New York State Testing Program

Mathematics
Common Core Sample Questions

Grade 8

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 $\dfrac{1}{25}$?

    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

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3

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

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Key: 8×10^{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 4.5×10^{-6} seconds, or $2.\overline{2} \times 10^8$ multiplications per second ($1000/4.5 \times 10^{-6}$). Application of the conversion of 1 hour = 3600 seconds [$(2.\overline{2} \times 10^8)$ x 3600] gives the number of operations (8×10^{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 $\quad y = -2x + 5$
B $\quad y = 2x - 5$
C $\quad y = 5x - 2$
D $\quad y = -5x - 2$
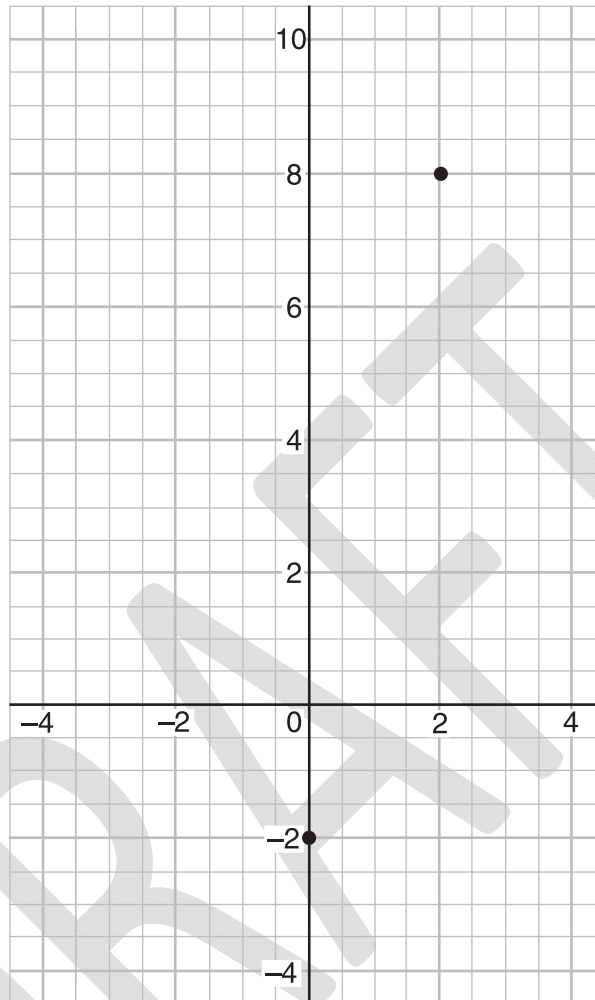
Key: C

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: $m = \dfrac{28 - (-2)}{6 - 0} = \dfrac{30}{6} = 5$. 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 $m = \dfrac{8-(-2)}{2-0} = \dfrac{10}{2} = 5$. Accurately substituting these values into the slope-intercept form of a linear equation gives $y = 5x - 2$.

Domain: Geometry/Expressions and Equations
Item: CR

6 In the diagram below, Δ*ABC* is similar to Δ*ART*.
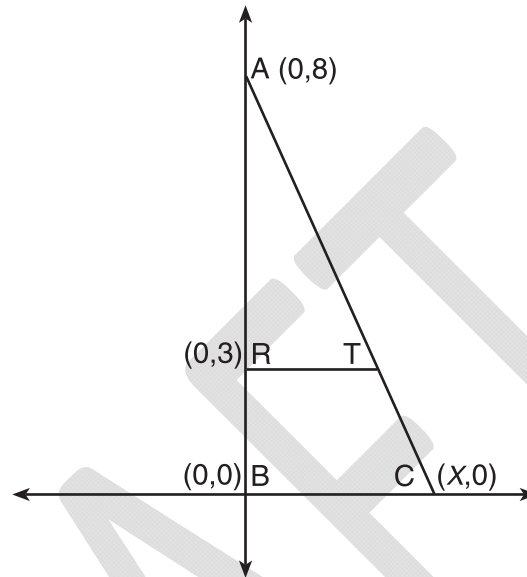
Part A: What is the scale factor from Δ*ABC* to Δ*ART*?

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: $\dfrac{AB}{AR} = \dfrac{8}{5}$

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*:

$0 = -2x + 8$
$-8 = -2x$
$4 = x$
$x = 4$

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

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

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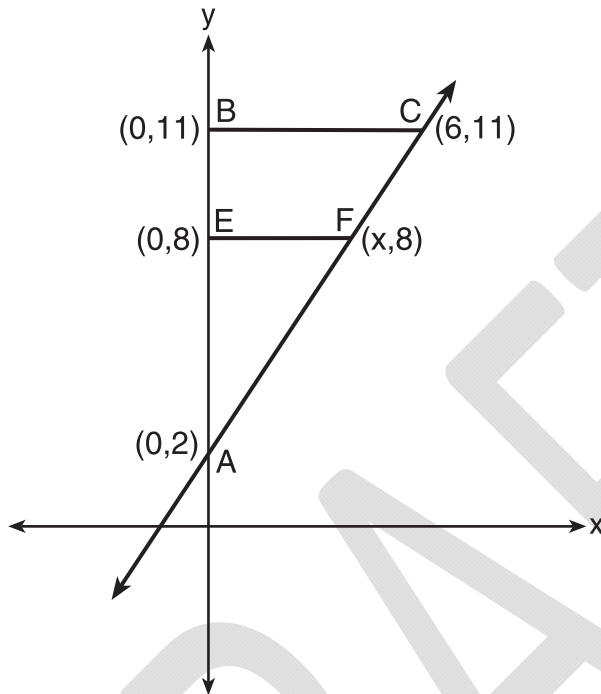
$$x = \frac{20}{8} = \frac{5}{2} = 2.5$$

