

## Math: Question 1

$$3x - 10 = 11$$

What value of  $x$  satisfies the given equation?

- A.  $\frac{1}{3}$
- B. 7
- C. 18
- D. 24

Choice B is correct. Adding 10 to both sides of the given equation yields  $3x = 21$ . Dividing both sides of this equation by 3 yields  $x = 7$ .

Choices A, C, and D are incorrect. When these values are substituted for  $x$  in the given equation, they each result in a false statement and, therefore, don't satisfy the given equation. Substituting  $\frac{1}{3}$  for  $x$  yields  $3\left(\frac{1}{3}\right) - 10 = 11$ , or  $-9 = 11$ , which is false. Substituting 18 for  $x$  yields

$3(18) - 10 = 11$ , or  $44 = 11$ , which is false. Substituting 24 for  $x$  yields  $3(24) - 10 = 11$ , or  $62 = 11$ , which is false.

**Question Difficulty:** Easy

## Math: Question 2

$$x^2 - 5 = 20$$

Which of the following is a solution to the given equation?

- A. 4
- B. 5
- C. 15
- D. 25

Choice B is correct. Adding 5 to both sides of the given equation yields  $x^2 = 25$ . Taking the square root of both sides of this equation yields  $x = 5$  or  $-5$ . Therefore, 5 is a solution to the given equation.

Choice A is incorrect and may result from dividing 20 by 5 instead of adding 5 and 20, then not taking the square root of both sides of the equation. Choice C is incorrect and may result from subtracting 5 from 20 instead of adding 5 to 20, then not taking the square root of both sides of the equation. Choice D is incorrect and may result from adding 5 to both sides of the equation but then not taking the square root of both sides of the equation.

**Question Difficulty:** Easy

### Math: Question 3

Which of the following expressions is equivalent to  $4r+3s-2r$  ?

- A.  $5rs$
- B.  $7rs-2r$
- C.  $4r+rs$
- D.  $2r+3s$

Choice D is correct. The given expression can be rewritten as  $4r-2r+3s$ . Combining the like terms yields  $2r+3s$ .

Choice A is incorrect and may result from incorrectly combining all the numerical coefficients ( $4+3-2$ ) with the variables. Choice B is incorrect and may result from incorrectly adding  $4r$  and  $3s$ . Choice C is incorrect and may result from incorrectly subtracting  $3s$  and  $2r$ .

**Question Difficulty:** Easy

## Math: Question 4

Miguel made 6 bracelets each day to sell at a craft fair. The function  $f$  gives the total number of bracelets Miguel made in  $x$  days. Which of the following could define  $f$  ?

A.  $f(x) = x + 6$

B.  $f(x) = x - 6$

C.  $f(x) = \frac{1}{6}x$

D.  $f(x) = 6x$

Choice D is correct. It's given that Miguel made 6 bracelets each day, so the number of bracelets Miguel made in  $x$  days is represented by the expression  $6x$ . Therefore, the function  $f(x) = 6x$  gives the total number of bracelets Miguel made in  $x$  days.

Choices A, B, and C are incorrect and may result from misinterpreting the meaning of the value of 6.

**Question Difficulty:** Medium

## Math: Question 5

In the  $xy$ -plane, a line has a slope of 6 and passes through the point  $(0,8)$ . Which of the following is an equation of this line?

- A.  $y = 6x + 8$
- B.  $y = 6x + 48$
- C.  $y = 8x + 6$
- D.  $y = 8x + 48$

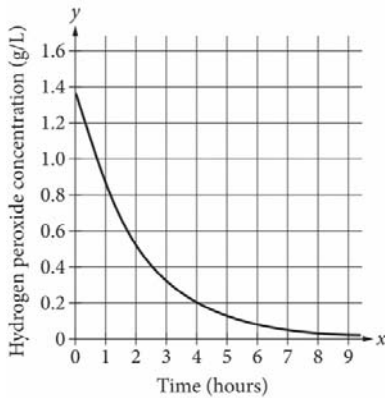
Choice A is correct. The slope-intercept form of an equation for a line is  $y = mx + b$ , where  $m$  is the slope of the line and  $b$  is the  $y$ -coordinate of the  $y$ -intercept of the line. It's given that the slope is 6, so  $m = 6$ . It's also given that the line passes through the point  $(0,8)$  on the  $y$ -axis, so  $b = 8$ . Substituting  $m = 6$  and  $b = 8$  into the equation  $y = mx + b$  gives  $y = 6x + 8$ .

Choices B, C, and D are incorrect and may result from misinterpreting the slope-intercept form of an equation of a line.

**Question Difficulty:** Medium

## Math: Question 6

Under some conditions, hydrogen peroxide breaks down and its concentration changes over time.



