PSAT/NMSQT®

Preliminary SAT/National Merit Scholarship Qualifying Test

Practice Test #2

ANSWER EXPLANATIONS

These answer explanations are for students taking the digital PSAT/NMSQT in nondigital format.

PSAT/NMSQT® CollegeBoard / NATIONAL MERIT SCHOLARSHIP CORPORATION

Math

Module 1

(27 questions)

QUESTION 1

Choice A is correct. The given absolute value equation can be rewritten as two linear equations: $x+45=48$ and $-(x+45)=48$, or $x+45=-48$. Subtracting 45 from both sides of the equation $x+45=48$ yields $x=3$. Subtracting 45 from both sides of the equation $x+45=-48$ yields $x=-93$. Thus, the given equation has two possible solutions, 3 and -93. Therefore, the positive solution to the given equation is 3.

Choice B is incorrect and may result from conceptual or calculation errors.
Choice C is incorrect and may result from conceptual or calculation errors.
Choice D is incorrect and may result from conceptual or calculation errors.

QUESTION 2

Choice A is correct. The first equation in the given system of equations is $x=4$. Substituting 4 for x in the second equation in the given system of equations yields $y=5-4$, or $y=1$.

Choice B is incorrect. This is the value of x in the solution to the given system of equations, not the value of y. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 3

Choice C is correct. Let d represent the mass, in grams, of vitamin D in the mixture, and let c represent the mass, in grams, of calcium in the mixture. It's given that the mixture consists of only vitamin D and calcium and that the total mass of the mixture is 150 grams. Therefore, the equation $d+c=150$ represents this situation. It's also given that the mass of vitamin D in the mixture is 50 grams. Substituting 50 for d in the equation $d+c=150$ yields $50+c=150$. Subtracting

50 from both sides of this equation yields $c = 100$. Therefore, the mass of calcium in the mixture is 100 grams.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice B* is incorrect. This is the total mass, in grams, of the mixture, not the mass, in grams, of calcium in the mixture. *Choice D* is incorrect. This is the mass, in grams, of vitamin D in the mixture, not the mass, in grams, of calcium in the mixture.

QUESTION 4

Choice C is correct. It's given that this service contract requires a monthly cost of \$23. A monthly cost of \$23 for t months results in a cost of $\$23t$. It's also given that this service contract requires a onetime activation cost of \$35. Adding the onetime activation cost to the monthly cost of the service contract for t months yields the total cost c, in dollars, of this service contract for t months. Therefore, this situation can be represented by the equation $c = 23t + 35$.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 5

Choice B is correct. It's given that the function f is defined by $f(x) = 3x - 8$. The value of $f(7)$ is the value of $f(x)$ when $x = 7$. Substituting 7 for x in the given equation yields $f(7) = 3(7) - 8$, which is equivalent to $f(7) = 21 - 8$, or $f(7) = 13$.

Choice A is incorrect. This is the value of $f(7)$ when $f(x) = 3x + 8$, rather than $f(x) = 3x - 8$. *Choice C* is incorrect. This is the value of $f(1)$, rather than $f(7)$. *Choice D* is incorrect. This is the value of $f(-7)$, rather than $f(7)$.

QUESTION 6

The correct answer is 40. The y-intercept of a graph in the xy-plane is the point (x, y) on the graph where $x = 0$. The y-intercept of the graph shown is $(0, 40)$. Therefore, the value of y is 40.

QUESTION 7

The correct answer is 130. It's given that $8x - 7x + 130 = 260$. Combining like terms on the left-hand side of this equation yields $x + 130 = 260$. Subtracting 130 from each side of this equation yields $x = 130$. Therefore, the value of x that's the solution to the given equation is 130.

QUESTION 8

Choice C is correct. It's given that the geologist has already collected 63 samples from the volcano. Let x represent the number of additional samples the geologist needs to collect. After collecting x additional samples, the geologist will have collected a total of $63 + x$ samples. It's given that the geologist needs to collect at least 67 samples. Therefore, $63+x\geq 67$. Subtracting 63 from each side of this inequality yields the inequality $x\geq 4$. Thus, the geologist needs to collect a minimum of 4 additional samples.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice B* is incorrect. This is the number of samples the geologist has already collected, rather than the minimum number of additional samples the geologist needs to collect. *Choice D* is incorrect. If the geologist collects 0 additional samples, the geologist will have collected a total of 63 samples, which is less than 67 samples.

QUESTION 9

Choice A is correct. If one of the gemstones is selected at random, the probability of selecting a gemstone of color Y is equal to the number of gemstones of color Y divided by the total number of gemstones. According to the table, there are 3 gemstones of color Y, and it's given that the total number of gemstones is 157. Therefore, if one of the gemstones is selected at random, the probability of selecting a gemstone of color Y is $\frac{3}{157}$.

Choice B is incorrect. This is the probability of selecting a gemstone of color Z. *Choice C* is incorrect. This is the probability of selecting a gemstone of color X. *Choice D* is incorrect. This is the probability of selecting a gemstone that's not of color Y.

QUESTION 10

Choice A is correct. The equation for the line representing the boundary of the shaded region can be written in slope-intercept form $y=mx+b$, where m is the slope and $(0, b)$ is the y-intercept of the line. For the graph shown, the boundary line passes through the points $(0, -6)$ and $(9, 0)$. Given two points on a line, (x_1, y_1) and (x_2, y_2), the slope of the line can be calculated using the equation $m=\frac{y_2-y_1}{x_2-x_1}$. Substituting the points $(0, -6)$ and $(9, 0)$ for (x_1, y_1) and (x_2, y_2), respectively, in this equation yields $m=\frac{0-(-6)}{9-0}$, which is equivalent to $m=\frac{6}{9}$, or $m=\frac{2}{3}$. Since the point $(0, -6)$ represents the y-intercept, it follows that $b=-6$. Substituting $\frac{2}{3}$ for m and -6 for b in the equation $y=mx+b$ yields $y=\frac{2}{3}x-6$ as the equation of the boundary line. Since the shaded region represents all the points on and above this boundary line, it follows that the shaded region shown represents the solutions to the inequality $y\geq\frac{2}{3}x-6$.

