, 1).

QUESTION 2

Choice A is correct. A circle has 360 degrees of arc. In the circle shown, *O* is the center of the circle and angle *AOC* is a central angle of the circle. From the figure, the two diameters that meet to form angle *AOC* are perpendicular, so the measure of angle *AOC* is 90°. This central angle intercepts minor arc *AC*, meaning minor arc *AC* has 90° of arc. Since the circumference (length) of the entire circle is 36, the length of minor arc *AC* is $\frac{90}{360} \times 36 = 9$.

Choices B, C, and D are incorrect. The perpendicular diameters divide the circumference of the circle into four equal arcs; therefore, minor arc *AC* is $\frac{1}{4}$ of the circumference. However, the lengths in choices B and C are, respectively, $\frac{1}{3}$ and $\frac{1}{2}$ the circumference of the circle, and the length in choice D is the length of the entire circumference. None of these lengths is $\frac{1}{4}$ the circumference.

QUESTION 3

Choice B is correct. Dividing both sides of the quadratic equation $4x^2 - 8x - 12 = 0$ by 4 yields $x^2 - 2x - 3 = 0$. The equation $x^2 - 2x - 3 = 0$ can be factored as $(x + 1)(x - 3) = 0$. This equation is true when $x + 1 = 0$ or $x - 3 = 0$. Solving for x gives the solutions to the original quadratic equation: $x = -1$ and $x = 3$.

Choices A and C are incorrect because −3 is not a solution of $4x^2 - 8x - 12 = 0$: $4(-3)^2 - 8(-3) - 12 = 36 + 24 - 12 \neq 0$. Choice D is incorrect because 1 is not a solution of $4x^2 - 8x - 12 = 0$: $4(1)^2 - 8(1) - 12 = 4 - 8 - 12 \neq 0$.

QUESTION 4

Choice C is correct. If f is a function of x, then the graph of f in the xy-plane consists of all points $(x, f(x))$. An x-intercept is where the graph intersects the x-axis; since all points on the x-axis have y-coordinate 0, the graph of f will cross the x-axis at values of x such that $f(x) = 0$. Therefore, the graph of a function f will have no x-intercepts if and only if f has no real zeros. Likewise, the graph of a quadratic function with no real zeros will have no x-intercepts.

Choice A is incorrect. The graph of a linear function in the xy-plane whose rate of change is not zero is a line with a nonzero slope. The x-axis is a horizontal line and thus has slope 0, so the graph of the linear function whose rate of change is not zero is a line that is not parallel to the x-axis. Thus, the graph must intersect the x-axis at some point, and this point is an x-intercept of the graph. Choices B and D are incorrect because the graph of any function with a real zero must have an x-intercept.

QUESTION 5

Choice D is correct. If $x = 9$ in the equation $\sqrt{k+2} - x = 0$, this equation becomes $\sqrt{k+2} - 9 = 0$, which can be rewritten as $\sqrt{k+2} = 9$. Squaring each side of $\sqrt{k+2} = 9$ gives $k + 2 = 81$, or $k = 79$. Substituting $k = 79$ into the equation $\sqrt{k+2} - 9 = 0$ confirms this is the correct value for k.

Choices A, B, and C are incorrect because substituting any of these values for k in the equation $\sqrt{k+2} - 9 = 0$ gives a false statement. For example, if $k = 7$, the equation becomes $\sqrt{7+2} - 9 = \sqrt{9} - 9 = 3 - 9 = 0$, which is false.

QUESTION 6

Choice A is correct. The sum of $(a^2 - 1)$ and $(a + 1)$ can be rewritten as $(a^2 - 1) + (a + 1)$, or $a^2 - 1 + a + 1$, which is equal to $a^2 + a + 0$. Therefore, the sum of the two expressions is equal to $a^2 + a$.

Choices B and D are incorrect. Since neither of the two expressions has a term with a^3, the sum of the two expressions cannot have the term a^3 when simplified. Choice C is incorrect. This choice may result from mistakenly adding the terms a^2 and a to get $2a^2$.

QUESTION 7

Choice C is correct. If Jackie works x hours as a tutor, which pays \$12 per hour, she earns $12x$ dollars. If Jackie works y hours as a lifeguard, which pays \$9.50 per hour, she earns $9.5y$ dollars. Thus the total, in dollars, Jackie earns in a week that she works x hours as a tutor and y hours as a lifeguard is $12x + 9.5y$. Therefore, the condition that Jackie wants to earn at least \$220 is represented by the inequality $12x + 9.5y \geq 220$. The condition that Jackie can work no more than 20 hours per week is represented by the inequality $x + y \leq 20$. These two inequalities form the system shown in choice C.

Choice A is incorrect. This system represents the conditions that Jackie earns no more than \$220 and works at least 20 hours. Choice B is incorrect. The first inequality in this system represents the condition that Jackie earns no more than \$220. Choice D is incorrect. The second inequality in this system represents the condition that Jackie works at least 20 hours.

QUESTION 8

Choice A is correct. The constant term 331.4 in $S(T) = 0.6T + 331.4$ is the value of S when $T = 0$. The value $T = 0$ corresponds to a temperature of 0°C. Since $S(T)$ represents the speed of sound, 331.4 is the speed of sound, in meters per second, when the temperature is 0°C.

