Math: Question 1

The function g is defined by $g(x) = -x + 8$. What is the value of $g(0)$?

      A. -8

      B. 0

      C. 4

      D. 8

Choice D is correct. The value of $g(0)$ is found by substituting 0 for x in the function g. This yields $g(0) = -0 + 8$, which can be rewritten as $g(0) = 8$.

Choice A is incorrect and may result from misinterpreting the equation as $g(x) = x + (-8)$ instead of $g(x) = -x + 8$. Choice B is incorrect. This is the value of x, not $g(x)$. Choice C is incorrect and may result from calculation errors.

Question Difficulty: Easy

Math: Question 2

$(x+5)+(2x-3)$

Which of the following is equivalent to the given expression?

      A. $3x-2$
      B. $3x+2$
      C. $3x-8$
      D. $3x+8$

Choice B is correct. Using the associative and commutative properties of addition, the given expression $(x+5)+(2x-3)$ can be rewritten as $(x+2x)+(5-3)$. Adding these like terms results in $3x+2$.
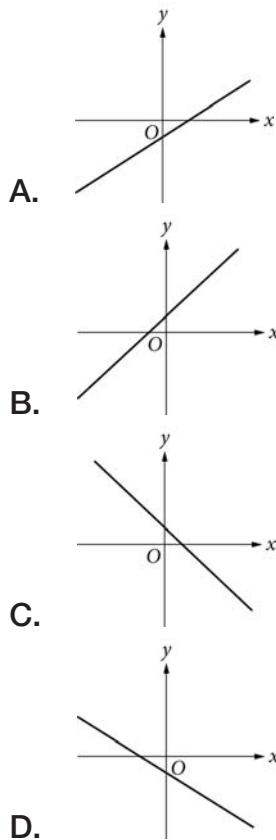
Choice A is incorrect and may result from adding $(x-5)+(2x+3)$. Choice C is incorrect and may result from adding $(x-5)+(2x-3)$. Choice D is incorrect and may result from adding $(x+5)+(2x+3)$.

Question Difficulty: Medium

Math: Question 3

$$f(x) = \frac{3}{4}x - 2$$

Which of the following could be the graph in the xy-plane of the function above?

A.

B.

C.

D.

Choice A is correct. The equation $f(x) = \frac{3}{4}x - 2$ is written in slope-intercept form, $f(x) = mx + b$, where m represents the slope and b represents the y-coordinate of the y-intercept of the graph. Based on the given equation, the slope of the line is $\frac{3}{4}$ and the y-intercept is $(0, -2)$. Choice A is the only option with a positive slope and a y-intercept below the x-axis.

Choice B is incorrect because the line graphed has a y-intercept above the x-axis. Choice C is incorrect because the line graphed has a negative slope and a y-intercept above the x-axis. Choice D is incorrect because the line graphed has a negative slope.

Question Difficulty: Medium

Math: Question 4

As part of her role on the planning committee for the high school prom, Keisha hired a DJ. The DJ charges $150 per hour for performing plus a $100 flat fee for setup and takedown. The committee budgeted $700 for a DJ for the prom. Which of the following represents the number of performing hours, x, for which the DJ could be hired to stay within the committee budget?

    A. $x \geq 7$

    B. $x \leq 7$

    C. $x \geq 4$

    D. $x \leq 4$

Choice D is correct. The total amount that the DJ charges is the amount charged for x hours plus the flat fee. The amount charged for x hours is the hourly charge of $150 times the hours performed, or $150x$. Adding the flat fee of $100 yields the expression $150x + 100$. Since the planning committee's budget is $700, the amount that the DJ charges must be less than or equal to 700. Therefore, $150x + 100 \leq 700$. Subtracting 100 from both sides of this inequality yields $150x \leq 600$. Dividing both sides of this inequality by 150 yields $x \leq 4$.