Choice B is incorrect. This inequality represents a region whose boundary line has a y-intercept of $(0, 6)$, not $(0, -6)$. *Choice C* is incorrect. This inequality represents a region whose boundary line has a y-intercept of $(0, -9)$, not $(0, -6)$. *Choice D* is incorrect. This inequality represents a region whose boundary line has a y-intercept of $(0, 9)$, not $(0, -6)$.

QUESTION 11

Choice A is correct. In an equilateral triangle, all three sides have the same length. It's given that in triangle ABC, $AB = 4{,}680$ mm and $BC = 4{,}680$ mm. Therefore, if $AC = 4{,}680$ mm, then all three sides of triangle ABC have the same length, so triangle ABC is equilateral. Therefore, $AC = 4{,}680$ mm is sufficient to prove that triangle ABC is equilateral.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 12

Choice C is correct. The function P gives the predicted population, in millions, of a certain country for the period from 1984 to 2018, where t is the number of years after 1984. Since the value of $P(8)$ is the value of $P(t)$ when $t = 8$, it follows that "$P(8)$ is approximately equal to 32.91" means that the value of $P(t)$ is approximately equal to 32.91 when $t = 8$. Therefore, the best interpretation of the statement "$P(8)$ is approximately equal to 32.91" is that 8 years after 1984, the predicted population of this country was approximately 32.91 million.

Choice A is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 8 million. *Choice B* is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 32.91 million. *Choice D* is incorrect. 32.91 years after 1984, the predicted population of this country was $24.8(1.036)^{32.91}$ million, or approximately 79.42 million, not approximately 8 million.

QUESTION 13

The correct answer is 29. The volume, V, of a right circular cylinder is given by the formula $V = \pi r^2 h$, where r is the radius of the base of the cylinder and h is the height of the cylinder. Since the base of the cylinder is a circle with radius r, the area of the base of the cylinder is πr^2. It's given that a right circular cylinder has a volume of 377 cubic centimeters; therefore, $V = 377$. It's also given that the area of the base of the cylinder is 13 square centimeters; therefore, $\pi r^2 = 13$. Substituting 377 for V and 13 for πr^2 in the formula $V = \pi r^2 h$ yields $377 = 13h$. Dividing both sides of this equation by 13 yields $29 = h$. Therefore, the height of the cylinder, in centimeters, is 29.

QUESTION 14

The correct answer is 3,630. The mean of a data set is the sum of the values in the data set divided by the number of values in the data set. The sum of the masses, in grams, of these alpine marmots is $4{,}010 + 4{,}010 + 3{,}030 + 4{,}050 + 3{,}050$, or 18,150 grams. The number of alpine marmots in the data set is 5. Therefore, the mean mass, in grams, of these 5 alpine marmots is $\frac{18{,}150}{5}$, or 3,630.

QUESTION 15

Choice A is correct. The first equation in the given system of equations is $x = 3$. Substituting 3 for x in the second equation in the given system of equations yields $y = (15 - 3)^2$, or $y = 144$. Substituting 3 for x and 144 for y in the expression xy yields (3)(144), or 432. Therefore, the value of xy is 432.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 16

Choice B is correct. The cosine of an acute angle in a right triangle is defined as the ratio of the length of the leg adjacent to the angle to the length of the hypotenuse. In the triangle shown, the length of the leg adjacent to angle A is 41, and the length of the hypotenuse is 42. Therefore, $\cos A = \frac{41}{42}$.

Choice A is incorrect. This is the value of $\frac{1}{\cos A}$. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 17

Choice D is correct. The area, A, of a circle is given by the formula $A = \pi r^2$, where r is the radius of the circle. It's given that the circle has a radius of 43 meters. Substituting 43 for r in the formula $A = \pi r^2$ yields $A = \pi(43)^2$, or $A = 1{,}849\pi$. Therefore, the area, in square meters, of the circle is $1{,}849\pi$.

Choice A is incorrect. This is the area, in square meters, of a circle with a radius of $\sqrt{\frac{43}{2}}$ meters. *Choice B* is incorrect. This is the area, in square meters, of a circle with a radius of $\sqrt{43}$ meters. *Choice C* is incorrect. This is the circumference, in meters, of the circle.

QUESTION 18

Choice A is correct. It's given that the object has a mass of 168 grams and a volume of 24 cubic centimeters. Dividing the mass, in grams, of the object by the volume, in cubic centimeters, of the object gives the density, in grams per cubic centimeter, of the object. It follows that the density of the object is $\frac{168 \text{ grams}}{24 \text{ cubic centimeters}}$, which is equivalent to $\frac{168}{24}$ grams per cubic centimeter, or 7 grams per cubic centimeter.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 19

Choice B is correct. It's given that in January 2018, there were 1,300 customers subscribed to a company's newsletter and for the next 24 months after January 2018, the total number of customers subscribed to the newsletter each month was 7% greater than the total number subscribed the previous month. It follows that this situation can be represented by the equation $c = a\left(1 + \frac{r}{100}\right)^m$, where c is the total number of customers subscribed to the company's newsletter m months after January 2018, a is the number of customers subscribed to the newsletter in January 2018, and the total number of customers subscribed to the newsletter each month was r% greater than the total number subscribed the previous month. Substituting 1,300 for a and 7 for r in this equation yields $c = 1{,}300\left(1 + \frac{7}{100}\right)^m$, or $c = 1{,}300(1.07)^m$.