Choice B is incorrect. When $T = 0.6$°C, $S(T) = 0.6(0.6) + 331.4 = 331.76$, not 331.4, meters per second. Choice C is incorrect. Based on the given formula, the speed of sound increases by 0.6 meters per second for every increase of temperature by 1°C, as shown by the equation $0.6(T + 1) + 331.4 = (0.6T + 331.4) +0.6$. Choice D is incorrect. An increase in the speed of sound, in meters per second, that corresponds to an increase of 0.6°C is $0.6(0.6) = 0.36$.

QUESTION 9

Choice A is correct. Substituting x^2 for y in the second equation gives $2(x^2) + 6 = 2(x + 3)$. This equation can be solved as follows:

$2x^2 + 6 = 2x + 6$ (Apply the distributive property.)

$2x^2 + 6 - 2x - 6 = 0$ (Subtract $2x$ and 6 from both sides of the equation.)

$2x^2 - 2x = 0$ (Combine like terms.)

$2x(x - 1) = 0$ (Factor both terms on the left side of the equation by $2x$.)

Thus, $x = 0$ and $x = 1$ are the solutions to the system. Since $x > 0$, only $x = 1$ needs to be considered. The value of y when $x = 1$ is $y = x^2 = 1^2 = 1$. Therefore, the value of xy is $(1)(1) = 1$.

Choices B, C, and D are incorrect and likely result from a computational or conceptual error when solving this system of equations.

QUESTION 10

Choice B is correct. Substituting $a^2 + b^2$ for z and ab for y into the expression $4z + 8y$ gives $4(a^2 + b^2) + 8ab$. Multiplying $a^2 + b^2$ by 4 gives $4a^2 + 4b^2 + 8ab$, or equivalently $4(a^2 + 2ab + b^2)$. Since $(a^2 + 2ab + b^2) = (a + b)^2$, it follows that $4z + 8y$ is equivalent to $(2a + 2b)^2$.

Choices A, C, and D are incorrect and likely result from errors made when substituting or factoring.

QUESTION 11

Choice C is correct. The volume of right circular cylinder A is given by the expression $\pi r^2 h$, where r is the radius of its circular base and h is its height. The volume of a cylinder with twice the radius and half the height of cylinder A is given by $\pi(2r)^2(\frac{1}{2})h$, which is equivalent to $4\pi r^2(\frac{1}{2})h = 2\pi r^2 h$. Therefore, the volume is twice the volume of cylinder A, or 2 × 22 = 44.

Choice A is incorrect and likely results from not multiplying the radius of cylinder A by 2. Choice B is incorrect and likely results from not squaring the 2 in 2*r* when applying the volume formula. Choice D is incorrect and likely results from a conceptual error.

QUESTION 12

Choice D is correct. Since 9 can be rewritten as 3^2, $9^{\frac{3}{4}}$ is equivalent to $3^{2^{(\frac{3}{4})}}$. Applying the properties of exponents, this can be written as $3^{\frac{3}{2}}$, which can further be rewritten as $3^{\frac{2}{2}}(3^{\frac{1}{2}})$, an expression that is equivalent to $3\sqrt{3}$.

Choices A is incorrect; it is equivalent to $9^{\frac{1}{3}}$. Choice B is incorrect; it is equivalent to $9^{\frac{1}{4}}$. Choice C is incorrect; it is equivalent to $3^{\frac{1}{2}}$.

QUESTION 13

Choice B is correct. When *n* is increased by 1, *t* increases by the coefficient of *n*, which is 1.

Choices A, C, and D are incorrect and likely result from a conceptual error when interpreting the equation.

QUESTION 14

Choice C is correct. The graph of $y = -f(x)$ is the graph of the equation $y = -(2^x + 1)$, or $y = -2^x - 1$. This should be the graph of a decreasing exponential function. The *y*-intercept of the graph can be found by substituting the value $x = 0$ into the equation, as follows: $y = -2^0 - 1 = -1 - 1 = -2$. Therefore, the graph should pass through the point (0, −2). Choice C is the only function that passes through this point.

Choices A and B are incorrect because the graphed functions are increasing instead of decreasing. Choice D is incorrect because the function passes through the point (0, −1) instead of (0, −2).

QUESTION 15

Choice D is correct. Since gasoline costs \$4 per gallon, and since Alan's car travels an average of 25 miles per gallon, the expression $\frac{4}{25}$ gives the cost, in dollars per mile, to drive the car. Multiplying $\frac{4}{25}$ by *m* gives the cost for Alan to drive *m* miles in his car. Alan wants to reduce his weekly spending by \$5, so setting $\frac{4}{25}m$ equal to 5 gives the number of miles, *m*, by which he must reduce his driving.

Choices A, B, and C are incorrect. Choices A and B transpose the numerator and the denominator in the fraction. The fraction $\frac{25}{4}$ would result in the unit miles per dollar, but the question requires a unit of dollars per mile. Choices A and C set the expression equal to 95 instead of 5, a mistake that may result from a misconception that Alan wants to reduce his driving by 5 miles each week; instead, the question says he wants to reduce his weekly expenditure by \$5.

QUESTION 16

The correct answer is 4. The equation $60h + 10 \leq 280$, where *h* is the number of hours the boat has been rented, can be written to represent the situation. Subtracting 10 from both sides and then dividing by 60 yields $h \leq 4.5$. Since the boat can be rented only for whole numbers of hours, the maximum number of hours for which Maria can rent the boat is 4.

