



# ***New York State Testing Program***

## **Mathematics Common Core Sample Questions**

**Grade**

**8**

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**Domain:** Functions

**Item:** CR

**1**

A trainer for a professional football team keeps track of the amount of water players consume throughout practice. The trainer observes that the amount of water consumed is a linear function of the temperature on a given day. The trainer finds that when it is 90°F the players consume about 220 gallons of water, and when it is 76°F the players consume about 178 gallons of water.

**Part A:** Write a linear function to model the relationship between the gallons of water consumed and the temperature.

**Part B:** Explain the meaning of the slope in the context of the problem.

**Key:**

**Part A:**  $y = 3x - 50$

**Part B:** For every one degree increase in temperature, the number of gallons consumed increases by 3.

**Aligned CCLS:** 8.F.4

**Commentary:** This question aligns to CCLS 8.F.4 because it assesses a student's ability to construct a function that models a linear relationship from a description of a relationship between two values  $(x,y)$  and interpret the rate of change.

**Rationale:** The correct answer indicates the ability to construct a function to model a linear relationship. Given that water consumption is a function of temperature, the values cited in the problem are understood as coordinate pairs that can be related by a linear function.

**Part A:**

$$\frac{220-178}{90-76} = \frac{42}{14} = 3$$

$$y = 3x + b$$

$$220 = 3(90) + b$$

$$-50 = b$$

**Part B:** The slope indicates 3 gallons per degree ( $\frac{3}{1}$ ), which shows that for every temperature increase in one degree, the number of gallons of water consumed would increase by three.

**Domain:** Expressions and Equations

**Item:** MC

**2** Which of the following expressions is **not** equivalent to  $\frac{1}{25}$ ?

- A**  $5^3 \times 5^{-5}$
- B**  $5^{-1} \times 5^{-1}$
- C**  $5^{-3} \times 5$
- D**  $5^{-2} \times 5^4$

**Key:** D

**Aligned CCLS:** 8.EE.1

**Commentary:** This question aligns to CCLS 8.EE.1 because it assesses a student's ability to apply properties of exponents to rewrite exponential expressions.

**Rationale:** Selecting Option D could indicate that student recognizes the incorrect addition of exponents or confusion on the concept of equivalence ( $5^4 \times 5^{-2} = 25$ ). Options A, B, and C involve the correct application of the properties of integer exponents.

**Domain:** Expressions and Equations

**Item:** CR

**3**

A computer can do 1000 operations in  $4.5 \times 10^{-6}$  seconds. How many operations can be done by this computer in one hour? Express your answer in scientific notation.

**Key:**  $8 \times 10^{11}$

**Aligned CCLS:** 8.EE.4

**Commentary:** This question aligns to CCLS 8.EE.4 because it assesses a student's ability to perform operations with numbers expressed in scientific notation.

**Rationale:** The computer works at the rate of the 1000 operations in  $4.5 \times 10^{-6}$  seconds, or  $2.2 \times 10^8$  multiplications per second ( $1000/4.5 \times 10^{-6}$ ). Application of the conversion of 1 hour = 3600 seconds [ $(2.2 \times 10^8) \times 3600$ ] gives the number of operations ( $8 \times 10^{11}$ ) the computer can complete in one hour.