Domain: Expressions and Equations
Item: CR

7 In the coordinate plane below, Δ*ABC* is similar to Δ*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 $\dfrac{11-2}{6-0}$ to find the slope of $\overline{AC} = \dfrac{3}{2}$. Next, the student finds the slope, $\overline{FA} = \dfrac{8-2}{x-0} = \dfrac{6}{x}$, and then the student will set ratios equal $\dfrac{3}{2} = \dfrac{6}{x}$ 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

$$2(w + 2w - 3) = 60$$
$$2w + 4w - 6 = 60$$
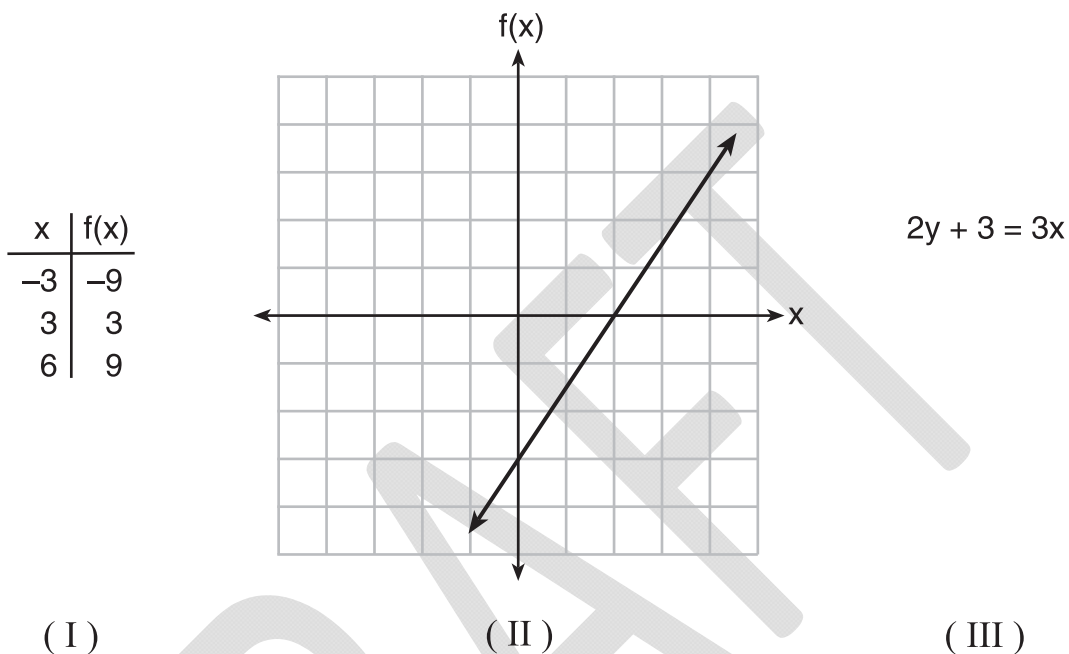$$6w = 66$$
$$w = 11$$
$$2w - 3 = 19$$

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.

f(x)

x	f(x)
–3	–9
3	3
6	9

$2y + 3 = 3x$

x

(I)   (II)   (III)

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 $\frac{3}{2}$.
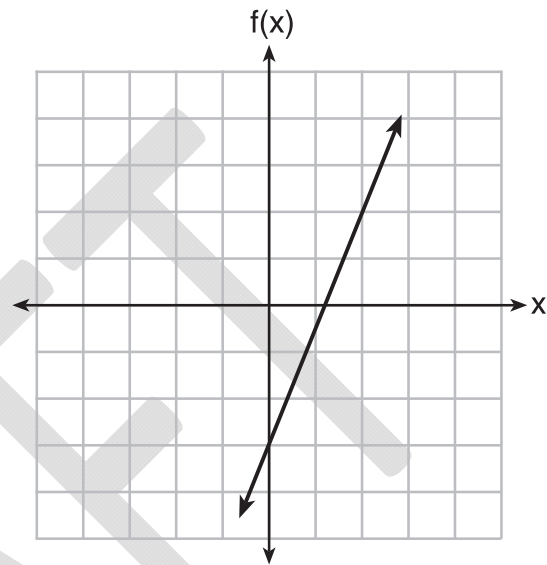
Domain: Functions
Item: MC

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)

f(x)

x

(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 $\frac{7}{3}$.

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