QUESTION 17

The correct answer is $\frac{6}{5}$, or 1.2. To solve the equation $2(p + 1) + 8(p - 1) = 5p$, first distribute the terms outside the parentheses to the terms inside the parentheses: $2p + 2 + 8p - 8 = 5p$. Next, combine like terms on the left side of the equal sign: $10p - 6 = 5p$. Subtracting $10p$ from both sides yields $-6 = -5p$. Finally, dividing both sides by −5 gives $p = \frac{6}{5} = 1.2$. Either 6/5 or 1.2 can be gridded as the correct answer.

QUESTION 18

The correct answer is $\frac{21}{4}$, or 5.25. Use substitution to create a one-variable equation that can be solved for *x*. The second equation gives that $y = 2x$. Substituting $2x$ for *y* in the first equation gives $\frac{1}{2}(2x + 2x) = \frac{21}{2}$. Dividing both sides of this equation by $\frac{1}{2}$ yields $(2x + 2x) = 21$. Combining like terms results in $4x = 21$. Finally, dividing both sides by 4 gives $x = \frac{21}{4} = 5.25$. Either 21/4 or 5.25 can be gridded as the correct answer.

QUESTION 19

The correct answer is 2. The given expression can be rewritten as $\frac{2x+6}{(x+2)^2} - \frac{2x+4}{(x+2)^2}$, which is equivalent to $\frac{2x+6-2x-4}{(x+2)^2}$, or $\frac{2}{(x+2)^2}$. This is in the form $\frac{a}{(x+2)^2}$; therefore, $a = 2$.

QUESTION 20

The correct answer is 97. The intersecting lines form a triangle, and the angle with measure of $x°$ is an exterior angle of this triangle. The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles of the triangle. One of these angles has measure of 23° and the other, which is supplementary to the angle with measure 106°, has measure of 180° − 106° = 74°. Therefore, the value of x is 23 + 74 = 97.

Section 4: Math Test - Calculator

QUESTION 1

Choice D is correct. The change in the number of 3-D movies released between any two consecutive years can be found by first estimating the number of 3-D movies released for each of the two years and then finding the positive difference between these two estimates. Between 2003 and 2004, this change is approximately 2 − 2 = 0 movies; between 2008 and 2009, this change is approximately 20 − 8 = 12 movies; between 2009 and 2010, this change is approximately 26 − 20 = 6 movies; and between 2010 and 2011, this change is approximately 46 − 26 = 20 movies. Therefore, of the pairs of consecutive years in the choices, the greatest increase in the number of 3-D movies released occurred during the time period between 2010 and 2011.

Choices A, B, and C are incorrect. Between 2010 and 2011, approximately 20 more 3-D movies were released. The change in the number of 3-D movies released between any of the other pairs of consecutive years is significantly smaller than 20.

QUESTION 2

Choice C is correct. Because *f* is a linear function of *x*, the equation *f*(*x*) = *mx* + *b*, where *m* and *b* are constants, can be used to define the relationship between *x* and *f*(*x*). In this equation, *m* represents the increase in the value of *f*(*x*) for every increase in the value of *x* by 1. From the table, it can be determined that the value of *f*(*x*) increases by 8 for every increase in the value of *x* by 2. In other words, for the function *f* the value of *m* is $\frac{8}{2}$, or 4. The value of *b* can be found by substituting the values of *x* and *f*(*x*) from any row of the table and the value of *m* into the equation *f*(*x*) = *mx* + *b* and solving for *b*. For example, using *x* = 1, *f*(*x*) = 5, and *m* = 4 yields 5 = 4(1) + *b*. Solving for *b* yields *b* = 1. Therefore, the equation defining the function *f* can be written in the form *f*(*x*) = 4*x* + 1.

Choices A, B, and D are incorrect. Any equation defining the linear function *f* must give values of *f*(*x*) for corresponding values of *x*, as shown in each row of the table. According to the table, if *x* = 3, *f*(*x*) = 13. However, substituting *x* = 3 into the equation given in choice A gives *f*(3) = 2(3) + 3, or *f*(3) = 9, not 13. Similarly, substituting *x* = 3 into the equation given in choice B gives *f*(3) = 3(3) + 2, or *f*(3) = 11, not 13. Lastly, substituting *x* = 3 into the equation given in choice D gives *f*(3) = 5(3), or *f*(3) = 15, not 13. Therefore, the equations in choices A, B, and D cannot define *f*.

QUESTION 3

Choice A is correct. If 2.5 ounces of chocolate are needed for each muffin, then the number of ounces of chocolate needed to make 48 muffins is 48 × 2.5 = 120 ounces. Since 1 pound = 16 ounces, the number of pounds that is equivalent to 120 ounces is $\frac{120}{16}$ = 7.5 pounds. Therefore, 7.5 pounds of chocolate are needed to make the 48 muffins.

Choice B is incorrect. If 10 pounds of chocolate were needed to make 48 muffins, then the total number of ounces of chocolate needed would be 10 × 16 = 160 ounces. The number of ounces of chocolate per muffin would then be $\frac{160}{48}$ = 3.33 ounces per muffin, not 2.5 ounces per muffin. Choices C and D are also incorrect. Following the same procedures as used to test choice B gives 16.8 ounces per muffin for choice C and 40 ounces per muffin for choice D, not 2.5 ounces per muffin. Therefore, 50.5 and 120 pounds cannot be the number of pounds needed to make 48 signature chocolate muffins.

QUESTION 4

Choice B is correct. The value of *c* + *d* can be found by dividing both sides of the given equation by 3. This yields *c* + *d* = $\frac{5}{3}$.