**Domain:** Expressions and Equations

**Item:** MC

$x$	$y$
-8	-42
-3	-17
0	-2
6	28

4

If a line contains the points in the table above, the equation of the line is

- A  $y = -2x + 5$
- B  $y = 2x - 5$
- C  $y = 5x - 2$
- D  $y = -5x - 2$

**Key:** C

**Aligned CCLS:** 8.EE.6

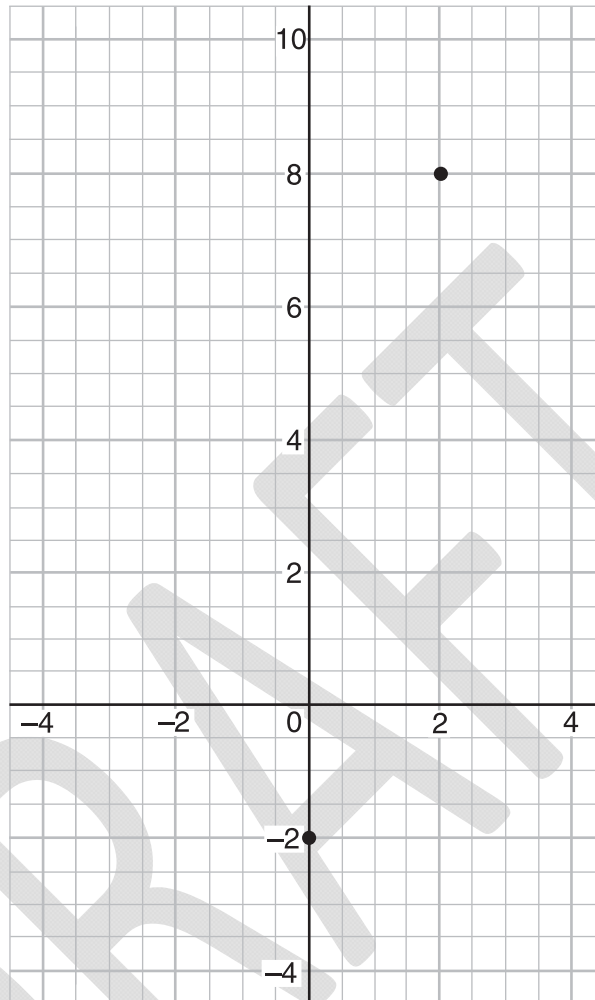
**Commentary:** This question aligns to CCLS 8.EE.6 because a student uses  $y = mx + b$  to write the equation of a line given its slope and the  $y$ -intercept.

**Rationale:** Option C is correct. The equation of a line can be represented in slope-intercept form ( $y = mx + b$ ) if the slope and  $y$ -intercept is known or can be found. The slope,  $m$ , can be found by performing the following with any two pairs of the given points:  $m = \frac{28 - (-2)}{6 - 0} = \frac{30}{6} = 5$ . The  $y$ -intercept,  $b$ , is given in the table as -2 (0,-2).

Accurately substituting these values into the slope-intercept form of the equation gives  $y = 5x - 2$ . Option C can also be determined by testing each of the options to determine which equation is satisfied by the set of points in the table. Selecting Option A indicates confusion in the proper location of these two values in a slope-intercept form. Selecting Option B also indicates confusion in the proper location of these two values in a slope-intercept form, as well as possible sign errors for the values of both the slope and the  $y$ -intercept. Selecting Option D indicates an incorrect calculation of slope from the given table.

Domain: Expressions and Equations

Item: MC



5

If a line passes through the two points above, the equation of the line is

- A  $y = -2x + 5$
- B  $y = 2x - 5$
- C  $y = 5x - 2$
- D  $y = -5x - 2$

Key: C

Aligned CCLS: 8.EE.6

**Commentary:** This question aligns to CCLS 8.EE.6 because a student uses  $y = mx + b$  to write the equation of a line given its slope and the y-intercept.

**Rationale:** Option C is correct. The student can determine the slope graphically or algebraically and can identify (0, -2) as the y-intercept from the graph. Algebraically the slope can be determined by  $m = \frac{8 - (-2)}{2 - 0} = \frac{10}{2} = 5$ . Accurately substituting these values into the slope-intercept form of a linear equation gives  $y = 5x - 2$ .

