

Math

Module 1

(27 questions)

QUESTION 1

Choice D is correct. If the number of plants sold increased each day during a four-day period, it follows that the number of plants sold on each of the days must be greater than the number of plants sold on the previous day. The line graph in choice D shows the number of plants sold increasing from left to right, indicating that the number of plants sold on each of the days is greater than the number of plants sold on the previous day. Therefore, of the given choices, choice D is the only line graph that shows the number of plants sold increasing each day.

Choice A is incorrect. This line graph shows that the number of plants sold remained constant each day rather than increased each day. *Choice B* is incorrect. This line graph shows that the number of plants sold decreased each day rather than increased each day. *Choice C* is incorrect. This line graph shows that the number of plants sold increased from day 1 to day 2 but then decreased from day 2 to day 3 and from day 3 to day 4 rather than increased each day.

QUESTION 2

Choice D is correct. It's given that the solution to a system of linear equations is $(5, 5)$. It follows that the graph of the two lines represented by the system intersect at the point $(5, 5)$. Of the given choices, only choice D is a graph of two lines that intersect at the point $(5, 5)$. Therefore, of the given choices, only choice D could be the graph of the equations in the system.

Choice A is incorrect. This is the graph of a system of linear equations whose solution is $(2.5, 2.5)$ rather than $(5, 5)$. *Choice B* is incorrect. This is the graph of a system of linear equations whose solution is $(5, 0)$ rather than $(5, 5)$. *Choice C* is incorrect. This is the graph of a system of linear equations with no solutions rather than a system of linear equations whose solution is $(5, 5)$.

QUESTION 3

Choice D is correct. It's given that during a race, a bicyclist's speed was 37 feet per second. Since 1 minute is equal to 60 seconds, 37 feet per second is equivalent to $\left(\frac{37 \text{ feet}}{1 \text{ second}}\right)\left(\frac{60 \text{ seconds}}{1 \text{ minute}}\right)$, or 2,220 feet per minute.

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 4

Choice A is correct. It's given that the system has infinitely many solutions. A system of two linear equations has infinitely many solutions when the two linear equations are equivalent. For the equations $y = 4x - 13$ and $y = ax - 13$ to be equivalent, the coefficients of x must be the same. Therefore, the value of a is 4.

Choice B is incorrect. If $a = -9$, the system of equations would have exactly one solution rather than infinitely many solutions. *Choice C* is incorrect. If $a = -13$, the system of equations would have exactly one solution rather than infinitely many solutions. *Choice D* is incorrect. If $a = -17$, the system of equations would have exactly one solution rather than infinitely many solutions.

QUESTION 5

Choice A is correct. Adding 38 to each side of the given equation $y - 38 = mx$, where m , x , and y are distinct positive numbers, yields $y = mx + 38$. Therefore, the equation $y = mx + 38$ correctly expresses y in terms of m and x .

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 40. It's given that Mara has read 120 pages of a 160-page research paper. The number of pages remaining can be found by subtracting the number of pages read from the total number of pages, which is $160 - 120$, or 40 pages. It's also given that Mara reads 1 page every minute on average. It follows that Mara will spend $1(40)$, or 40, minutes reading the remaining pages of the research paper.

QUESTION 7

The correct answer is 27. The table shows that 6 homes were designed 21 to 25 years ago, 12 homes were designed 26 to 30 years ago, and 9 homes were designed 31 to 35 years ago. Therefore, $6 + 12 + 9$, or 27, of the 58 homes were designed by the architecture firm 21 or more years ago.

QUESTION 8

Choice C is correct. The vertex of the graph shown represents a maximum value. The vertical axis, y , gives the estimated revenue, in dollars, for a company when the price of the company's product is x dollars. Therefore, the y -value of the vertex of the graph represents the maximum estimated revenue, in dollars, in this context.

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

QUESTION 9

Choice C is correct. It's given that the equation $y = 500 - 148x$ gives the machine's distance, in meters, from the designated location x hours after the start of the experiment. For a linear equation of the form $y = b + mx$, where m and b are constants, b represents the value of y when $x = 0$. It follows that in the given equation, 500 represents the value of y when $x = 0$. Since $x = 0$ corresponds to the start of the experiment, the best interpretation of 500 in this context is the machine's distance y , in meters, from the designated location at the start of the experiment.