Choice A is incorrect. If the value of $c + d$ is $\frac{3}{5}$, then $3 \times \frac{3}{5} = 5$; however, $\frac{9}{5}$ is not equal to 5.

Choice C is incorrect. If the value of $c + d$ is 3, then $3 \times 3 = 5$; however, 9 is not equal to 5. Choice D is incorrect. If the value of $c + d$ is 5, then $3 \times 5 = 5$; however, 15 is not equal to 5.

QUESTION 5

Choice C is correct. The weight of an object on Venus is approximately $\frac{9}{10}$ of its weight on Earth. If an object weighs 100 pounds on Earth, then the object's weight on Venus is given by $\frac{9}{10}(100)$ = 90 pounds. The same object's weight on Jupiter is approximately $\frac{23}{10}$ of its weight on Earth; therefore, the object weighs $\frac{23}{10}(100)$ = 230 pounds on Jupiter. The difference between the object's weight on Jupiter and the object's weight on Venus is $230 - 90 = 140$ pounds. Therefore, an object that weighs 100 pounds on Earth weighs 140 more pounds on Jupiter than it weighs on Venus.

Choice A is incorrect because it is the weight, in pounds, of the object on Venus. Choice B is incorrect because it is the weight, in pounds, of an object on Earth if it weighs 100 pounds on Venus. Choice D is incorrect because it is the weight, in pounds, of the object on Jupiter.

QUESTION 6

Choice B is correct. Let n be the number of novels and m be the number of magazines that Sadie purchased. If Sadie purchased a total of 11 novels and magazines, then $n + m = 11$. It is given that the combined price of 11 novels and magazines is \$20. Since each novel sells for \$4 and each magazine sells for \$1, it follows that $4n + m = 20$. So the system of equations below must hold.

$$4n + m = 20$$
$$n + m = 11$$

Subtracting side by side the second equation from the first equation yields $3n = 9$, so $n = 3$. Therefore, Sadie purchased 3 novels.

Choice A is incorrect. If 2 novels were purchased, then a total of \$8 was spent on novels. That leaves \$12 to be spent on magazines, which means that 12 magazines would have been purchased. However, Sadie purchased a total of 11 novels and magazines. Choices C and D are incorrect. If 4 novels were purchased, then a total of \$16 was spent on novels. That leaves \$4 to be spent on magazines, which means that 4 magazines would have been purchased. By the same logic, if Sadie purchased 5 novels, she would have no money at all ($0) to buy magazines. However, Sadie purchased a total of 11 novels and magazines.

QUESTION 7

Choice A is correct. The DBA plans to increase its membership by n businesses each year, so x years from now, the association plans to have increased its membership by nx businesses. Since there are already b businesses at the beginning of this year, the total number of businesses, y, the DBA plans to have as members x years from now is modeled by $y = nx + b$.

Choice B is incorrect. The equation given in choice B correctly represents the increase in membership x years from now as nx. However, the number of businesses at the beginning of the year, b, has been subtracted from this amount of increase, not added to it. Choices C and D are incorrect because they use exponential models to represent the increase in membership. Since the membership increases by n businesses each year, this situation is correctly modeled by a linear relationship.

QUESTION 8

Choice C is correct. The first expression $(1.5x - 2.4)^2$ can be rewritten as $(1.5x - 2.4)(1.5x - 2.4)$. Applying the distributive property to this product yields $(2.25x^2 - 3.6x - 3.6x + 5.76) - (5.2x^2 - 6.4)$. This difference can be rewritten as $(2.25x^2 - 3.6x - 3.6x + 5.76) + (-1)(5.2x^2 - 6.4)$. Distributing the factor of -1 through the second expression yields $2.25x^2 - 3.6x - 3.6x + 5.76 - 5.2x^2 + 6.4$. Regrouping like terms, the expression becomes $(2.25x^2 - 5.2x^2) + (-3.6x - 3.6x) + (5.76 + 6.4)$. Combining like terms yields $-2.95x^2 - 7.2x + 12.16$.

Choices A, B, and D are incorrect and likely result from errors made when applying the distributive property or combining the resulting like terms.

QUESTION 9

Choice B is correct. In 1908, the marathon was lengthened by $42 - 40 = 2$ kilometers. Since 1 mile is approximately 1.6 kilometers, the increase of 2 kilometers can be converted to miles by multiplying as shown: $2\,\text{kilometers} \times \frac{1\,\text{mile}}{1.6\,\text{kilometers}} = 1.25\,\text{miles}$.

Choices A, C, and D are incorrect and may result from errors made when applying the conversion rate or other computational errors.

QUESTION 10

Choice A is correct. The density d of an object can be found by dividing the mass m of the object by its volume V. Symbolically this is expressed by the equation $d = \frac{m}{V}$. Solving this equation for m yields $m = dV$.

Choices B, C, and D are incorrect and are likely the result of errors made when translating the definition of density into an algebraic equation and errors made when solving this equation for m. If the equations given in choices B, C, and D are each solved for density d, none of the resulting equations are equivalent to $d = \frac{m}{V}$.

QUESTION 11

Choice A is correct. The equation $-2x + 3y = 6$ can be rewritten in the slope-intercept form as follows: $y = \frac{2}{3}x + 2$. So the slope of the graph of the given equation is $\frac{2}{3}$. In the xy-plane, when two nonvertical lines are perpendicular, the product of their slopes is -1. So, if m is the slope of a line perpendicular to the line with equation $y = \frac{2}{3}x + 2$, then $m \times \frac{2}{3} = -1$, which yields $m = -\frac{3}{2}$. Of the given choices, only the equation in choice A can be rewritten in the form $y = -\frac{3}{2}x + b$, for some constant b. Therefore, the graph of the equation in choice A is perpendicular to the graph of the given equation.