Choice A is incorrect and may result from incorrectly creating the inequality $100x \geq 700$. Choice B is incorrect and may result from incorrectly creating the inequality $100x \leq 700$. Choice C is incorrect and may result from misinterpreting the inequality symbol needed to represent the amount the DJ charges.

Question Difficulty: Medium

Math: Question 5

The total revenue from sales of a product can be calculated using the formula $T = PQ$, where T is the total revenue, P is the price of the product, and Q is the quantity of the product sold. Which of the following equations gives the quantity of product sold in terms of P and T ?

A. $Q = \dfrac{P}{T}$

B. $Q = \dfrac{T}{P}$

C. $Q = PT$

D. $Q = T - P$

Choice B is correct. Solving the given equation for Q gives the quantity of the product sold in terms of P and T. Dividing both sides of the given equation by P yields $\dfrac{T}{P} = Q$, or $Q = \dfrac{T}{P}$.

Therefore, $Q = \dfrac{T}{P}$ gives the quantity of product sold in terms of P and T.

Choice A is incorrect and may result from an error when dividing both sides of the given equation by P. Choice C is incorrect and may result from multiplying, rather than dividing, both sides of the given equation by P. Choice D is incorrect and may result from subtracting P from both sides of the equation rather than dividing both sides by P.

Question Difficulty: Medium

Math: Question 6

$(b-2)x = 8$

In the given equation, b is a constant. If the equation has no solution, what is the value of b ?

    A. 2
    B. 4
    C. 6
    D. 10

Choice A is correct. This equation has no solution when there is no value of x that produces a true statement. Solving the given equation for x by dividing both sides by $(b-2)$ gives $x = \dfrac{8}{(b-2)}$. When $(b-2) = 0$, the right-hand side of this equation will be undefined, and the equation will have no solution. Therefore, when $b = 2$, there is no value of x that satisfies the given equation.

Choices B, C, and D are incorrect. Substituting 4, 6, and 10 for b in the given equation yields exactly one solution, rather than no solution, for x. For example, substituting 4 for b in the given equation yields $(4-2)x = 8$, or $2x = 8$. Dividing both sides of $2x = 8$ by 2 yields $x = 4$. Similarly, if $b = 6$ or $b = 10$, $x = 2$ and $x = 1$, respectively.

Question Difficulty: Medium

Math: Question 7

Which of the following is the graph of the equation $y = 2(3)^x$ in the xy-plane?

A.

B.

C.

D.
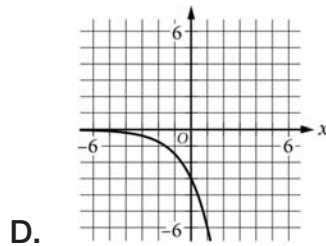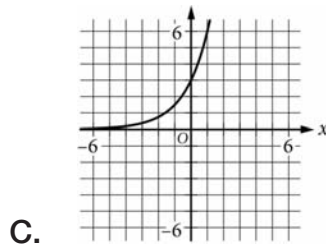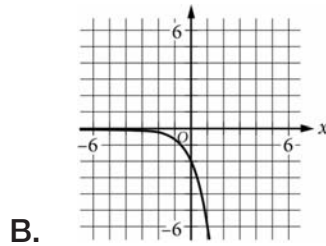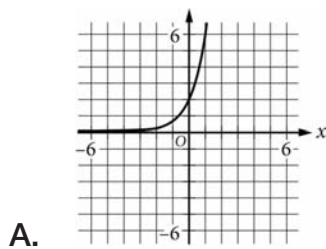
Choice A is correct. The equation $y = 2(3)^x$ defines an exponential function. The base of the exponential function is 3, which is greater than 1, so the equation defines an increasing exponential function. Therefore, the graph of $y = 2(3)^x$ represents an increasing exponential function. The y-intercept of the graph of the given equation can be found by substituting 0 for x in the equation, which gives $y = 2(3)^0$, which can be rewritten as $y = 2$. Thus, the y-intercept of the graph of $y = 2(3)^x$ is $(0,2)$. The graph in choice A is the only graph of an increasing function with a y-intercept at $(0,2)$.

