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

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 ($1/4.5 \times 10^{-6}$). 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

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-8</td>
<td>-42</td>
</tr>
<tr>
<td>-3</td>
<td>-17</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>6</td>
<td>28</td>
</tr>
</tbody>
</table>

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

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 \( y = 5x - 2 \).
Domain: Geometry/Expressions and Equations  
Item: CR

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 $C$:

\[
0 = -2x + 8
\]
\[
-8 = -2x
\]
\[
x = 4
\]

**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

In the coordinate plane below, ΔABC is similar to ΔAEF.

What is the value of $x$?

![Coordinate plane with points A(0,2), B(0,11), C(6,11), E(0,8), F(x,8).]

**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

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

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

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
\[ 2w - 3 = \text{length} \]

\[ 2(w + 2w - 3) = 60 \]
\[ 2w + 4w - 6 = 60 \]
\[ 6w = 66 \]
\[ w = 11 \]
\[ 2w - 3 = 19 \]

Other processes may also result in the correct answer.
The three different linear functions below are represented in three different ways, as shown.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-9</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

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 \( \frac{3}{2} \).
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, \( x \).

\[
\begin{array}{c|c}
 x & h(x) \\
-6 & -10 \\
-3 & -3 \\
3 & 11 \\
\end{array}
\]

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