Choice A is incorrect. This equation represents a situation where the total number of customers subscribed each month was 93% less, not 7% greater, than the total number subscribed the previous month. *Choice C* is incorrect. This equation represents a situation where the total number of customers subscribed each month was 70%, not 7%, greater than the total number subscribed the previous month. *Choice D* is incorrect. This equation represents a situation where the total number of customers subscribed each month was 600%, not 7%, greater than the total number subscribed the previous month.

QUESTION 20

The correct answer is 6. The line of best fit predicts a greater y-value than the actual y-value for any data point that's located below the line of best fit. For the scatterplot shown, 6 of the data points are below the line of best fit. Therefore, the line of best fit predicts a greater y-value than the actual y-value for 6 of the data points.

QUESTION 21

The correct answer is 156. In the figure shown, the sum of the measures of angle UVS and angle RVS is 180°. It's given that the measure of angle RVS is 41°. Therefore, the measure of angle UVS is $(180 - 41)°$, or 139°. The sum of the measures of the interior angles of a triangle is 180°. In triangle UVS, the measure of angle UVS is 139° and it's given that the measure of angle VST is 29°. Thus, the measure of angle VUS is $(180 - 139 - 29)°$, or 12°. It's given that $RT = TU$. Therefore, triangle TUR is an isosceles triangle and the measure of VUS is equal to the measure of angle TRU. In triangle TUR, the measure of angle VUS is 12° and the measure of angle TRU is 12°. Thus, the measure of angle UTR is $(180 - 12 - 12)°$, or 156°. The figure shows that the measure of angle UTR is $x°$, so the value of x is 156.

QUESTION 22

Choice D is correct. A system of two linear equations in two variables, x and y, has zero solutions if the lines representing the equations in the xy-plane are distinct and parallel. Two lines are distinct and parallel if they have the same slope but different y-intercepts. Each equation in the given system can be written in slope-intercept form $y = mx + b$, where m is the slope of the line representing the equation in the xy-plane and $(0, b)$ is the y-intercept. Adding $12x$ to both sides of the first equation in the given system of equations, $-12x + 14y = 36$, yields $14y = 12x + 36$. Dividing both sides of this equation by 14 yields $y = \frac{6}{7}x + \frac{18}{7}$. It follows that the first equation in the given system of equations has a slope of $\frac{6}{7}$ and a y-intercept of $\left(0, \frac{18}{7}\right)$. Adding $6x$ to both sides of the second equation in the given system of equations, $-6x + 7y = -18$, yields $7y = 6x - 18$. Dividing both sides of this equation by 7 yields $y = \frac{6}{7}x - \frac{18}{7}$. It follows that the second equation in the given system of equations has a slope of $\frac{6}{7}$ and a y-intercept of $\left(0, -\frac{18}{7}\right)$. Since the slopes of these lines are the same and the y-intercepts are different, it follows that the given system of equations has zero solutions.

Alternate approach: To solve the system by elimination, multiplying the second equation in the given system of equations, $-6x + 7y = -18$, by -2 yields $12x - 14y = 36$. Adding this equation to the first equation in the given system of equations, $-12x + 14y = 36$, yields $(-12x + 12x) + (-14y + 14y) = 36 + 36$, or $0 = 72$. Since this equation isn't true, the given system of equations has zero solutions.

Choice A is incorrect and may result from conceptual or calculation errors.
Choice B is incorrect and may result from conceptual or calculation errors.
Choice C is incorrect and may result from conceptual or calculation errors.

QUESTION 23

Choice D is correct. Let $n\%$ represent the percent by which the positive quantity x is decreased to result in $0.35x$. The value of n can be found by solving the equation $x - \left(\frac{n}{100}\right)x = 0.35x$. Since x is a common factor of each of the terms on the left-hand side of this equation, the equation can be rewritten as $x\left(1 - \frac{n}{100}\right) = 0.35x$. Dividing each side of this equation by x yields $1 - \frac{n}{100} = 0.35$. Multiplying each side of this equation by 100 yields $100 - n = 35$. Subtracting 100 from each side of this equation yields $-n = -65$. Dividing each side of this equation by -1 yields $n = 65$. Therefore, the expression $0.35x$ represents the result of decreasing the positive quantity x by 65%.

Choice A is incorrect. Decreasing the quantity x by 3.5% yields $x - 0.035x$, or $0.965x$, not $0.35x$. *Choice B* is incorrect. Decreasing the quantity x by 35% yields $x - 0.35x$, or $0.65x$, not $0.35x$. *Choice C* is incorrect. Decreasing the quantity x by 6.5% yields $x - 0.065x$, or $0.935x$, not $0.35x$.

QUESTION 24

Choice B is correct. It's given that object R travels a distance of $4x$ inches in y seconds. This speed can be written as $\frac{4x \text{ inches}}{y \text{ seconds}}$. It's given that the speed of object R is half the speed of object S. It follows that the speed of object S is twice the speed of object R, which is $2\left(\frac{4x \text{ inches}}{y \text{ seconds}}\right)$, or $\frac{8x \text{ inches}}{y \text{ seconds}}$. Let n represent the time, in seconds, it takes object S to travel a distance of $24x$ inches. The value of n can be found by solving the equation $\frac{8x \text{ inches}}{y \text{ seconds}} = \frac{24x \text{ inches}}{n \text{ seconds}}$, which can be written as $\frac{8x}{y} = \frac{24x}{n}$. Multiplying each side of this equation by ny yields $8xn = 24xy$. Dividing each side of this equation by $8x$ yields $n = 3y$. Therefore, the expression $3y$ represents the time, in seconds, it takes object S to travel a distance of $24x$ inches.