Choice B is incorrect. This is the graph of $y = -2(3)^x$. Choices C and D are incorrect. These graphs show a y-intercept of $(0,3)$ and $(0, -3)$, respectively.

Question Difficulty: Medium

Math: Question 8

$y = x - 4$

$y = x^2 - 16$

If (x,y) is a solution to the system of equations above, which of the following could be the value of x ?

A.

20

B.

12

C.

−3

D.

−4

Choice C is correct. The values of x of the solutions to this system of equations can be found by first eliminating the variable y. Subtracting the first equation from the second equation yields $y - y = (x^2 - 16) - (x - 4)$, or $0 = (x^2 - 16) - (x - 4)$. Using the distributive property of multiplication on the right-hand side of the equation yields $0 = x^2 - 16 - x + 4$, and combining like terms yields $0 = x^2 - x - 12$. Factoring the expression on the right-hand side of this equation gives $0 = (x - 4)(x + 3)$. Setting each factor equal to 0 results in $x - 4 = 0$ and $x + 3 = 0$, which gives $x = 4$ and $x = -3$. Of these values of x, only −3 is given as a choice.

Choice A is incorrect and may result from a calculation error. Choice B is incorrect and may result from an error when factoring the expression $x^2 - x - 12$. Choice D is incorrect. This is the opposite of the value of x of one of the solutions.

Question Difficulty: Hard

Math: Question 9
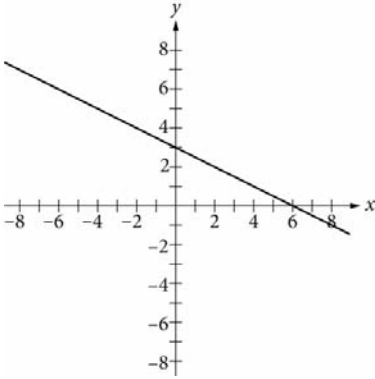
Which of the following is an equation of the line shown in the xy-plane above?

A. $x + \frac{1}{2}y = 3$

B. $x + \frac{1}{2}y = 6$

C. $x + 2y = 3$

D. $x + 2y = 6$

Choice D is correct. The graph of the line shown in the xy-plane has x- and y-intercepts at $(6,0)$ and $(0,3)$, respectively. The standard form of an equation of a line is $ax + by = c$, where a, b, and c are constants. When an equation of a line is in standard form, the x- and y-intercepts of the corresponding line can be found by substituting $x = 0$ and $y = 0$, respectively, into the equation. Substituting $x = 0$ in $x + 2y = 6$ yields $0 + 2y = 6$, or $2y = 6$. Dividing both sides of $2y = 6$ by 2 yields $y = 3$. This implies that the y-intercept of the corresponding line is $(0,3)$. Similarly, substituting $y = 0$ in $x + 2y = 6$ yields $x + 2(0) = 6$, or $x = 6$. This implies that the x-intercept of the corresponding line is $(6,0)$. Since there is only one line that passes through $(0,3)$ and $(6,0)$, the equation in choice D is an equation of the line shown in the xy-plane.

Choices A, B, and C are incorrect. None of these equations gives both the corresponding x- and y-intercepts of the graph of the line shown in the xy-plane.

Question Difficulty: Hard

Math: Question 10

$$N(d) = 115(0.90)^d$$

The function N defined above can be used to model the number of species of brachiopods at various ocean depths d, where d is in <u>hundreds</u> of meters. Which of the following does the model predict?

A.

For every increase in depth by 1 meter, the number of brachiopod species decreases by 115.

B.

For every increase in depth by 1 meter, the number of brachiopod species decreases by 10%.

C.