Choice A is incorrect and may result from conceptual errors. *Choice B* is incorrect. The machine's velocity, in meters per hour, during the experiment is the best interpretation of -148 , not 500. *Choice D* is incorrect and may result from conceptual errors.

QUESTION 10

Choice C is correct. Adding the first equation to the second equation in the given system yields $(6x + (-6x)) + (6y + 2y) = 50 + 6$, or $8y = 56$. Dividing both sides of this equation by 8 yields $y = 7$.

Choice A is incorrect. This is the value of $-2y$, not y . *Choice B* is incorrect. This is the value of $-y$, not y . *Choice D* is incorrect. This is the value of $2y$, not y .

QUESTION 11

Choice C is correct. It's given that the scatterplot shows the relationship between two variables, x and y , and the data are modeled using a linear equation. As the x -values of the points in the scatterplot increase, the y -values also increase, which indicates that the slope of this linear model is positive. Additionally, data points near $(2, 2)$, $(10, 10)$, and $(12, 12)$ indicate that y increases at approximately the same rate as x . Of the given equations, $y = x$ best represents this relationship, since the x -values of the data points tend to be similar to the y -values. Therefore, the most appropriate linear model for the data shown is $y = x$.

Choice A is incorrect. This equation indicates that the y -values of the points in the scatterplot decrease as the x -values increase, and the slope of this linear model is negative, not positive. *Choice B* is incorrect. This equation indicates that the y -values of the points in the scatterplot decrease as the x -values increase, and the slope of this linear model is negative, not positive. *Choice D* is incorrect. This equation indicates that the y -values of the points in the scatterplot increase at a faster rate than the x -values, not at approximately the same rate.

QUESTION 12

Choice A is correct. It's given that g is defined by $g(x) = (14 - 2x)(8 + 2x)$, which represents a quadratic function with a maximum value. The maximum value of $g(x)$ corresponds to the value of x that's equidistant from the two zeros of the function g . The zeros of the function g are the values of x for which $g(x) = 0$. Substituting 0 for $g(x)$ in the equation $g(x) = (14 - 2x)(8 + 2x)$ yields $0 = (14 - 2x)(8 + 2x)$. By the zero product property, if $0 = (14 - 2x)(8 + 2x)$, then either $14 - 2x = 0$, or $8 + 2x = 0$, or both. Subtracting 14 from both sides of the equation $14 - 2x = 0$ yields $-2x = -14$. Dividing both sides of this equation by -2 yields $x = 7$. Subtracting 8 from both sides of the equation $8 + 2x = 0$ yields $2x = -8$. Dividing both sides of this equation by 2 yields $x = -4$. It follows that the zeros of function g are 7 and -4 . The value of x that is equidistant from $x = 7$ and $x = -4$ is equivalent to the mean of $x = 7$ and $x = -4$, which is $x = \frac{7 + (-4)}{2}$, or $x = 1.5$. Since 1.5 is equidistant from 7 and -4 , the value of x for which $g(x)$ reaches its maximum is 1.5.

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 13

The correct answer is 2. Substituting 5 for x in the given equation yields

$$f(5) = \frac{12}{11 - 5}, \text{ which is equivalent to } f(5) = \frac{12}{6}, \text{ or } f(5) = 2.$$

QUESTION 14

The correct answer is -9 . It's given that the y -intercept of the graph of $5x + 3y = -27$ in the xy -plane is $(0, y)$. Substituting 0 for x in the equation $5x + 3y = -27$ yields $5(0) + 3y = -27$, or $3y = -27$. Dividing both sides of this equation by 3 yields $y = -9$. Therefore, the value of y is -9 .