Based on the graph, which of the following is closest to the concentration, in grams per liter (g/L), of hydrogen peroxide remaining 1 hour after the sample begins breaking down?

- A. 0.02
- B. 0.51
- C. 0.85
- D. 1.36

Choice C is correct. For each point  $(x,y)$  on the graph shown, the  $x$ -coordinate represents the time, in hours, after the sample begins breaking down, and the  $y$ -coordinate represents the hydrogen peroxide concentration, in g/L. Therefore, the  $y$ -coordinate of the point on the graph where  $x = 1$  represents the hydrogen peroxide concentration remaining 1 hour after the sample begins breaking down. Based on the graph, the  $y$ -coordinate of this point is between 0.8 and 1.0. Of the values given in the options, only 0.85 lies between 0.8 and 1.0. Therefore, 0.85 is closest to the concentration, in g/L, of hydrogen peroxide remaining 1 hour after the sample begins breaking down.

Choices A and B are incorrect. This is the hydrogen peroxide concentration remaining approximately 9 hours (choice A) and approximately 2 hours (choice B) after the sample begins breaking down. Choice D is incorrect. This is the hydrogen peroxide concentration before the sample begins breaking down.

**Question Difficulty:** Medium

## Math: Question 7

$$x + 2y = 7$$

$$x + 3y = 9$$

If  $(x,y)$  is the solution to the given system of equations, what is the value of  $x$  ?

- A. 2
- B. 3
- C. 5
- D. 8

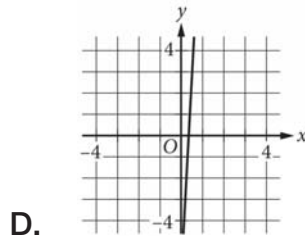
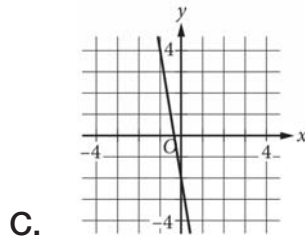
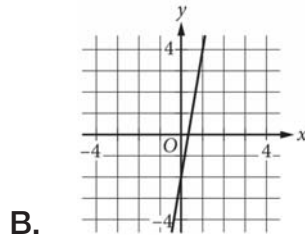
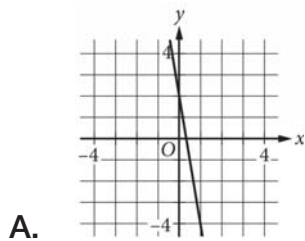
Choice B is correct. A solution to a system of two equations in two variables is an ordered pair  $(x,y)$  that satisfies both equations in the system. Multiplying the first equation in the given system by  $-1$  yields  $-x - 2y = -7$ . Adding  $-x - 2y = -7$  to the second equation in the system yields  $(-x + x) + (-2y + 3y) = -7 + 9$ , or  $y = 2$ . Substituting 2 for  $y$  in the first equation in the given system yields  $x + 2(2) = 7$ , or  $x + 4 = 7$ . Subtracting 4 from both sides of this equation yields  $x = 3$ . The ordered pair  $(3,2)$  is the solution to the given system of equations and satisfies both equations in the system. Since the question asks for the  $x$ -coordinate of the solution to the system, it follows that  $x = 3$ .

Choice A is incorrect. This value is the  $y$ -coordinate, not the  $x$ -coordinate, of the solution to the given system. Choices C and D are incorrect and may result from conceptual or computational errors.

**Question Difficulty:** Medium

## Math: Question 8

Which of the following is the graph of the equation  $18x + 3y = 6$  in the  $xy$ -plane?



Choice A is correct. The given equation can be rewritten in slope-intercept form,  $y = mx + b$ , where  $m$  is the slope of the line and  $b$  is the  $y$ -intercept. Subtracting  $18x$  from both sides of the equation  $18x + 3y = 6$  yields  $3y = -18x + 6$ . Dividing both sides of the equation by 3 results in  $y = -\frac{18}{3}x + \frac{6}{3}$ , or  $y = -6x + 2$ . This is the equation of a line with a slope of  $-6$  and a  $y$ -intercept of 2, which matches the graph in this option.

Choices B, C, and D are incorrect. These are the graphs of  $y = 6x - 2$ ,  $y = -6x - 2$ , and  $y = 6x - 5$ , respectively, and therefore aren't the graph of  $18x + 3y = 6$ .

**Question Difficulty:** Medium



## Math: Question 9

If  $5mn + p = 18$ , which of the following correctly expresses  $p$  in terms of  $m$  and  $n$  ?

