

Math

Module 2

(27 questions)

QUESTION 1

Choice A is correct. It's given that Tilly earns p dollars for every w hours of work. This can be represented by the proportion $\frac{p}{w}$. The amount of money, x , Tilly earns for $39w$ hours of work can be found by setting up the proportion $\frac{p}{w} = \frac{x}{39w}$. This can be rewritten as $39pw = xw$. Dividing both sides by w results in $x = 39p$.

Choice B is incorrect. This is the amount of money Tilly earns in dollars per hour, not the amount of money Tilly earns for $39w$ hours of work. **Choice C** is incorrect. This is the amount of money Tilly earns for w hours of work plus 39, not the amount of money Tilly earns for $39w$ hours of work. **Choice D** is incorrect. This is the amount of money Tilly earns for w hours of work minus 39, not the amount of money Tilly earns for $39w$ hours of work.

QUESTION 2

Choice D is correct. It's given that Juan rides his bike at an average rate of 5.7 minutes per mile. The number of minutes it will take Juan to ride x miles can be determined by multiplying his average rate by the number of miles, x , which yields $5.7x$. Therefore, the function $m(x) = 5.7x$ models the number of minutes it will take Juan to ride x miles.

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

QUESTION 3

Choice B is correct. Adding the second equation in the given system to the first equation in the given system yields $3x + (-3x + y) = 12 + (-6)$, which is equivalent to $y = 6$.

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 given equation, s is the speed, in miles per hour, of a certain car t seconds after it began to accelerate. Therefore, the speed of the car, in miles per hour, 5 seconds after it began to accelerate can be found by substituting 5 for t in the given equation, which yields $s = 40 + 3(5)$, or $s = 55$. Thus, the speed of the car 5 seconds after it began to accelerate is 55 miles per hour.

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 5

Choice D is correct. By the Pythagorean theorem, if a right triangle has a hypotenuse with length c and legs with lengths a and b , then $c^2 = a^2 + b^2$. In the right triangle shown, the hypotenuse has length c and the legs have lengths a and b . It's given that $a = 4$ and $b = 5$. Substituting 4 for a and 5 for b in the Pythagorean theorem yields $c^2 = 4^2 + 5^2$. Taking the square root of both sides of this equation yields $c = \pm\sqrt{4^2 + 5^2}$. Since the length of a side of a triangle must be positive, the value of c is $\sqrt{4^2 + 5^2}$.

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 6

The correct answer is 40. Subtracting 5 from both sides of the given equation yields $4x = 160$. Dividing both sides of this equation by 4 yields $x = 40$.

Therefore, the solution to the given equation is 40.

QUESTION 7

The correct answer is 7. It's given that the x -intercept of the graph shown is $(x, 0)$.

The graph passes through the point $(7, 0)$. Therefore, the value of x is 7.

QUESTION 8

Choice B is correct. The y -intercept of the graph of a function in the xy -plane is the point on the graph where $x = 0$. It's given that $f(x) = \frac{1}{10}x - 2$. Substituting 0 for x in this equation yields $f(0) = \frac{1}{10}(0) - 2$, or $f(0) = -2$. Since it's given that $y = f(x)$, it follows that $y = -2$ when $x = 0$. Therefore, the y -intercept of the graph of $y = f(x)$ in the xy -plane is $(0, -2)$.

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 9

Choice D is correct. If the graph of $y = g(x)$ is the result of shifting the graph of $y = f(x)$ down k units in the xy -plane, the function g can be defined by an equation of the form $g(x) = f(x) - k$. It's given that $f(x) = 7x^3$ and the graph of $y = g(x)$ is the result of shifting the graph of $y = f(x)$ down 2 units. Substituting $7x^3$ for $f(x)$ and 2 for k in the equation $g(x) = f(x) - k$ yields $g(x) = 7x^3 - 2$.

Choice A is incorrect and may result from conceptual errors. *Choice B* is incorrect and may result from conceptual errors. *Choice C* is incorrect. This equation defines a function g for which the graph of $y = g(x)$ is the result of shifting the graph of $y = f(x)$ up, not down, 2 units.