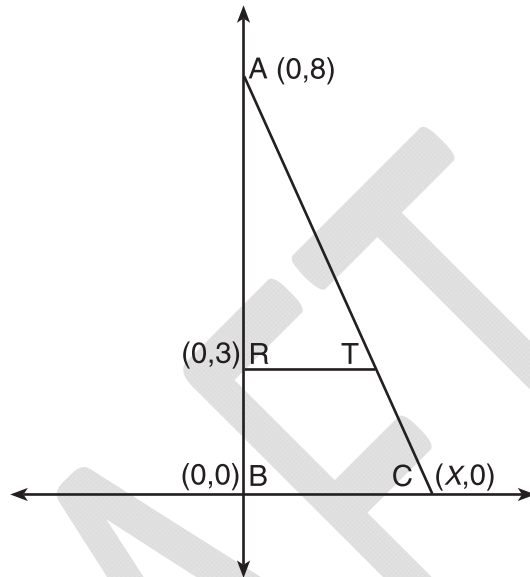
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**Domain:** Geometry/Expressions and Equations

**Item:** CR

6

In the diagram below,  $\triangle ABC$  is similar to  $\triangle ART$ .



**Part A:** What is the scale factor from  $\triangle ABC$  to  $\triangle ART$ ?

**Part B:** If the slope of  $AC$  is  $-2$ , what is the value of  $x$  for coordinate  $C$ ?

**Part C:** Using the information from parts A and B, what is the length of  $RT$ ?

**Key:**

**Part A:**  $\frac{AB}{AR} = \frac{8}{5}$

**Part B:** 4

**Part C:** 2.5

**Aligned CCLS:** 8.G.4, 8.EE.6, and 8.EE.7b

**Commentary:** This question aligns to CCLS 8.G.4, 8.EE.6, and 8.EE.7b because it assesses the construction and application of a similarity ratio, the creation of a linear equation, and solving a linear equation with one variable.



**Rationale:**

**Part A:** The ratio of side  $AB$  to side  $AR$  is determined by

$$\frac{AB}{AR} = \frac{8-0}{8-3} = \frac{8}{5}$$

**Part B:** The  $y$ -intercept is  $(0,8)$  and the given slope of  $-2$  yields the resulting linear equation for segment  $AB$  of  $y = -2x + 8$ . Solving this equation for  $y = 0$  yields the following value for  $C$ :

$$\begin{aligned} 0 &= -2x + 8 \\ -8 &= -2x \\ 4 &= x \\ x &= 4 \end{aligned}$$

**Part C:** The length of side  $BC$  is the difference in  $x$ -values between point  $B$  and point  $C$ ,  $4 - 0 = 4$ . The ratio of side  $BC$  to side  $RT$  is  $\frac{8}{5}$ . Using these two pieces of information the solution to side  $RT$  can be found by solving the

proportion  $\frac{8}{5} = \frac{4}{x}$ .

$$\frac{8}{5} = \frac{4}{x}$$

$$8x = 20$$

$$x = \frac{20}{8} = \frac{5}{2} = 2.5$$

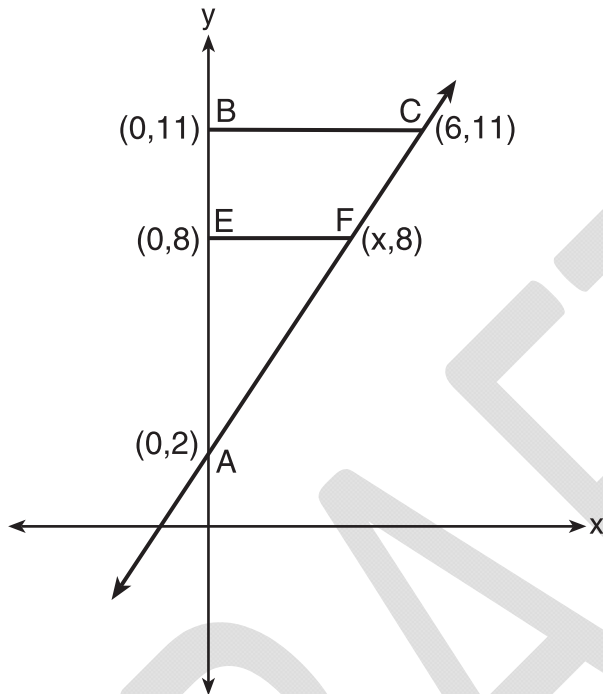
**Domain:** Expressions and Equations

**Item:** CR

**7**

In the coordinate plane below,  $\triangle ABC$  is similar to  $\triangle AEF$ .