Choices B, C, and D are incorrect because the graphs of the equations in these choices have slopes, respectively, of $-\frac{3}{4}$, $-\frac{1}{2}$, and $-\frac{1}{3}$, not $-\frac{3}{2}$.

QUESTION 12

Choice D is correct. Adding the two equations side by side eliminates y and yields $x = 6$, as shown.

$$\begin{array}{r} \frac{1}{2}y = 4 \\ x - \frac{1}{2}y = 2 \\ \hline x + 0 = 6 \end{array}$$

If (x, y) is a solution to the system, then (x, y) satisfies both equations in the system and any equation derived from them. Therefore, $x = 6$.

Choices A, B, and C are incorrect and may be the result of errors when solving the system.

QUESTION 13

Choice D is correct. Any point (x, y) that is a solution to the given system of inequalities must satisfy both inequalities in the system. Since the second inequality in the system can be rewritten as $y < x - 1$, the system is equivalent to the following system.

$$y \leq 3x + 1$$
$$y < x - 1$$

Since $3x + 1 > x - 1$ for $x > -1$ and $3x + 1 \leq x - 1$ for $x \leq -1$, it follows that $y < x - 1$ for $x > -1$ and $y \leq 3x + 1$ for $x \leq -1$. Of the given choices, only (2, −1) satisfies these conditions because $-1 < 2 - 1 = 1$.

Alternate approach: Substituting (2, −1) into the first inequality gives $-1 \leq 3(2) + 1$, or $-1 \leq 7$, which is a true statement. Substituting (2, −1) into the second inequality gives $2 - (-1) > 1$, or $3 > 1$, which is a true statement. Therefore, since (2, −1) satisfies both inequalities, it is a solution to the system.

Choice A is incorrect because substituting −2 for x and −1 for y in the first inequality gives $-1 \leq 3(-2) + 1$, or $-1 \leq -5$, which is false. Choice B is incorrect because substituting −1 for x and 3 for y in the first inequality gives $3 \leq 3(-1) + 1$, or $3 \leq -2$, which is false. Choice C is incorrect because substituting 1 for x and 5 for y in the first inequality gives $5 \leq 3(1) + 1$, or $5 \leq 4$, which is false.

QUESTION 14

Choice A is correct. According to the table, 74 orthopedic surgeons indicated that research is their major professional activity. Since a total of 607 surgeons completed the survey, it follows that the probability that the randomly selected surgeon is an orthopedic surgeon whose indicated major professional activity is research is 74 out of 607, or 74/607, which is ≈ 0.122.

Choices B, C, and D are incorrect and may be the result of finding the probability that the randomly selected surgeon is an orthopedic surgeon whose major professional activity is teaching (choice B), an orthopedic surgeon whose major professional activity is either teaching or research (choice C), or a general surgeon or orthopedic surgeon whose major professional activity is research (choice D).

QUESTION 15

Choice A is correct. Statement I need not be true. The fact that 78% of the 1,000 adults who were surveyed responded that they were satisfied with the air quality in the city does not mean that the exact same percentage of all adults in the city will be satisfied with the air quality in the city. Statement II need not be true because random samples, even when they are of the same size, are not necessarily identical with regard to percentages of people in them who have a certain opinion. Statement III need not be true for the same reason that statement II need not be true: results from different samples can vary. The variation may be even bigger for this sample since it would be selected from a different city. Therefore, none of the statements must be true.

Choices B, C, and D are incorrect because none of the statements must be true.

QUESTION 16

Choice D is correct. According to the given information, multiplying a tree species' growth factor by the tree's diameter is a method to approximate the age of the tree. Multiplying the growth factor, 4.0, of the American elm given in the table by the given diameter of 12 inches yields an approximate age of 48 years.

Choices A, B, and C are incorrect because they do not result from multiplying the given diameter of an American elm tree with that tree species' growth factor..

QUESTION 17

Choice D is correct. The growth factor of a tree species is approximated by the slope of a line of best fit that models the relationship between diameter and age. A line of best fit can be visually estimated by identifying a line that goes in the same direction of the data and where roughly half the given data points fall above and half the given data points fall below the line. Two points that fall on the line can be used to estimate the slope and *y*-intercept of the equation of a line of best fit. Estimating a line of best fit for the given scatterplot could give the points (11, 80) and (15, 110). Using these two points, the slope of the equation of the line of best fit can be calculated as $\frac{110-80}{15-11}$, or 7.5. The slope of the equation is interpreted as the growth factor for a species of tree. According to the table, the species of tree with a growth factor of 7.5 is shagbark hickory.

Choices A, B, and C are incorrect and likely result from errors made when estimating a line of best fit for the given scatterplot and its slope.

QUESTION 18

Choice C is correct. According to the given information, multiplying a tree species' growth factor by the tree's diameter is a method to approximate the age of the tree. A white birch with a diameter of 12 inches (or 1 foot) has a given growth factor of 5 and is approximately 60 years old. A pin oak with a diameter of 12 inches (or 1 foot) has a given growth factor of 3 and is approximately 36 years old. The diameters of the two trees 10 years from now can be found by dividing each tree's age in 10 years, 70 years, and 46 years, by its respective growth factor. This yields 14 inches and $15\frac{1}{3}$ inches. The difference between $15\frac{1}{3}$ and 14 is $1\frac{1}{3}$, or approximately 1.3 inches.