QUESTION 10

Choice A is correct. The solution to a system of equations is the ordered pair (x, y) that satisfies all equations in the system. It's given by the first equation in the system that $x + 7 = 10$. Substituting 10 for $x + 7$ into the second equation yields $10^2 = y$, or $y = 100$. The x -coordinate of the solution to the system of equations can be found by subtracting 7 from both sides of the equation $x + 7 = 10$, which yields $x = 3$. Therefore, the ordered pair $(3, 100)$ is a solution to the given system of equations.

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 11

Choice A is correct. Applying the distributive property, the given expression can be written as $7x^3 + 7x - 6x^3 + 3x$. Grouping like terms in this expression yields $(7x^3 - 6x^3) + (7x + 3x)$. Combining like terms in this expression yields $x^3 + 10x$.

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 A is correct. It's given that $p(n) = 7n^3$. Substituting 56 for $p(n)$ in this equation yields $56 = 7n^3$. Dividing each side of this equation by 7 yields $8 = n^3$. Taking the cube root of each side of this equation yields $2 = n$. Therefore, when $p(n)$ is equal to 56, the value of n is 2.

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 70. Based on the figure, the angle with measure 110° and the angle vertical to the angle with measure x° are same side interior angles. Since vertical angles are congruent, the angle vertical to the angle with measure x° also has measure x° . It's given that lines s and t are parallel. Therefore, same side interior angles between lines s and t are supplementary. It follows that $x + 110 = 180$. Subtracting 110 from both sides of this equation yields $x = 70$.

QUESTION 14

The correct answer is 10. The mean of a data set is calculated by dividing the sum of the data values by the number of data values in the data set. For this data set, the mean can be calculated as $\frac{6+8+16+4+17+26+8+5+5+5}{10}$, which is equivalent to $\frac{100}{10}$, or 10.

QUESTION 15

Choice A is correct. For an exponential function of the form $E(t) = a(b)^t$, where a and b are constants, the initial value of the function—that is, the value of the function when $t = 0$ —is a and the value of the function increases by a factor of b each time t increases by 1. Since the function $E(t) = 5(1.8)^t$ gives the estimated number of employees at a restaurant and t is the number of years since the restaurant opened, the best interpretation of the number 5 in this context is the estimated number of employees when $t = 0$, or when the restaurant opened.

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 16

Choice B is correct. For a quadratic function defined by an equation of the form $g(x) = a(x - h)^2 + k$, where a , h , and k are constants and $a > 0$, the minimum value of the function is k . In the given function, $a = 1$, $h = 0$, and $k = 55$. Therefore, the minimum value of the given function is 55.

Choice A is incorrect. This is the value of x for which the given function reaches its minimum value, not the minimum value of the function. **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 C is correct. Because the value of the investment increases each year, the function that best models how the value of the investment changes over time is an increasing function. It's given that each year, the value of the investment increases by 0.49% of its value the previous year. Since the value of the investment changes by a fixed percentage each year, the function that best

models how the value of the investment changes over time is an exponential function. Therefore, the function that best models how the value of the investment changes over time is an increasing exponential function.

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 18

Choice C is correct. Let x be the 2015 population of Greenville. It's given that the population increased by 7% from 2015 to 2016. The increase in population can be written as $(0.07)x$. The 2016 population of Greenville is given as the sum of the 2015 population of Greenville and the increase in population from 2015 to 2016. This can be rewritten as $x + (0.07)x$, or $1.07x$. Therefore, the value of k is 1.07.

Choice A is incorrect. This is the percent, represented as a decimal, that the population increased from 2015 to 2016, not the value of k . *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect. This is the value of k if the population increased by 70%, not 7%, from 2015 to 2016.

QUESTION 19

Choice B is correct. Since $\frac{12}{12} = 1$, multiplying the exponent of the given expression by $\frac{12}{12}$ yields an equivalent expression: $a^{\left(\frac{11}{12}\right)\left(\frac{12}{12}\right)} = a^{\left(\frac{132}{144}\right)}$. Since $\frac{132}{144} = 132\left(\frac{1}{144}\right)$, the expression $a^{\frac{132}{144}}$ can be rewritten as $a^{\left(132\right)\left(\frac{1}{144}\right)}$. Applying properties of exponents, this expression can be rewritten as $\left(a^{132}\right)^{\frac{1}{144}}$. An expression of the form $(m)^{\frac{1}{k}}$, where $m > 0$ and $k > 0$, is equivalent to $\sqrt[k]{m}$. Therefore, $\left(a^{132}\right)^{\frac{1}{144}}$ is equivalent to $\sqrt[144]{a^{132}}$.