For every increase in depth by 100 meters, the number of brachiopod species decreases by 115.

D.

For every increase in depth by 100 meters, the number of brachiopod species decreases by 10%.

Choice D is correct. The function N is exponential, so it follows that $N(d)$ changes by a fixed percentage for each increase in d by 1. Since d is measured in hundreds of meters, it also follows that the number of brachiopod species changes by a fixed percentage for each increase in ocean depth by 100 meters. Since the base of the exponent in the model is 0.90, which is less than 1, the number of brachiopod species decreases as the ocean depth increases. Specifically, the number of brachiopod species at a depth of $d+100$ meters is 90% of the number of brachiopod species at a depth of d meters. This means that for each increase in ocean depth by 100 meters, the number of brachiopod species decreases by 10%.

Choices A and C are incorrect. These describe situations where the number of brachiopod species are decreasing linearly rather than exponentially. Choice B is incorrect and results from interpreting the decrease in the number of brachiopod species as 10% for every 1-meter increase in ocean depth rather than for every 100-meter increase in ocean depth.

Question Difficulty: Medium

Math: Question 11

In the xy-plane, the lines with equations $x + y = 15$ and $y = 3x$ intersect at (a,b). What is the value of $b - a$?

A. $\dfrac{1}{4}$

B. $\dfrac{15}{4}$

C. $\dfrac{15}{2}$

D. $\dfrac{45}{2}$

Choice C is correct. The point of intersection of two lines is an ordered pair (x,y) that satisfies both equations. The second equation states that $y = 3x$, so $3x$ can be substituted for y in the first equation, which results in $x + 3x = 15$. Combining like terms yields $4x = 15$. Dividing both sides of this equation by 4 yields $x = \dfrac{15}{4}$. Substituting $\dfrac{15}{4}$ for x in the second equation yields $y = 3\left(\dfrac{15}{4}\right)$, or $y = \dfrac{45}{4}$. Therefore, the point of intersection of these lines is $(x,y) = (a,b) = \left(\dfrac{15}{4}, \dfrac{45}{4}\right)$. It follows that the value of $b - a$ is $\dfrac{45}{4} - \dfrac{15}{4} = \dfrac{30}{4}$, which can be rewritten as $\dfrac{15}{2}$.

Choices A and D are incorrect and may result from calculation errors. Choice B is incorrect; this is the value of a, not $b - a$.

Question Difficulty: Medium

Math: Question 12

To ship a parcel based on its weight, a certain mail-shipping service charges $2.50 for the first pound and $0.50 for each additional pound. If a parcel weighs w pounds, where w is a positive integer, which of the following equations represents the shipping charge c, in dollars, in terms of w ?

    A. $c = 2.5 + 0.5(w-1)$

    B. $c = 0.5 + 2.5(w-1)$

    C. $c = 2.5 + 0.5w$

    D. $c = 0.5 + 2.5w$

Choice A is correct. The shipping charge, c, for a parcel is based on its weight, w, in pounds. The shipping charge consists of a charge of $2.50 for the first pound of weight, plus $0.50 for each additional pound of weight. Since each additional pound can be expressed as $w-1$, it follows that the charge for the additional weight can be expressed as $0.50(w-1)$. Therefore, the total shipping charge can be represented by the equation $c = 2.50 + 0.50(w-1)$, or $c = 2.5 + 0.5(w-1)$.

Choice B is incorrect and may result from switching the charge for the first pound with the charge for each additional pound. Choice C is incorrect and may result from not subtracting 1 from w. Choice D is incorrect and may result from not subtracting 1 from w, in addition to switching the charges.

Question Difficulty: Hard

Math: Question 13

The equation $y = 7^x - 1$ is graphed in the xy-plane. What is the y-intercept of the graph?