QUESTION 15

Choice B is correct. It's given that the product of a positive number x and the number that is 1 less than x is equal to 72, which can be represented by the equation $x(x - 1) = 72$. Using the distributive property to expand the left-hand side of this equation yields $x^2 - x = 72$. Subtracting 72 from both sides of this equation yields $x^2 - x - 72 = 0$. Factoring the left-hand side of this equation yields $(x - 9)(x + 8) = 0$. By the zero-product property, if the product of two factors is zero, then at least one of the factors must be zero. Setting each factor equal to zero yields $x - 9 = 0$ and $x + 8 = 0$. Adding 9 to both sides of the equation $x - 9 = 0$ yields $x = 9$. Subtracting 8 from both sides of the equation $x + 8 = 0$ yields $x = -8$. Since x represents a positive number, $x = 9$.

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 16

Choice C is correct. It's given that $1.28n$ represents the result of increasing the positive quantity n by $p\%$. The result of increasing the quantity n by $p\%$ is the sum of n and $p\%$ of n , expressed as $n + \frac{p}{100}n$, or $(1 + \frac{p}{100})n$. Since $1.28n$ and $(1 + \frac{p}{100})n$ represent the same quantity, it follows that $1.28n = (1 + \frac{p}{100})n$. Dividing both sides of this equation by n yields $1.28 = 1 + \frac{p}{100}$. Subtracting 1 from both sides of this equation yields $0.28 = \frac{p}{100}$. Multiplying both sides of this equation by 100 yields $p = 28$. Therefore, the value of p is 28.

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 17

Choice C is correct. It's shown in the figure that triangle JKL has a right angle at $\angle K$ and the length of $\overline{JL}$ is 95. Since $\angle K$ is a right angle, $\overline{JL}$ is the hypotenuse, $\overline{JK}$ is the leg opposite $\angle L$, and $\overline{KL}$ is the leg adjacent to $\angle L$. The tangent of an acute angle in a right triangle is the ratio of the length of the leg opposite the angle to the length of the leg adjacent to the angle. Therefore, $\tan L = \frac{JK}{KL}$. It's given that the tangent of $\angle L$ is $\frac{3}{4}$, which can be written as $\tan L = \frac{3}{4}$. Since $\tan L = \frac{JK}{KL}$ and $\tan L = \frac{3}{4}$, it follows that $\frac{JK}{KL} = \frac{3}{4}$, which can be rewritten as $JK = \frac{3}{4}(KL)$. Let $KL = x$, where x is positive. It follows that $JK = \frac{3}{4}x$. By the Pythagorean theorem, $JK^2 + KL^2 = JL^2$. Substituting $\frac{3}{4}x$ for JK , x for KL , and 95 for JL in this equation yields $(\frac{3}{4}x)^2 + x^2 = 95^2$, or $\frac{9}{16}x^2 + x^2 = 9,025$. Combining like terms on the left-hand side of this equation yields $\frac{25}{16}x^2 = 9,025$. Multiplying both sides of this equation by $\frac{16}{25}$ yields $x^2 = \frac{16}{25}(9,025)$, or $x^2 = 5,776$. Since x is positive, $x = \sqrt{5,776}$, or $x = 76$. Substituting 76 for x in the equation $JK = \frac{3}{4}x$ yields $JK = \frac{3}{4}(76)$, or $JK = 57$. Therefore, the length of $\overline{JK}$ is 57.

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. This is the length of $\overline{KL}$, not $\overline{JK}$.

QUESTION 18

Choice D is correct. Based on the table, there are a total of 48 sweatshirts that are Tigers sweatshirts and there are 24 that are both Tigers sweatshirts and medium. The probability of selecting at random a sweatshirt that is medium, given that the sweatshirt is a Tigers sweatshirt, is equal to the number of sweatshirts that are both Tigers sweatshirts and medium divided by the total number of Tigers sweatshirts. Therefore, the probability of selecting at random a sweatshirt that is medium, given that the sweatshirt is a Tigers sweatshirt, is $\frac{24}{48}$, or 0.50.

Choice A is incorrect. This is the approximate probability of selecting at random a sweatshirt that is medium and a Tigers sweatshirt from all 114 sweatshirts.

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

Choice C is incorrect. This is the approximate probability of selecting at random a sweatshirt that is a Tigers sweatshirt, given that it is medium.

QUESTION 19

Choice D is correct. It's given that for the linear function p , $p(c) = -2$, where c is a constant, $p(5) = 22$, and the slope of the graph of $y = p(x)$ in the xy -plane is 4.