- A.  $p = \frac{18}{5mn}$
- B.  $p = 18(5mn)$
- C.  $p = 18 - 5mn$
- D.  $p = 18 + 5mn$

Choice C is correct. To isolate the variable  $p$ ,  $5mn$  should be subtracted from both sides of the equation, yielding  $p = 18 - 5mn$ .

Choice A is incorrect and may result from dividing the right-hand side of the equation by  $5mn$  instead of subtracting. Choice B is incorrect and may result from multiplying the right-hand side of the equation by  $5mn$  instead of subtracting. Choice D is incorrect and may result from adding  $5mn$  to the right-hand side of the equation instead of subtracting.

**Question Difficulty:** Medium

## Math: Question 10

$$y = 18 - 5x$$

The equation above represents the speed  $y$ , in feet per second, of Sheila's bicycle  $x$  seconds after she applied the brakes at the end of a ride. If the equation is graphed in the  $xy$ -plane, which of the following is the best interpretation of the  $x$ -coordinate of the line's  $x$ -intercept in the context of the problem?

- A. The speed of Sheila's bicycle, in feet per second, before Sheila applied the brakes
- B. The number of feet per second the speed of Sheila's bicycle decreased each second after Sheila applied the brakes
- C. The number of seconds it took from the time Sheila began applying the brakes until the bicycle came to a complete stop
- D. The number of feet Sheila's bicycle traveled from the time she began applying the brakes until the bicycle came to a complete stop

Choice C is correct. It's given that for each point  $(x, y)$  on the graph of the given equation, the  $x$ -coordinate represents the number of seconds after Sheila applied the brakes, and the  $y$ -coordinate represents the speed of Sheila's bicycle at that moment in time. For the graph of the equation, the  $y$ -coordinate of the  $x$ -intercept is 0. Therefore, the  $x$ -coordinate of the  $x$ -intercept of the graph of the given equation represents the number of seconds it took from the time Sheila began applying the brakes until the bicycle came to a complete stop.

Choice A is incorrect. The speed of Sheila's bicycle before she applied the brakes is represented by the  $y$ -coordinate of the  $y$ -intercept of the graph of the given equation, not the  $x$ -coordinate of the  $x$ -intercept. Choice B is incorrect. The number of feet per second the speed of Sheila's bicycle decreased each second after Sheila applied the brakes is represented by the slope of the graph of the given equation, not the  $x$ -coordinate of the  $x$ -intercept. Choice D is incorrect and may result from misinterpreting  $x$  as the distance, in feet, traveled after applying the brakes, rather than the time, in seconds, after applying the brakes.

**Question Difficulty:** Hard

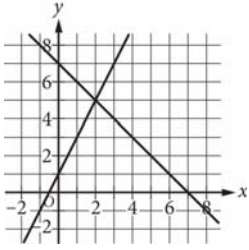
## Math: Question 11

For the function  $f$  defined by  $f(x) = x + 5$ , what is the value of  $f(2)$ ?

The correct answer is 7. To solve for the value of  $f(2)$ , 2 should be substituted for  $x$  in the equation  $f(x) = x + 5$ . This gives  $f(2) = 2 + 5$ , or  $f(2) = 7$ .

**Question Difficulty:** Medium

## Math: Question 12

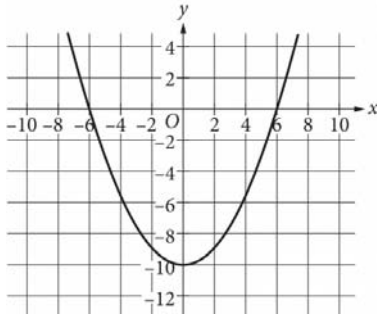


The two equations of a system of linear equations are shown graphed in the  $xy$ -plane. If  $(x,y)$  is the solution to the system of equations, what is the value of  $x$  ?

The correct answer is 2. The solution to a system of equations occurs where the graphs of the two equations intersect. For the system shown, the solution is  $(2,5)$ . Therefore, the value of  $x$  is 2.

**Question Difficulty:** Medium

### Math: Question 13



An equation of the parabola shown in the  $xy$ -plane is  $y = ax^2 - c$ , where  $a$  is a constant and  $c$  is an integer. What is the value of  $c$  ?

The correct answer is 10. In an equation of a parabola with the form  $y = ax^2 + c$ , the value of  $c$  is the  $y$ -coordinate of the  $y$ -intercept of the parabola. The given equation is  $y = ax^2 - c$ ; therefore,  $c$  will be the opposite value of the  $y$ -coordinate of the  $y$ -intercept of the parabola. The  $y$ -intercept of the parabola shown is  $(0, -10)$ . Therefore, the value of  $c$  is 10.

**Question Difficulty:** Hard