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 20

The correct answer is 16. The total cost of the party is found by adding the onetime fee of the venue to the cost per attendee times the number of attendees. Let x be the number of attendees. The expression $35 + 10.25x$ thus represents the total cost of the party. It's given that the budget is \$200, so this situation can be represented by the inequality $35 + 10.25x \leq 200$. The greatest number of attendees can be found by solving this inequality for x . Subtracting 35 from both sides of this inequality gives $10.25x \leq 165$. Dividing both sides of this inequality by 10.25 results in approximately $x \leq 16.098$. Since the question is stated in terms of attendees, rounding x down to the nearest whole number, 16, gives the greatest number of attendees possible.

QUESTION 21

The correct answer is 28. The given absolute value equation can be rewritten as two linear equations: $4x - 4 = 112$ and $-(4x - 4) = 112$, or $4x - 4 = -112$. Adding 4 to both sides of the equation $4x - 4 = 112$ results in $4x = 116$. Dividing both sides of this equation by 4 results in $x = 29$. Adding 4 to both sides of the equation $4x - 4 = -112$ results in $4x = -108$. Dividing both sides of this equation by 4 results in $x = -27$. Therefore, the two values of $x - 1$ are $29 - 1$, or 28, and $-27 - 1$, or -28 . Thus, the positive value of $x - 1$ is 28.

Alternate approach: The given equation can be rewritten as $|4(x - 1)| = 112$, which is equivalent to $4|x - 1| = 112$. Dividing both sides of this equation by 4 yields $|x - 1| = 28$. This equation can be rewritten as two linear equations: $x - 1 = 28$ and $-(x - 1) = 28$, or $x - 1 = -28$. Therefore, the positive value of $x - 1$ is 28.

QUESTION 22

Choice A is correct. The volume of a cube can be found by using the formula $V = s^3$, where V is the volume and s is the edge length of the cube. Therefore, the volume of the given cube is $V = 68^3$, or 314,432 cubic inches. The volume of a sphere can be found by using the formula $V = \frac{4}{3}\pi r^3$, where V is the volume and r is the radius of the sphere. Therefore, the volume of the given sphere is $V = \frac{4}{3}\pi(34)^3$, or approximately 164,636 cubic inches. The volume of the space in the cube not taken up by the sphere is the difference between the volume of the cube and volume of the sphere. Subtracting the approximate volume of the sphere from the volume of the cube gives $314,432 - 164,636 = 149,796$ cubic inches.

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 23

Choice B is correct. The standard form of an equation of a circle in the xy -plane is $(x - h)^2 + (y - k)^2 = r^2$, where the coordinates of the center of the circle are (h, k) and the length of the radius of the circle is r . For the circle in the xy -plane with equation $(x - 5)^2 + (y - 3)^2 = 16$, it follows that $r^2 = 16$. Taking the square root of both sides of this equation yields $r = 4$ or $r = -4$. Because r represents the length of the radius of the circle and this length must be positive, $r = 4$. Therefore, the radius of the circle is 4. The diameter of a circle is twice the length of the radius of the circle. Thus, $2(4)$ yields 8. Therefore, the diameter of the circle is 8.

Choice A is incorrect. This is the radius of the circle. **Choice C** is incorrect. This is the square of the radius of the circle. **Choice D** is incorrect and may result from conceptual or calculation errors.

QUESTION 24

Choice C is correct. For the form of the function in choice C, $f(x) = 128(1.6)^{x-1}$, the value of $f(1)$ can be found as $128(1.6)^{1-1}$, which is equivalent to $128(1.6)^0$, or 128. Therefore, $k = 128$, which is shown in $f(x) = 128(1.6)^{x-1}$ as the coefficient.