What is the value of  $x$ ?



**Key:**  $x = 4$

**Aligned CCLS:** 8.EE.6

**Commentary:** This question aligns to CCLS 8.EE.6 because it assesses the student's understanding that slope is the same along a line between any two distinct points.

**Rationale:** The student can compute  $\frac{11-2}{6-0}$  to find the slope of  $\overline{AC} = \frac{3}{2}$ . Next, the student finds the slope,  $\overline{FA} = \frac{8-2}{x-0} = \frac{6}{x}$ , and then the student will set ratios equal  $\frac{3}{2} = \frac{6}{x}$  to find  $x = 4$ .

**Domain:** Expressions and Equations

**Item:** MC

**8**

$$\frac{2}{3}(2x-1) + 2\frac{1}{3} = 7 + \frac{1}{2}x$$

Which step would **not** be a possible first step for solving this equation algebraically?

- A multiplying every term in the equation by six
- B subtracting  $2\frac{1}{3}$  from 7
- C subtracting  $\frac{1}{2}x$  from  $2x$
- D multiplying  $-1$  by  $\frac{2}{3}$

**Key:** C

**Aligned CCLS:** 8.EE.7b

**Commentary:** This question aligns to CCLS 8.EE.7b because it assesses the student's ability to use the distributive property and to combine like terms when solving an equation.

**Rationale:** Option C is correct. Given that  $2x$  is multiplying a factor of  $\frac{2}{3}$ , distribution or some other algebraic beginning that would be necessary before subtracting  $\frac{1}{2}x$  from  $2x$ . Options A, B, and D all represent reasonable starting points.

**Domain:** Expressions and Equations

**Item:** CR

**9**

David currently has a square garden. He wants to redesign his garden and make it into a rectangle with a length that is 3 feet shorter than twice its width. He decides that the perimeter should be 60 feet.

Determine the dimensions, in feet, of his new garden.

**Show your work.**

**Key:** 11 feet wide and 19 feet long

**Aligned CCLS:** 8.EE.7b

**Commentary:** This question aligns to CCLS 8.EE.7b because it assesses the student's ability to find the perimeter of a rectangle by expanding expressions using the distributive property and collecting terms.

**Rationale:** Width = 11 and length = 19 produces a rectangle with a perimeter of 60. The length is 3 feet shorter than twice the width.