Choice A is incorrect. This expression represents the time, in seconds, it would take object S to travel a distance of $24x$ inches if the speed of object R were twice, not half, the speed of object S. *Choice C* is incorrect. This expression represents the time, in seconds, it takes object S to travel a distance of $128x$ inches, not $24x$ inches. *Choice D* is incorrect. This expression represents the time, in seconds, it takes object R, not object S, to travel a distance of $24x$ inches.

QUESTION 25

Choice C is correct. The equation representing the linear relationship shown can be written in slope-intercept form $y = mx + b$, where m is the slope and $(0, b)$ is the y-intercept of the line. The line shown passes through the points $(0, 6)$ and $(2, 0)$. Given two points on a line, (x_1, y_1) and (x_2, y_2), the slope of the line can be calculated using the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting $(0, 6)$ and $(2, 0)$ for (x_1, y_1) and (x_2, y_2), respectively, in this equation yields $m = \frac{0-6}{2-0}$, which is equivalent to $m = -\frac{6}{2}$, or $m = -3$. Since $(0, 6)$ is the y-intercept, it follows that $b = 6$. Substituting -3 for m and 6 for b in the equation $y = mx + b$ yields $y = -3x + 6$. Adding $3x$ to both sides of this equation yields $3x + y = 6$. Multiplying this equation by 6 yields $18x + 6y = 36$. It follows that the equation $18x + Ry = 36$, where R is a positive constant, represents this relationship.

Choice A is incorrect. The graph of this relationship passes through the point $(0, 2)$, not $(0, 6)$. *Choice B* is incorrect. The graph of this relationship passes through the point $(0, 2)$, not $(0, 6)$. *Choice D* is incorrect. The graph of this relationship passes through the point $(-2, 0)$, not $(2, 0)$.

QUESTION 26

Choice B is correct. Let x represent the total mass, in grams, of the first piece, and let y represent the total mass, in grams, of the second piece. It's given that the sample has a total mass of 50.0 grams. Therefore, the equation $x + y = 50.0$ represents this situation. It's also given that the sample is 50.0% silicon by mass. Therefore, the total mass of the silicon in the sample is $0.500(50.0)$, or 25.0, grams. It's also given that the first piece was 30.0% silicon by mass and the second piece was 80.0% silicon by mass. Therefore, the masses, in grams, of the silicon in the first and second pieces can be represented by the expressions $0.300x$ and $0.800y$, respectively. Since the sample was created by combining the first and second pieces, and the total mass of the silicon in the sample is 25.0 grams, the equation $0.300x + 0.800y = 25.0$ represents this situation.

Subtracting y from both sides of the equation $x+y=50.0$ yields $x=50.0-y$. Substituting $50.0-y$ for x in the equation $0.300x+0.800y=25.0$ yields $0.300(50.0-y)+0.800y=25.0$. Distributing 0.300 on the left-hand side of this equation yields $15.0-0.300y+0.800y=25.0$. Combining like terms on the left-hand side of this equation yields $15.0+0.500y=25.0$. Subtracting 15.0 from both sides of this equation yields $0.500y=10.0$. Dividing both sides of this equation by 0.500 yields $y=20.0$. Substituting 20.0 for y in the expression representing the mass, in grams, of the silicon in the second piece, $0.800y$, yields $0.800(20.0)$, or 16.0. Therefore, the mass, in grams, of the silicon in the second piece is 16.0.

Choice A is incorrect. This is the mass, in grams, of the silicon in the first piece, not the second piece. *Choice C* is incorrect. This is the total mass, in grams, of the second piece, not the mass, in grams, of the silicon in the second piece. *Choice D* is incorrect. This is the total mass, in grams, of the first piece, not the mass, in grams, of the silicon in the second piece.

QUESTION 27

The correct answer is 14. Let x represent the first integer and y represent the second integer. If the first integer is 5 greater than twice the second integer, then $x=2y+5$. It's given that the product of the two integers is 462; therefore $xy=462$. Substituting $2y+5$ for x in this equation yields $(2y+5)(y)=462$, which can be written as $2y^2+5y=462$. Subtracting 462 from each side of this equation yields $2y^2+5y-462=0$. The left-hand side of this equation can be factored by finding two values whose product is $2(-462)$, or -924, and whose sum is 5. The two values whose product is -924 and whose sum is 5 are 33 and -28. Thus, the equation $2y^2+5y-462=0$ can be rewritten as $2y^2-28y+33y-462=0$, which is equivalent to $2y(y-14)+33(y-14)=0$, or $(2y+33)(y-14)=0$. By the zero product property, it follows that $2y+33=0$ or $y-14=0$. Subtracting 33 from both sides of the equation $2y+33=0$ yields $2y=-33$. Dividing both sides of this equation by 2 yields $y=-\frac{33}{2}$. Since y is a positive integer, the value of y isn't $-\frac{33}{2}$. Adding 14 to both sides of the equation $y-14=0$ yields $y=14$. Substituting 14 for y in the equation $xy=462$ yields $x(14)=462$. Dividing both sides of this equation by 14 yields $x=33$. Therefore, the two integers are 14 and 33, so the smaller of the two integers is 14.

Math

Module 2

(27 questions)

QUESTION 1

Choice B is correct. The height of each bar in the graph shown represents the number of containers that contain the number of walnuts specified at the bottom of the bar. The bar for 78 walnuts has a height of 7. Therefore, 7 of these containers of walnuts contain exactly 78 walnuts.