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 25

Choice B is correct. Since the model estimates that the number of squirrels in the population increased by a fixed percentage, 150%, each year, the model can be represented by an exponential equation of the form $n = a\left(1 + \frac{p}{100}\right)^t$, where a is the estimated number of squirrels in the population at the end of 2015, and the model estimates that at the end of each year, the number is $p\%$ more than the number at the end of the previous year. Since the model estimates that at the end of each year, the number was 150% more than the number at the end of the previous year, $p = 150$. Substituting 150 for p in the equation $n = a\left(1 + \frac{p}{100}\right)^t$ yields $n = a\left(1 + \frac{150}{100}\right)^t$, which is equivalent to $n = a(1 + 1.5)^t$, or $n = a(2.5)^t$. It's given that the estimated number of squirrels at the end of 2016 was 180. This means that when $t = 1$, $n = 180$. Substituting 1 for t and 180 for n in the equation $n = a(2.5)^t$ yields $180 = a(2.5)^1$, or $180 = 2.5a$. Dividing each side of this equation by 2.5 yields $72 = a$. Substituting 72 for a in the equation $n = a(2.5)^t$ yields $n = 72(2.5)^t$.

Choice A is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year. *Choice C* is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year, and the estimated number of squirrels at the end of 2015, not the end of 2016, was 180. *Choice D* is incorrect. This equation represents a model where the estimated number of squirrels at the end of 2015, not the end of 2016, was 180.

QUESTION 26

Choice B is correct. Two lines are perpendicular if their slopes are negative reciprocals, meaning that the slope of the first line is equal to -1 divided by the slope of the second line. Each equation in the given pair of equations can be written in slope-intercept form, $y = mx + b$, where m is the slope of the graph of the equation in the xy -plane and $(0, b)$ is the y -intercept. For the first equation, $5x + 7y = 1$, subtracting $5x$ from both sides gives $7y = -5x + 1$, and dividing both sides of this equation by 7 gives $y = -\frac{5}{7}x + \frac{1}{7}$. Therefore, the slope of the graph of this equation is $-\frac{5}{7}$. For the second equation, $ax + by = 1$, subtracting ax from both sides gives $by = -ax + 1$, and dividing both sides of this equation by b gives $y = -\frac{a}{b}x + \frac{1}{b}$. Therefore, the slope of the graph of this equation is $-\frac{a}{b}$. Since the graph of the given pair of equations is a pair of perpendicular lines, the slope of the graph of the second equation, $-\frac{a}{b}$, must be the negative reciprocal of the slope of the graph of the first equation, $-\frac{5}{7}$. The negative reciprocal of $-\frac{5}{7}$ is $\frac{7}{5}$, or $\frac{1}{\left(-\frac{5}{7}\right)}$. Therefore, $-\frac{a}{b} = \frac{7}{5}$, or $\frac{a}{b} = -\frac{7}{5}$. Similarly, rewriting the equations in choice B in slope-intercept form yields $y = -\frac{10}{7}x + \frac{1}{7}$ and $y = -\frac{a}{2b}x + \frac{1}{2b}$. It follows that the slope of the graph of the first equation in choice B is $-\frac{10}{7}$ and the slope of the graph of the second equation in choice B is $-\frac{a}{2b}$. Since $\frac{a}{b} = -\frac{7}{5}$, $-\frac{a}{2b}$ is equal to $-\left(\frac{1}{2}\right)\left(-\frac{7}{5}\right)$, or $\frac{7}{10}$. Since $\frac{7}{10}$ is the negative reciprocal of $-\frac{10}{7}$, the pair of equations in choice B represents a pair of perpendicular lines.

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 27

The correct answer is 289. A quadratic equation of the form $ax^2 + bx + c = 0$, where a , b , and c are constants, has no real solutions when the value of the discriminant, $b^2 - 4ac$, is less than 0. In the given equation, $x^2 - 34x + c = 0$, $a = 1$ and $b = -34$. Therefore, the discriminant of the given equation can be expressed as $(-34)^2 - 4(1)(c)$, or $1,156 - 4c$. It follows that the given equation has no real solutions when $1,156 - 4c < 0$. Adding $4c$ to both sides of this inequality yields $1,156 < 4c$. Dividing both sides of this inequality by 4 yields $289 < c$, or $c > 289$. It's given that the equation $x^2 - 34x + c = 0$ has no real solutions when $c > n$. Therefore, the least possible value of n is 289.