Since $p(c) = -2$ and $p(5) = 22$, it follows that the graph of $y = p(x)$ in the xy -plane contains the points $(c, -2)$ and $(5, 22)$. The slope, m , of a line that passes through the points (x_1, y_1) and (x_2, y_2) can be found using the formula $m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$.

Substituting $(c, -2)$ for (x_1, y_1) , $(5, 22)$ for (x_2, y_2) , and 4 for m yields $4 = \frac{(22 - (-2))}{(5 - c)}$,

or $4 = \frac{24}{(5 - c)}$. Multiplying both sides of this equation by $5 - c$ yields $4(5 - c) = 24$,

or $20 - 4c = 24$. Subtracting 20 from both sides of this equation yields $-4c = 4$.

Dividing both sides of this equation by -4 yields $c = -1$. It's also given that for the linear function t , $t(c) = -5$ and $t(6) = 44$. Since $c = -1$, it follows that $t(-1) = -5$.

Since $t(-1) = -5$ and $t(6) = 44$, it follows that the graph of $y = t(x)$ in the xy -plane contains the points $(-1, -5)$ and $(6, 44)$. Substituting $(-1, -5)$ for (x_1, y_1) and

$(6, 44)$ for (x_2, y_2) in the slope formula yields $m = \frac{(44 - (-5))}{(6 - (-1))}$, which is equivalent to $m = \frac{49}{7}$, or $m = 7$. Therefore, the slope of the graph of $y = t(x)$ in the xy -plane is 7.

Choice A is incorrect. This is the value of c , not the slope of the graph of $y = t(x)$ in the xy -plane. *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect. This is the slope of the graph of $y = p(x)$ in the xy -plane, not the slope of the graph of $y = t(x)$ in the xy -plane.

QUESTION 20

The correct answer is 85. The perimeter of a square is the sum of the lengths of its four equal sides, which can be expressed as $4s$, where s represents the length of one side. It's given that the perimeter can be expressed as $4(85)$, meaning $4s = 4(85)$. Dividing both sides of this equation by 4 yields $s = 85$. Therefore, the length of one side of this square is 85 units.

QUESTION 21

The correct answer is 4. It's given that $5x - 6y = x^2$ and $5x - 6y = 16$. Substituting x^2 for $5x - 6y$ in the second equation of the given system yields $x^2 = 16$. Taking the square root of both sides of this equation yields $x = 4$ or $x = -4$. It's given that a solution to the given system of equations is (x, y) , where x is positive. It follows that the value of x is 4.

QUESTION 22

Choice A is correct. It's given that the exponential function f is defined by $f(x) = ab^x$, where a and b are positive constants. It's also given that $f(n) = p$, where n and p are constants. Since f is an exponential function where a and b are positive constants, it follows that the value of the function is always positive. Therefore, the value of p must be greater than 0. Substituting n for x in the equation $f(x) = ab^x$ yields $f(n) = ab^n$. Substituting p for $f(n)$ in this equation yields $p = ab^n$. Substituting $n + 1$ for x in the equation $f(x) = ab^x$ yields $f(n + 1) = ab^{(n+1)}$. By the product property of exponents, $b^{(n+1)}$ is equivalent to $b(b^n)$. Therefore, $f(n + 1) = a(b)^{(n+1)}$ is equivalent to $f(n + 1) = ab(b)^n$, or $f(n + 1) = b(ab^n)$. Substituting p for ab^n in this equation yields $f(n + 1) = b(p)$. It's also given that the value of $f(n + 1)$ is 83.00% less than the value of p , where n and p are constants. It follows that $f(n + 1) = p - 0.83p$, or $f(n + 1) = 0.17p$. Substituting $0.17p$ for $f(n + 1)$ in the equation $f(n + 1) = b(p)$ yields $0.17p = b(p)$. Dividing both sides of this equation by p yields $0.17 = b$. Therefore, the value of b is 0.17.

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. This is the value of b if the value of $f(n + 1)$ is 83.00% more, not less, than the value of p .

