

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 yards = 1 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 $(\frac{1}{7}, a)$. Substituting $\frac{1}{7}$ for x

and a for y in the equation $y = 4x + 24$ yields $a = 4(\frac{1}{7}) + 24$, 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 $-x^2 + (\frac{1}{29})nk^2$, 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 $-x^2 + (\frac{1}{29})nk^2$, 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.