Choices A, B, and D are incorrect and a result of incorrectly calculating the diameters of the two trees in 10 years.

QUESTION 19

Choice B is correct. Triangles *ADB* and *CDB* are congruent to each other because they are both 30°-60°-90° triangles and share the side $\overline{BD}$. In triangle *ADB*, side $\overline{AD}$ is opposite to the angle 30°; therefore, the length of $\overline{AD}$ is half the length of hypotenuse $\overline{AB}$. Since the triangles are congruent, *AB* = *BC* = 12. So the length of $\overline{AD}$ is $\frac{12}{2} = 6$.

Choice A is incorrect. If the length of $\overline{AD}$ were 4, then the length of $\overline{AB}$ would be 8. However, this is incorrect because $\overline{AB}$ is congruent to $\overline{BC}$, which has a length of 12. Choices C and D are also incorrect. Following the same procedures as used to test choice A gives $\overline{AB}$ a length of $12\sqrt{2}$ for choice C and $12\sqrt{3}$ for choice D. However, these results cannot be true because $\overline{AB}$ is congruent to $\overline{BC}$, which has a length of 12.

QUESTION 20

Choice D is correct. The graph on the right shows the change in distance from the ground of the mark on the rim over time. The *y*-intercept of the graph corresponds to the mark's position at the start of the motion (*t* = 0); at this moment, the mark is at its highest point from the ground. As the wheel rolls, the mark approaches the ground, its distance from the ground decreasing until it reaches 0—the point where it touches the ground. After that, the mark moves up and away from the ground, its distance from the ground increasing until it reaches its maximum height from the ground. This is the moment when the wheel has completed a full rotation. The remaining part of the graph shows the distance of the mark from the ground during the second rotation of the wheel. Therefore, of the given choices, only choice D is in agreement with the given information.

Choice A is incorrect because the speed at which the wheel is rolling does not change over time, meaning the graph representing the speed would be a horizontal line. Choice B is incorrect because the distance of the wheel from its starting point to its ending point increases continuously; the graph shows a quantity that changes periodically over time, alternately decreasing and increasing. Choice C is incorrect because the distance of the mark from the center of the wheel is constant and equals the radius of the wheel. The graph representing this distance would be a horizontal line, not the curved line of the graph shown.

QUESTION 21

Choice A is correct. The equation can be rewritten as $1-\frac{b}{a}=c$, or equivalently $1-c=\frac{b}{a}$. Since $a < 0$ and $b > 0$, it follows that $\frac{b}{a}<0$, and so $1 - c < 0$, or equivalently $c > 1$.

Choice B is incorrect. If $c = 1$, then $a - b = a$, or $b = 0$. But it is given that $b > 0$, so $c = 1$ cannot be true. Choice C is incorrect. If $c = -1$, then $a - b = -a$, or $2a = b$. But this equation contradicts the premise that $a < 0$ and $b > 0$, so $c = -1$ cannot be true. Choice D is incorrect. For example, if $c = -2$, then $a - b = -2a$, or $3a = b$. But this contradicts the fact that a and b have opposite signs, so $c < -1$ cannot be true.

QUESTION 22

Choice C is correct. It is given that 34.6% of 26 students in Mr. Camp's class reported that they had at least two siblings. Since 34.6% of 26 is 8.996, there must have been 9 students in the class who reported having at least two siblings and 17 students who reported that they had fewer than two siblings. It is also given that the average eighth-grade class size in the state is 26 and that Mr. Camp's class is representative of all eighth-grade classes in the state. This means that in each eighth-grade class in the state there are about 17 students who have fewer than two siblings. Therefore, the best estimate of the number of eighth-grade students in the state who have fewer than two siblings is 17 × (number of eighth-grade classes in the state), or 17 × 1,800 = 30,600.

Choice A is incorrect because 16,200 is the best estimate for the number of eighth-grade students in the state who have at least, not fewer than, two siblings. Choice B is incorrect because 23,400 is half of the estimated total number of eighth-grade students in the state; however, since the students in Mr. Camp's class are representative of students in the eighth-grade classes in the state and more than half of the students in Mr. Camp's class have fewer than two siblings, more than half of the students in each eighth-grade class in the state have fewer than two siblings, too. Choice D is incorrect because 46,800 is the estimated total number of eighth-grade students in the state.

QUESTION 23

Choice D is correct. The linear function that represents the relationship will be in the form $r(p) = ap + b$, where a and b are constants and $r(p)$ is the monthly rental price, in dollars, of a property that was purchased with p thousands of dollars. According to the table, (70, 515) and (450, 3,365) are ordered pairs that should satisfy the function, which leads to the system of equations below.

$$\begin{cases} 70a + b = 515 \\ 450a + b = 3{,}365 \end{cases}$$

Subtracting side by side the first equation from the second eliminates b and gives $380a = 2{,}850$; solving for a gives $a = \frac{2{,}850}{380} = 7.5$. Substituting 7.5 for a in the first equation of the system gives $525 + b = 515$; solving for b gives $b = -10$. Therefore, the linear function that represents the relationship is $r(p) = 7.5p - 10$.

Choices A, B, and C are incorrect because the coefficient of p, or the rate at which the rental price, in dollars, increases for every thousand-dollar increase of the purchase price is different from what is suggested by these choices. For example, the Glenview Street property was purchased for \$140,000, but the rental price that each of the functions in these choices provides is significantly off from the rental price given in the table, \$1,040.