Let  $w$  = width

$2w - 3$  = length

$$2(w + 2w - 3) = 60$$

$$2w + 4w - 6 = 60$$

$$6w = 66$$

$$w = 11$$

$$2w - 3 = 19$$

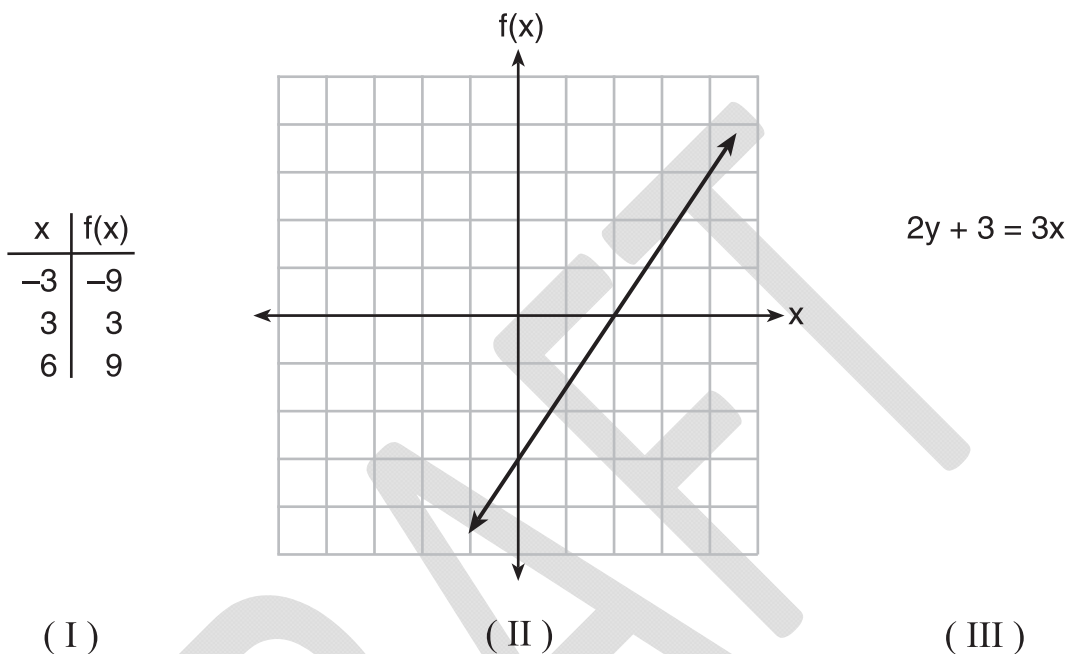
Other processes may also result in the correct answer.

**Domain:** Functions

**Item:** CR

**10**

The three different linear functions below are represented in three different ways, as shown.



Which function has the greatest rate of change? Does any pair of functions have the same rate of change? **Justify your answer.**

**Key:** The linear function in I has the greatest rate of change of the three given functions.

The linear functions in II and III each have a rate of change of  $\frac{3}{2}$ .

**Aligned CCLS:** 8.F.2

**Commentary:** This question aligns to CCLS 8.F.2 because it assesses a student's ability to recognize and compare properties of functions represented in different ways: table of values, graphically, and algebraically.

**Rationale:** I – The rate of change is 2.

II and III – The rate of change for each is  $\frac{3}{2}$ .

**Domain:** Functions

**Item:** MC

**11**

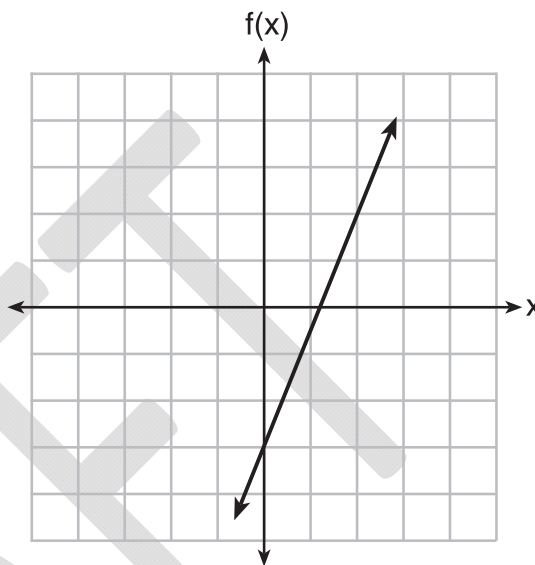
Of the four linear functions represented below, which has the greatest rate of change?

( A ) A number,  $y$ , is two less than twice a number,  $x$ .

$x$	$h(x)$
-6	-10
-3	-3
3	11

( B )  $3y - 4x = 3$

( C )



( D )

**Key:** D

**Aligned CCLS:** 8.F.2

**Commentary:** This question aligns to CCLS 8.F.2 because it assesses a student's ability to compare rates of changes for functions represented in different ways.

**Rationale:** Option D is correct because the rate of change is  $\frac{5}{2}$ ; in Option A it is 2, in Option B it is  $\frac{4}{3}$ , and in Option C it is  $\frac{7}{3}$ .



# Grade 8 Mathematics Common Core Sample Questions

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