Choice A is incorrect. This is the number of containers that contain exactly 75 walnuts, not 78 walnuts. *Choice C* is incorrect. This is the total number of containers of walnuts represented in the bar graph, not the number that contain exactly 78 walnuts. *Choice D* is incorrect. This is the number of walnuts in a container that contains exactly 78 walnuts, not the number of containers that contain exactly 78 walnuts.

QUESTION 2

Choice C is correct. For the line graph shown, the probability of snow, as a percent, is represented on the vertical axis. According to the line graph, during this four-day period, the probability of snow is 30% for Thursday.

Choice A is incorrect. The probability of snow on Tuesday is 60%. *Choice B* is incorrect. The probability of snow on Wednesday is 90%. *Choice D* is incorrect. The probability of snow on Friday is 70%.

QUESTION 3

Choice B is correct. The solution (x, y) to the system of two equations corresponds to the point where the graphs of the equations intersect in the *xy*-plane. The graphs of the linear equation and the nonlinear equation shown intersect at the point $(-2, 6)$. Thus, the solution (x, y) to this system is $(-2, 6)$.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 4

Choice D is correct. In the figure shown, the angles with measures $w°$ and $z°$ are vertical angles. Since vertical angles are congruent, $w = z$. Therefore, if $w = 136$, the value of z is 136.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice B* is incorrect. This is the measure, in degrees, of an angle that's supplementary, not congruent, to the angle with measure $w°$. *Choice C* is incorrect and may result from conceptual or calculation errors.

QUESTION 5

Choice A is correct. The expression $19(x^2 - 7)$ can be rewritten as $19(x^2) - 19(7)$, which is equivalent to $19x^2 - 133$.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 6

The correct answer is 7. It's given that the parabola intersects the y-axis at the point (x, y). The graph shows that the parabola intersects the y-axis at the point $(0, 7)$. Therefore, the value of y is 7.

QUESTION 7

The correct answer is 17. It's given that $2x + 3 = 9$. Multiplying each side of this equation by 3 yields $3(2x + 3) = 3(9)$, or $6x + 9 = 27$. Subtracting 10 from each side of this equation yields $6x + 9 - 10 = 27 - 10$, or $6x - 1 = 17$. Therefore, the value of $6x - 1$ is 17.

QUESTION 8

Choice D is correct. A linear model can be written in the form $y = mx + b$, where m is the slope of the graph of the model in the xy-plane and $(0, b)$ is the y-intercept. The graph of an appropriate linear model for this relationship passes near the points $(1, 3)$ and $(9, 10)$ in the xy-plane. Two points on a line, (x_1, y_1) and (x_2, y_2), can be used to find the slope of the line using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting the points $(1, 3)$ and $(9, 10)$ for (x_1, y_1) and (x_2, y_2), respectively, in the slope formula yields $m = \frac{10 - 3}{9 - 1}$, or $m = 0.875$. Therefore, the value of m for an appropriate linear model is approximately 0.875. Substituting 0.875 for m in $y = mx + b$ yields $y = 0.875x + b$. Since an appropriate linear model passes near the point $(1, 3)$, the approximate value of b can be found by substituting 1 for x and 3 for y in the equation $y = 0.875x + b$, which yields $3 = (0.875)(1) + b$, or $3 = 0.875 + b$. Subtracting 0.875 from both sides of this equation yields $2.125 = b$. Therefore, the value of b for an appropriate linear model is approximately 2.125. Thus, of the given choices, $y = 0.9x + 2.2$ is the most appropriate linear model for this relationship.

Alternate approach: A linear model can be written in the form $y = mx + b$, where m is the slope of the graph of the model in the xy-plane and $(0, b)$ is the y-intercept. The scatterplot shows that as the x-values of the data points increase, the y-values of the data points increase, which means the graph of an appropriate linear model has a positive slope. Of the given choices, $y = 0.9x + 2.2$ is the only linear model whose graph has a positive slope.

Choice A is incorrect. The graph of this model has a negative slope, not a positive slope. *Choice B* is incorrect. The graph of this model has a negative slope, not a positive slope. *Choice C* is incorrect. The graph of this model has a negative slope, not a positive slope.

QUESTION 9

Choice B is correct. It's given that the equation $d = 16 - \frac{x}{30}$ gives the estimated amount of diesel d, in gallons, that remains in the gas tank of the truck after being driven x miles. Substituting 300 for x in the given equation yields $d = 16 - \frac{300}{30}$, which is equivalent to $d = 16 - 10$, or $d = 6$. Therefore, the estimated amount of diesel that remains in the gas tank of the truck when $x = 300$ is 6 gallons.

Choice A is incorrect. This is the estimated amount of diesel, in gallons, that will remain in the gas tank of the truck when $x = 480$, not when $x = 300$. *Choice C* is incorrect. This is the estimated amount of diesel, in gallons, that will remain in the gas tank of the truck when $x = 60$, not when $x = 300$. *Choice D* is incorrect. This is the estimated amount of diesel, in gallons, that will remain in the gas tank of the truck when $x = 0$, not when $x = 300$.

QUESTION 10

Choice C is correct. Each of the tables shows the same three values of x: -1, 0, and 1. Substituting -1 for x in the given function yields $g(-1) = 11(-1) + 4$, or $g(-1) = -7$. Therefore, when $x = -1$, the corresponding value of $g(x)$ is -7. Substituting 0 for x in the given function yields $g(0) = 11(0) + 4$, or $g(0) = 4$. Therefore, when $x = 0$, the corresponding value of $g(x)$ is 4. Substituting 1 for x in the given function yields $g(1) = 11(1) + 4$, or $g(1) = 15$. Therefore, when $x = 1$, the corresponding value of $g(x)$ is 15. The table in choice C shows -7, 4, and 15 as the corresponding value of $g(x)$ for x-values of -1, 0, and 1, respectively. Therefore, the table in choice C shows three values of x and their corresponding values of $g(x)$.