QUESTION 24

Choice B is correct. Let x be the original price, in dollars, of the Glenview Street property. After the 40% discount, the price of the property became $0.6x$ dollars, and after the additional 20% off the discounted price, the price of the property became $0.8(0.6x)$. Thus, in terms of the original price of the property, x, the purchase price of the property is $0.48x$. It follows that $0.48x = 140{,}000$. Solving this equation for x gives $x = 291{,}666.\bar{6}$. Therefore, of the given choices, \$291,700 best approximates the original price of the Glenview Street property.

Choice A is incorrect because it is the result of dividing the purchase price of the property by 0.4, as though the purchase price were 40% of the original price. Choice C is incorrect because it is the closest to dividing the purchase price of the property by 0.6, as though the purchase price were 60% of the original price. Choice D is incorrect because it is the result of dividing the purchase price of the property by 0.8, as though the purchase price were 80% of the original price.

QUESTION 25

Choice D is correct. Of the first 150 participants, 36 chose the first picture in the set, and of the 150 remaining participants, *p* chose the first picture in the set. Hence, the proportion of the participants who chose the first picture in the set is $\frac{36+p}{300}$. Since more than 20% of all the participants chose the first picture, it follows that $\frac{36+p}{300} > 0.20$. This inequality can be rewritten as $p + 36 > 0.20(300)$. Since *p* is a number of people among the remaining 150 participants, $p \leq 150$.

Choices A, B, and C are incorrect and may be the result of some incorrect interpretations of the given information or of computational errors.

QUESTION 26

Choice B is correct. A cube has 6 faces of equal area, so if the total surface area of a cube is $6\left(\frac{a}{4}\right)^2$, then the area of one face is $\left(\frac{a}{4}\right)^2$. Likewise, the area of one face of a cube is the square of one of its sides; therefore, if the area of one face is $\left(\frac{a}{4}\right)^2$, then the length of one side of the cube is $\frac{a}{4}$. Since the perimeter of one face of a cube is four times the length of one side, the perimeter is $4\left(\frac{a}{4}\right) = a$.

Choice A is incorrect because if the perimeter of one face of the cube is $\frac{a}{4}$, then the total surface area of the cube is $6\left(\frac{\frac{a}{4}}{4}\right)^2 = 6\left(\frac{a}{16}\right)^2$, which is not $6\left(\frac{a}{4}\right)^2$. Choice C is incorrect because if the perimeter of one face of the cube is $4a$, then the total surface area of the cube is $6\left(\frac{4a}{4}\right)^2 = 6a^2$, which is not $6\left(\frac{a}{4}\right)^2$. Choice D is incorrect because if the perimeter of one face of the cube is $6a$, then the total surface area of the cube is $6\left(\frac{6a}{4}\right)^2 = 6\left(\frac{3a}{2}\right)^2$, which is not $6\left(\frac{a}{4}\right)^2$.

QUESTION 27

Choice C is correct. If the mean score of 8 players is 14.5, then the total of all 8 scores is 14.5 × 8 = 116. If the mean of 7 scores is 12, then the total of all 7 scores is 12 × 7 = 84. Since the set of 7 scores was made by removing the highest score of the set of 8 scores, then the difference between the total of all 8 scores and the total of all 7 scores is equal to the removed score: 116 − 84 = 32.

Choice A is incorrect because if 20 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \cdot 8) - 20}{7} \approx 13.71$, not 12. Choice B is incorrect because if 24 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \cdot 8) - 24}{7} \approx 13.14$, not 12. Choice D is incorrect because if 36 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \cdot 8) - 36}{7} \approx 11.43$, not 12.

QUESTION 28

Choice C is correct. The slope of a line is $\frac{\text{rise}}{\text{run}}$ and can be calculated using the coordinates of any two points on the line. For example, the graph of *f* passes through the points (0, 3) and (2, 4), so the slope of the graph of *f* is $\frac{4-3}{2-0} = \frac{1}{2}$. The slope of the graph of function *g* is 4 times the slope of the graph of *f*, so the slope of the graph of *g* is $4\left(\frac{1}{2}\right) = 2$. Since the point (0, −4) is the *y*-intercept of *g*, *g* is defined as $g(x) = 2x - 4$. It follows that $g(9) = 2(9) - 4 = 14$.

Choice A is incorrect because if $g(9) = 5$, then the slope of the graph of function *g* is $\frac{-4-5}{0-9} = 1$, which is not 4 times the slope of the graph of *f*. Choices B and D are also incorrect. The same procedures used to test choice A yields $\frac{-4-9}{0-9} = \frac{13}{9}$ and $\frac{-4-18}{0-9} = \frac{22}{9}$ for the slope of the graph of *g* for choices B and D, respectively. Neither of these slopes is 4 times the slope of the graph of *f*.

QUESTION 29

Choice B is correct. The standard equation of a circle in the *xy*-plane is of the form $(x - h)^2 + (y - k)^2 = r^2$, where (*h*, *k*) are the coordinates of the center of the circle and *r* is the radius. To convert the given equation to the standard form, complete the squares. The first two terms need a 100 to complete the square, and the second two terms need a 64. Adding 100 and 64 to both sides of the given equation yields $(x^2 + 20x + 100) + (y^2 + 16y + 64) = -20 + 100 + 64$, which is equivalent to $(x + 10)^2 + (y + 8)^2 = 144$. Therefore, the coordinates of the center of the circle are (−10, −8).