QUESTION 23

Choice A is correct. It's given that the graph of $y = f(x) - k$ is shown in the xy -plane. This graph crosses the x -axis once at a negative x -value and twice at distinct positive x -values. It's given that k is a positive constant, so the graph of $y = f(x)$ is the result of shifting the graph of $y = f(x) - k$ up by k units. It follows that for any positive value of k , the graph of $y = f(x)$ must cross the x -axis exactly once at a negative x -value. When a graph crosses the x -axis at $x = -c$, where c is a positive constant, the equation that defines the graph must have a linear factor $x + c$ with an odd exponent. If a and b are positive constants, then choice A, $f(x) = (x - a)^2(x + b)$, has a linear factor $x + b$ with an exponent of 1, which is odd. Therefore, of the given choices, only $f(x) = (x - a)^2(x + b)$ could define f .

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

QUESTION 24

Choice B is correct. It's given that $\sqrt{(x+13)^2} = x+13$. The square root of a squared expression, $\sqrt{(a^2)}$, equals $|a|$. Therefore, the given equation can be rewritten as $|x+13| = x+13$, which is true for all values of x such that $x+13 \geq 0$. By the definition of absolute value, $x+13 = x+13$ or $x+13 = -(x+13)$. Subtracting 13 from both sides of the equation $x+13 = x+13$ yields $x = x$. Therefore, this equation is true for all values of x such that $x+13 \geq 0$. Applying the distributive property to the equation $x+13 = -(x+13)$ yields $x+13 = -x-13$. Subtracting 13 from both sides of this equation yields $x = -x-26$. Adding x to both sides of this equation yields $2x = -26$. Dividing both sides of this equation by 2 yields $x = -13$. It follows that since the given equation is true for all values of x such that $x+13 \geq 0$, or $x \geq -13$, the least value of x that is a solution to the given equation is -13 .

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 25

Choice B is correct. It's given that $\frac{36x+55}{11} = \frac{k}{22}x + n$ and that the equation has infinitely many solutions. For an equation to have infinitely many solutions, the two sides of the equation must be equivalent. Therefore, the expressions $\frac{36x+55}{11}$ and $\frac{k}{22}x + n$ should have equal coefficients of x and equal constant terms. The expression $\frac{36x+55}{11}$ is equivalent to $\frac{36}{11}x + \frac{55}{11}$. Therefore, $\frac{36}{11} = \frac{k}{22}$. Multiplying both sides of this equation by 22 yields $\frac{36}{11}(22) = k$, or $k = 72$. Similarly, $\frac{55}{11} = n$, or $n = 5$. Therefore, the value of kn is $72(5)$, or 360.

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

QUESTION 26

Choice B is correct. It's given that in triangle ABC and triangle DEF , sides AB and DE each have a side length of 6 inches, and angles A and D each have an angle measure of 65° . Within these triangles, angles A and D are adjacent to sides AB and DE , respectively. Statement I is that the measures of angles B and C are equal. Since these two angles are in the same triangle, this information is not sufficient to prove whether triangle ABC is congruent to triangle DEF . Statement II is that the lengths of sides AC and DF are equal. If sides AC and DF have equal length, then the triangles have two sides and the included angle

that are congruent, which is sufficient to prove that the triangles are congruent by side-angle-side (SAS) conditions. Statement III is that the lengths of sides BC and EF are equal. Since these two sides aren't adjacent to the given angles A and D , this information is not sufficient to prove whether the triangles are congruent. Thus, of the additional pieces of information, II is sufficient, but I and III are not sufficient to prove whether triangle ABC is congruent to triangle DEF .

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

QUESTION 27

The correct answer is 6. It's given that $32x + 84y = 360$ represents the volume of compost x , in cubic feet, and the volume of soil y , in cubic feet, in a mixture of compost and soil that weighs 360 pounds. Thus, if the volume of soil in the mixture is 2 cubic feet, then $y = 2$. Substituting 2 for y in the equation $32x + 84y = 360$ yields $32x + 84(2) = 360$, or $32x + 168 = 360$. Subtracting 168 from both sides of this equation yields $32x = 192$. Dividing both sides of this equation by 32 yields $x = 6$. Therefore, if the volume of soil in the mixture is 2 cubic feet, then the volume of compost in the mixture, in cubic feet, is 6.