Choice A is incorrect. This table shows three values of x and their corresponding values of $g(x)$ for the linear function $g(x) = 4x + 11$. *Choice B* is incorrect. This table shows three values of x and their corresponding values of $g(x)$ for the linear function $g(x) = 4x$. *Choice D* is incorrect. This table shows three values of x and their corresponding values of $g(x)$ for the linear function $g(x) = 11x$.

QUESTION 11

Choice A is correct. It's given that the pressure exerted on a scuba diver at sea level is 14.70 pounds per square inch (psi). It's also given that for each foot the scuba diver descends below sea level, the pressure exerted on the scuba diver increases by 0.44 psi. The total pressure, in psi, exerted on the scuba diver at x feet below sea level can be represented by the expression $0.44x + 14.70$. Substituting 105 for x in this expression yields $0.44(105) + 14.70$, or 60.90. Therefore, the total pressure exerted on the scuba diver at 105 feet below sea level is 60.90 psi.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect. This is the pressure, in psi, exerted on the scuba diver at sea level, not at 105 feet below sea level. *Choice D* is incorrect. This is the rate by which the pressure, in psi, exerted on the scuba diver increases for each foot the scuba diver descends below sea level.

QUESTION 12

Choice C is correct. It's given that function f is defined by the equation $f(x) = 4x^{-1}$. The value of $f(21)$ is the value of $f(x)$ when $x = 21$. Substituting 21 for x in the given equation yields $f(21) = 4(21)^{-1}$, which is equivalent to $f(21) = 4\left(\frac{1}{21}\right)$, or $f(21) = \frac{4}{21}$.

Choice A is incorrect. This is the value of $f(21)$ when $f(x) = -4x$, rather than $f(x) = 4x^{-1}$. *Choice B* is incorrect. This is the value of $f(21)$ when $f(x) = (4x)^{-1}$, rather than $f(x) = 4x^{-1}$. *Choice D* is incorrect. This is the value of $f(21)$ when $f(x) = (4^{-1})x$, rather than $f(x) = 4x^{-1}$.

QUESTION 13

The correct answer is 3. The area of a rectangle can be calculated by multiplying the length of its longest side by the length of its shortest side. It's given that the area of the rectangle is 57 square inches and the length of the longest side of the rectangle is 19 inches. Let x represent the length, in inches, of the shortest side of this rectangle. It follows that $57 = 19x$. Dividing both sides of this equation by 19 yields $3 = x$. Therefore, the length, in inches, of the shortest side of the rectangle is 3.

QUESTION 14

The correct answer is 423.5. It's given that $5.5 \text{ yards} = 1 \text{ rod}$. Therefore, 77 rods is equivalent to $(77 \text{ rods})\left(\frac{5.5 \text{ yards}}{1 \text{ rod}}\right)$, or 423.5 yards. Note that 423.5 and 847/2 are examples of ways to enter a correct answer.

QUESTION 15

Choice A is correct. The number of solutions of a quadratic equation of the form $ax^2 + bx + c = 0$, where a, b, and c are constants, can be determined by the value of the discriminant, $b^2 - 4ac$. If the value of the discriminant is positive, then the quadratic equation has exactly two distinct real solutions. If the value of the discriminant is equal to zero, then the quadratic equation has exactly one real solution. If the value of the discriminant is negative, then the quadratic equation has zero real solutions. In the given equation, $x^2-12x+27=0$, $a=1$, $b=-12$, and $c=27$. Substituting these values for a, b, and c in b^2-4ac yields $(-12)^2-4(1)(27)$, or 36. Since the value of its discriminant is positive, the given equation has exactly two distinct real solutions.

Choice B is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 16

Choice C is correct. An equation defining a linear function can be written in the form $g(x)=mx+b$, where m is the slope and $(0, b)$ is the y-intercept of the graph of $y=g(x)$ in the xy-plane. It's given that the graph of $y=g(x)$ has a slope of 2. Therefore, $m=2$. It's also given that the graph of $y=g(x)$ passes through the point $(1, 14)$. It follows that when $x=1$, $g(x)=14$. Substituting 1 for x, 14 for $g(x)$, and 2 for m in the equation $g(x)=mx+b$ yields $14=2(1)+b$, or $14=2+b$. Subtracting 2 from each side of this equation yields $12=b$. Therefore, $b=12$. Substituting 2 for m and 12 for b in the equation $g(x)=mx+b$ yields $g(x)=2x+12$. Therefore, the equation that defines g is $g(x)=2x+12$.

Choice A is incorrect. For this function, the graph of $y=g(x)$ in the xy-plane passes through the point $(1, 2)$, not $(1, 14)$. *Choice B* is incorrect. For this function, the graph of $y=g(x)$ in the xy-plane passes through the point $(1, 4)$, not $(1, 14)$. *Choice D* is incorrect. For this function, the graph of $y=g(x)$ in the xy-plane passes through the point $(1, 16)$, not $(1, 14)$.

QUESTION 17

Choice B is correct. On the graph shown, the y-axis represents estimated population, in thousands. The graph shows that when $x=0$, the y-coordinate is 6. Therefore, the estimated population at $x=0$ is 6 thousand. The graph also shows that when $x=1$, the y-coordinate is 9. Therefore, the estimated population at $x=1$ is 9 thousand. Dividing 9 thousand by 6 thousand yields 1.5; therefore, 9 thousand is 1.5 times 6 thousand. It follows that the estimated population at $x=1$ is 1.5 times the estimated population at $x=0$.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 18

Choice C is correct. It's given that the price of the collectible card was $\$15.50$ in March and $\$17.36$ in April. It's also given that the price of the collectible card in April was $p\%$ of the price in March. It follows that $\$17.36$ is $p\%$ of $\$15.50$. Therefore, the value of p can be calculated by solving the equation $17.36=\left(\frac{p}{100}\right)(15.50)$, or $17.36=\frac{15.50p}{100}$. Multiplying each side of this equation by

100 yields $1{,}736 = 15.50p$. Dividing each side of this equation by 15.50 yields $112 = p$. Therefore, the value of p is 112.