Choice A is incorrect and is likely the result of not properly dividing when attempting to complete the square. Choice C is incorrect and is likely the result of making a sign error when evaluating the coordinates of the center. Choice D is incorrect and is likely the result of not properly dividing when attempting to complete the square and making a sign error when evaluating the coordinates of the center.

QUESTION 30

Choice B is correct. The given equation can be thought of as the difference of two squares, where one square is x^2 and the other square is $\left(\sqrt{a}\right)^2$. Using the difference of squares formula, the equation can be rewritten as $y = \left(x + \sqrt{a}\right)\left(x - \sqrt{a}\right)$.

Choices A, C, and D are incorrect because they are not equivalent to the given equation. Choice A is incorrect because it is equivalent to $y = x^2 - a^2$. Choice C is incorrect because it is equivalent to $y = x^2 - \frac{a^2}{4}$. Choice D is incorrect because it is equivalent to $y = x^2 + 2ax + a^2$.

QUESTION 31

The correct answer is 1492. Let x be the number of watts that is equal to 2 horsepower. Since 5 horsepower is equal to 3730 watts, it follows that $\frac{2}{5} = \frac{x}{3730}$. Solving this proportion for x yields $5x = 7460$, or $x = \frac{7460}{5} = 1492$.

QUESTION 32

The correct answer is $\frac{29}{3}$. It is given that the height of the original painting is 29 inches and the reproduction's height is $\frac{1}{3}$ the original height. One-third of 29 is $\frac{29}{3}$, or $9.\overline{6}$. Either the fraction 29/3 or the decimals 9.66 or 9.67 can be gridded as the correct answer.

QUESTION 33

The correct answer is 7. It is given that $PQ = RS$, and the diagram shows that $PQ = x - 1$ and $RS = 3x - 7$. Therefore, the equation $x - 1 = 3x - 7$ must be true. Solving this equation for x leads to

$2x = 6$, so $x = 3$. The length of segment *PS* is the sum of the lengths of *PQ*, *QR*, and *RS*, which is $(x - 1) + x + (3x - 7)$, or equivalently $5x - 8$. Substituting 3 for x in this expression gives $5(3) - 8 = 7$.

QUESTION 34

The correct answer is 9. Since the point (2, 5) lies on the graph of $y = f(x)$ in the *xy*-plane, the ordered pair (2, 5) must satisfy the equation $y = f(x)$. That is, $5 = f(2)$, or $5 = k - 2^2$. This equation simplifies to $5 = k - 4$. Therefore, the value of the constant k is 9.

QUESTION 35

The correct answer is 13. Let w represent the width of the rectangular garden, in feet. Since the length of the garden will be 5 feet longer than the width of the garden, the length of the garden will be $w + 5$ feet. Thus the area of the garden will be $w(w + 5)$. It is also given that the area of the garden will be 104 square feet. Therefore, $w(w + 5) = 104$, which is equivalent to $w^2 + 5w - 104 = 0$. The quadratic formula can be used or the equation above can be factored to result in $(w + 13)(w - 8) = 0$. Therefore, $w = 8$ and $w = -13$. Because width cannot be negative, the width of the garden must be 8 feet. This means the length of the garden must be $8 + 5 = 13$ feet.

QUESTION 36

The correct answer is 80. The measure of an angle inscribed in a circle is half the measure of the central angle that intercepts the same arc. That is, $\text{m}\angle A = \frac{x°}{2}$. Also, the sum of the interior angles of quadrilateral *ABCP* is 360°, and the measure of the obtuse angle *P* is $360° - x°$. Hence, $\frac{x°}{2} + 20° + (360° - x°) + 20° = 360°$. Simplifying this equation gives $\frac{x°}{2} = 40°$, and so $x = 80$.

Alternate approach: If points *A* and *P* are joined, then the triangles that will be formed, *APB* and *APC*, are isosceles because $PA = PB = PC$. It follows that the base angles on both triangles each have measure of 20°. Angle *A* consists of two base angles, and therefore, $\text{m}\angle A = 40°$. Since the measure of an angle inscribed in a circle is half the measure of the central angle that intercepts the same arc, it follows that the value of x is 80°.

QUESTION 37

The correct answer is 43.5, 43, or 44. The distance from Ms. Simon's home to her workplace is $0.6 + 15.4 + 1.4 = 17.4$ miles. Ms. Simon took 24 minutes to drive this distance. Since there are 60 minutes in one hour, her average speed, in miles per hour, for this trip is $\frac{17.4}{24} \times 60 = 43.5$ miles per hour. Based on the directions, 87/2 or 43.5 can be gridded as the correct answer. We are accepting 43 and 44 as additional correct answers because the precision of the measurements provided does not support an answer with three significant digits.

QUESTION 38

The correct answer is 6. Ms. Simon travels 15.4 miles on the freeway, and her average speed for this portion of the trip is 50 miles per hour when there is no traffic delay. Therefore, when there is no traffic delay, Ms. Simon spends $\frac{15.4 \text{ miles}}{50 \text{ mph}} = 0.308 \text{ hours}$ on the freeway. Since there are 60 minutes in one hour, she spends (0.308)(60) = 18.48 minutes on the freeway when there is no delay. Leaving at 7:00 a.m. results in a trip that is 33% longer, and 33% of 18.48 minutes is 6.16; the travel time for each of the other two segments does not change. Therefore, rounded to the nearest minute, it takes Ms. Simon 6 more minutes to drive to her workplace when she leaves at 7:00 a.m.