    A. $(0, -1)$

    B. $(0, 0)$

    C. $(0, 6)$

    D. $(0, 7)$

Choice B is correct. The y-intercept of a graph is the point at which the graph passes through the y-axis, which occurs when $x = 0$. Substituting 0 for x in the given equation yields $y = 7^0 - 1$, which gives $y = 1 - 1$, or $y = 0$. Therefore, the y-intercept of the graph is $(0, 0)$.

Choice A is incorrect and may result from evaluating 7^0 as 0 instead of 1 in the equation $y = 7^0 - 1$. Choice C is incorrect. The value of y is 6 when $x = 1$, not when $x = 0$. Choice D is incorrect and may result from misinterpreting the meaning of 7 in the given equation.

Question Difficulty: Hard

Math: Question 14

If $5x + 100 = 2100$, what is the value of x ?

The correct answer is 400. Subtracting 100 from both sides of the given equation yields $5x = 2000$. Dividing both sides of this equation by 5 yields $x = 400$.

Question Difficulty: Easy

Math: Question 15

$x^2 + 10x + 24$

When the given expression is rewritten in the form $(x+4)(x+k)$, where k is a constant, what is the value of k ?

The correct answer is 6. The given expression $x^2 + 10x + 24$ can be rewritten in the form $(x+4)(x+k)$, where k is a constant, by factoring. This involves finding two factors that when added their sum is the coefficient of the middle term, 10, and when multiplied their product is 24. Since $4+6=10$ and $4(6)=24$, the two factors are 4 and 6. Therefore, factoring the trinomial completely gives $(x+4)(x+6)$. The value of k is given in the second factor, $(x+6)$. Thus, the value of k is 6.

Alternate approach: It's given that $x^2 + 10x + 24$ can be rewritten as $(x+4)(x+k)$. Multiplying the expression $(x+4)(x+k)$ gives $x^2 + kx + 4x + 4k$. Setting this expression equal to $x^2 + 10x + 24$ finds the value of k. This gives $x^2 + kx + 4x + 4k = x^2 + 10x + 24$. Subtracting x^2 from both sides of this equation gives $kx + 4x + 4k = 10x + 24$. Subtracting $4x$ from both sides of this equation isolates all k-terms on the left-hand side: $kx + 4k = 6x + 24$. This equation implies that $kx = 6x$ and $4k = 24$. Solving both $kx = 6x$ and $4k = 24$ for k yields $k = 6$.

**Question Difficulty: Medium**

Math: Question 16

$(x-7)^2 - 25 = 0$

What is one value of x that satisfies the given equation?

The correct answer is 2 or 12. Adding 25 to both sides of the given equation yields $(x-7)^2 = 25$. Since $5^2 = 25$ and $(-5)^2 = 25$, it follows that $(x-7) = 5$ or $(x-7) = -5$. Solving both of these equations for x yields $x = 12$ or $x = 2$. Either 2 or 12 may be entered as the correct answer.

Question Difficulty: Medium

Math: Question 17
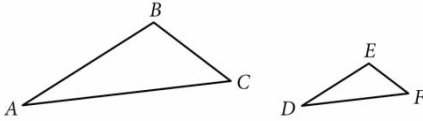
Note: Figures not drawn to scale.

Triangle ABC and triangle DEF are shown. The relationship between the side lengths of the two triangles is such that $\dfrac{AB}{DE} = \dfrac{BC}{EF} = \dfrac{AC}{DF} = 3$. If the measure of angle BAC is 20°, what is the measure, in degrees, of angle EDF ? (Disregard the degree symbol when gridding your answer.)

The correct answer is 20. By the equality given, the three pairs of corresponding sides of the two triangles are in the same proportion. By the side-side-side (SSS) similarity theorem, triangle ABC is similar to triangle DEF. In similar triangles, the measures of corresponding angles are congruent. Since angle BAC corresponds to angle EDF, these two angles are congruent and their measures are equal. It's given that the measure of angle BAC is 20°, so the measure of angle EDF is also 20°.

Question Difficulty: Hard