Choice A is incorrect. 12% is the percent increase in the price of the collectible card from March to April. *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 19

Choice B is correct. To express a in terms of b and x, the given equation can be rewritten such that a is isolated on one side of the equation. Since it's given that b is a positive number, $b + 9$ is not equal to zero. Therefore, dividing both sides of the given equation by $8(b + 9)$ yields the equivalent equation $\frac{x}{8(b+9)} = a$, or $a = \frac{x}{8(b+9)}$.

Choice A is incorrect. This equation is equivalent to $x = 8(a + (b + 9))$. *Choice C* is incorrect. This equation is equivalent to $x = \frac{8(b+9)}{a}$. *Choice D* is incorrect. This equation is equivalent to $x = \frac{a}{8(b+9)}$.

QUESTION 20

The correct answer is 4. It's given that line k is parallel to line j. It follows that the slope of line k is equal to the slope of line j. Given two points on a line in the xy-plane, (x_1, y_1) and (x_2, y_2), the slope of the line can be calculated as $\frac{y_2 - y_1}{x_2 - x_1}$. In the xy-plane shown, the points $(0, 5)$ and $(1, 9)$ are on line j. It follows that the slope of line j is $\frac{9-5}{1-0}$, or 4. Since the slope of line j is equal to the slope of line k, the slope of line k is also 4.

QUESTION 21

The correct answer is 34. It's given that a line segment has a length of 115 cm and is divided into three parts, where one part is 47 cm long and the other two parts have lengths that are equal. If x represents the length, in cm, of each of the two parts of equal length, then the equation $47 + x + x = 115$, or $47 + 2x = 115$, represents this situation. Subtracting 47 from each side of this equation yields $2x = 68$. Dividing each side of this equation by 2 yields $x = 34$. Therefore, the length, in cm, of one of the two parts of equal length is 34.

QUESTION 22

Choice B is correct. For a quadratic function defined by an equation of the form $p(x) = a(x - h)^2 + k$, where a, h, and k are constants and $a > 0$, the minimum value of the function is k. Subtracting 57 from both sides of the given equation yields $p(x) = x^2 - 57$. This function is in the form $p(x) = a(x - h)^2 + k$, where $a = 1$, $h = 0$, and $k = -57$. Therefore, the minimum value of the function p is -57.

Choice A is incorrect and may result from conceptual or calculation errors.
Choice C is incorrect and may result from conceptual or calculation errors.
Choice D is incorrect and may result from conceptual or calculation errors.

QUESTION 23

Choice D is correct. The linear relationship between x and y can be represented by the equation $y=mx+b$, where m is the slope of the graph of this equation in the xy-plane and b is the y-coordinate of the y-intercept. The slope of a line between any two points (x_1, y_1) and (x_2, y_2) on the line can be calculated using the slope formula $m=\frac{y_2-y_1}{x_2-x_1}$. Based on the table, the graph contains the points $(-18, -48)$ and $(7, 52)$. Substituting $(-18, -48)$ and $(7, 52)$ for (x_1, y_1) and (x_2, y_2), respectively, in the slope formula yields $m=\frac{52-(-48)}{7-(-18)}$, which is equivalent to $m=\frac{100}{25}$, or $m=4$. Substituting 4 for m, -18 for x, and -48 for y in the equation $y=mx+b$ yields $-48=4(-18)+b$, or $-48=-72+b$. Adding 72 to both sides of this equation yields $24=b$. Therefore, $m=4$ and $b=24$. Substituting 4 for m and 24 for b in the equation $y=mx+b$ yields $y=4x+24$. Thus, the equation $y=4x+24$ represents the linear relationship between x and y. It's also given that the graph of the linear equation representing this relationship in the xy-plane passes through the point $\left(\frac{1}{7}, a\right)$. Substituting $\frac{1}{7}$ for x and a for y in the equation $y=4x+24$ yields $a=4\left(\frac{1}{7}\right)+24$, which is equivalent to $a=\frac{4}{7}+\frac{168}{7}$, or $a=\frac{172}{7}$.

Choice A is incorrect and may result from conceptual or calculation errors.
Choice B is incorrect and may result from conceptual or calculation errors.
Choice C is incorrect and may result from conceptual or calculation errors.

QUESTION 24

Choice A is correct. The y-intercept of a graph in the xy-plane is the point where $x=0$. Substituting 0 for x in the given equation, $y=576^{(2x+2)}$, yields $y=576^{(2(0)+2)}$, which is equivalent to $y=576^2$, or $y=331{,}776$. Therefore, the graph of the given equation in the xy-plane has a y-intercept of $(0, 331{,}776)$. It follows that $r=0$ and $s=331{,}776$. Thus, the equivalent equation $y=331{,}776^{(x+1)}$ displays the value of s as the base.

Choice B is incorrect and may result from conceptual or calculation errors.
Choice C is incorrect and may result from conceptual or calculation errors.
Choice D is incorrect and may result from conceptual or calculation errors.

QUESTION 25

Choice D is correct. If $k-x$ is a factor of the expression $-x^2+\left(\frac{1}{29}\right)nk^2$, then the expression can be written as $(k-x)(ax+b)$, where a and b are constants. This expression can be rewritten as $akx+bk-ax^2-bx$, or $-ax^2+(ak-b)x+bk$. Since this expression is equivalent to $-x^2+\left(\frac{1}{29}\right)nk^2$, it follows that $-a=-1$,

$ak-b=0$, and $bk=\left(\frac{1}{29}\right)nk^2$. Dividing each side of the equation $-a=-1$ by -1 yields $a=1$. Substituting 1 for a in the equation $ak-b=0$ yields $k-b=0$. Adding b to each side of this equation yields $k=b$. Substituting k for b in the equation $bk=\left(\frac{1}{29}\right)nk^2$ yields $k^2=\left(\frac{1}{29}\right)nk^2$. Since k is positive, dividing each side of this equation by k^2 yields $1=\left(\frac{1}{29}\right)n$. Multiplying each side of this equation by 29 yields $29=n$.

Alternate approach: The expression x^2-y^2 can be written as $(x-y)(x+y)$, which is a difference of two squares. It follows that $\left(\frac{1}{29}\right)nk^2-x^2$ is equivalent to $\left(\left(\sqrt{\frac{1}{29}n}\right)k-x\right)\left(\left(\sqrt{\frac{1}{29}n}\right)k+x\right)$. It's given that $k-x$ is a factor of $-x^2+\left(\frac{1}{29}\right)nk^2$, so the factor $\left(\sqrt{\frac{1}{29}n}\right)k-x$ is equal to $k-x$. Adding x to both sides of the equation $\left(\sqrt{\frac{1}{29}n}\right)k-x=k-x$ yields $\left(\sqrt{\frac{1}{29}n}\right)k=k$. Since k is positive, dividing both sides of this equation by k yields $\sqrt{\frac{1}{29}n}=1$. Squaring both sides of this equation yields $\frac{1}{29}n=1$. Multiplying both sides of this equation by 29 yields $n=29$.

Choice A is incorrect. This value of n gives the expression $-x^2+\left(\frac{1}{29}\right)(-29)k^2$, or $-x^2-k^2$. This expression doesn't have $k-x$ as a factor. *Choice B* is incorrect. This value of n gives the expression $-x^2+\left(\frac{1}{29}\right)\left(-\frac{1}{29}\right)k^2$, or $-x^2+\left(-\frac{1}{841}\right)k^2$. This expression doesn't have $k-x$ as a factor. *Choice C* is incorrect. This value of n gives the expression $-x^2+\left(\frac{1}{29}\right)\left(\frac{1}{29}\right)k^2$, or $-x^2+\left(\frac{1}{841}\right)k^2$. This expression doesn't have $k-x$ as a factor.

QUESTION 26

Choice D is correct. The figure shows that angle MRL and angle PRQ are vertical angles. Since vertical angles are congruent, angle MRL and angle PRQ are congruent. It's given that $\overline{LM}$ is parallel to $\overline{PQ}$. The figure also shows that $\overline{LQ}$ intersects $\overline{LM}$ and $\overline{PQ}$. If two parallel segments are intersected by a third segment, alternate interior angles are congruent. Thus, alternate interior angles MLR and PQR are congruent. Since triangles LMR and PQR have two pairs of congruent angles, the triangles are similar. Sides LR and MR in triangle LMR correspond to sides RQ and RP, respectively, in triangle PQR. Since the lengths of corresponding sides in similar triangles are proportional, it follows that $\frac{RQ}{LR}=\frac{RP}{MR}$. It's given that the lengths of $\overline{MR}$, $\overline{LR}$, and $\overline{RP}$ are 6, 7, and 11, respectively. Substituting 6 for MR, 7 for LR, and 11 for RP in the equation $\frac{RQ}{LR}=\frac{RP}{MR}$ yields $\frac{RQ}{7}=\frac{11}{6}$. Multiplying each side of this equation by 7 yields $RQ=\left(\frac{11}{6}\right)(7)$, or $RQ=\frac{77}{6}$. It's given that $\overline{LQ}$ intersects $\overline{MP}$ at point R, so $LQ=LR+RQ$. Substituting 7 for LR and $\frac{77}{6}$ for RQ in this equation yields $LQ=7+\frac{77}{6}$, or $LQ=\frac{119}{6}$. Therefore, the length of $\overline{LQ}$ is $\frac{119}{6}$.

Choice A is incorrect and may result from conceptual or calculation errors. *Choice B* is incorrect. This is the length of $\overline{RQ}$, not $\overline{LQ}$. *Choice C* is incorrect and may result from conceptual or calculation errors.

QUESTION 27

The correct answer is $\frac{31}{3}$. Subtracting $5(x+7)$ from each side of the given equation yields $0=15(x-17)(x+7)-5(x+7)$. Since $5(x+7)$ is a common factor of each of the terms on the right-hand side of this equation, it can be rewritten as $0=5(x+7)(3(x-17)-1)$. This is equivalent to $0=5(x+7)(3x-51-1)$, or $0=5(x+7)(3x-52)$. Dividing both sides of this equation by 5 yields $0=(x+7)(3x-52)$. Since a product of two factors is equal to 0 if and only if at least one of the factors is 0, either $x+7=0$ or $3x-52=0$. Subtracting 7 from both sides of the equation $x+7=0$ yields $x=-7$. Adding 52 to both sides of the equation $3x-52=0$ yields $3x=52$. Dividing both sides of this equation by 3 yields $x=\frac{52}{3}$. Therefore, the solutions to the given equation are -7 and $\frac{52}{3}$. It follows that the sum of the solutions to the given equation is $-7+\frac{52}{3}$, which is equivalent to $-\frac{21}{3}+\frac{52}{3}$, or $\frac{31}{3}$. Note that 31/3 and 10.33 are examples of ways to enter a correct answer.