Spring 2014 Student Performance Analysis

Algebra I
Standards of Learning

Presentation may be paused and resumed using the arrow keys or the mouse.

Performing Operations on Polynomials

SOL A.2

The student will perform operations on polynomials, including

a) applying the laws of exponents to perform operations on expressions;

b) adding, subtracting, multiplying, and dividing polynomials; and

c) factoring completely first- and second-degree binomials and trinomials in one or two variables. Graphing calculators will be used as a tool for factoring and for confirming algebraic factorizations.

Suggested Practice for SOL A.2a

Students need additional practice applying the laws of exponents when multiplying expressions.

Simplify: $\left(4x^3\right)^2\left(2x^4\right)$

a. $8x^9$ ← **Most common error**

b. $32x^9$

c. $16x^{10}$

d. $32x^{10}$

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Suggested Practice for SOL A.2b

Students need additional practice dividing polynomials.

1. If $x \neq \dfrac{4}{3}$ **, find the quotient of** $9x^2 - 9x - 4$ **and** $3x - 4$ **.** $\quad 3x + 1$

2. Simplify, if $n \neq 0$ **:** $\quad \dfrac{16n^2 + 4n}{4n} \quad 4n + 1$

3. Which polynomial is equivalent to this expression if $n \neq -2$ **?**

$$\dfrac{8 - 2n - 3n^2}{n + 2}$$

a. $3n - 4$ **b.** $4 + 3n$ **c.** $-3n + 4$ **d.** $-4 - 3n$

4

Suggested Practice for SOL A.2c

Students need additional practice identifying one of the factors of the completely factored form of a polynomial.

1. **Identify one of the factors of** $2x^2 - 7x - 30$ **when it is completely factored.**

   a. $(2x + 5)$ **b.** $(x + 6)$ **c.** $(2x - 5)$ **d.** $(x - 2)$

2. **Identify one of the factors of** $x^2 - 6x - 72$ **when it is completely factored.**

   a. $(x + 1)$ **b.** $(x + 12)$ **c.** $(x + 6)$ **d.** $(x - 72)$

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Suggested Practice for SOL A.2c

Students need additional practice identifying a factored form of a polynomial function when given the zeros.

A polynomial function has zeros at $x = 2$ and $x = 6$. Which function could be this polynomial function?

a. $f(x) = (x + 2)(x - 6)$

b. $f(x) = (x - 2)(x + 6)$

c. $f(x) = (x + 2)(x + 6)$ ⟵ **Most common error**

d. $f(x) = (x - 2)(x - 6)$

Express Square Roots and Cube Roots in Simplest Radical Form

SOL A.3

The student will express the square roots and cube roots of whole numbers and the square root of a monomial algebraic expression in simplest radical form.

Suggested Practice for SOL A.3

Students need additional practice identifying expressions that are in simplest radical form.

Identify each expression that is in simplest radical form.

$$\boxed{4\sqrt{x}} \qquad \sqrt{x^3} \qquad y^2\sqrt{8xy} \qquad y^3\sqrt{75} \qquad \boxed{16x^2y\sqrt{3x}}$$

Solving Linear and Quadratic Equations

SOL A.4

The student will solve multistep linear and quadratic equations in two variables, including

a)   solving literal equations (formulas) for a given variable;

b)   justifying steps used in simplifying expressions and solving equations, using field properties and axioms of equality that are valid for the set of real numbers and its subsets;

c)   solving quadratic equations algebraically and graphically;

d)   solving multistep linear equations algebraically and graphically;

e)   solving systems of two linear equations in two variables algebraically and graphically; and

f)   solving real-world problems involving equations and systems of equations.

Graphing calculators will be used both as a primary tool in solving problems and to verify algebraic solutions.

Suggested Practice for SOL A.4b

Students need additional practice justifying steps used to solve an equation using the axioms of equality.

What property justifies the work between step 1 and step 2?

Step 1: $-2x - 6 = 3x + 4$

Step 2: $2x + -2x - 6 = 2x + 3x + 4$

a. Commutative property of addition

b. Inverse property of addition $\longrightarrow$ $2x + -2x - 6 = 2x + 3x + 4$

c. Addition property of equality $\qquad 0 - 6 = 2x + 3x + 4$

d. Associative property of addition

Suggested Practice for SOL A.4c

Students need additional practice finding solutions to quadratic equations presented algebraically.

Identify the solutions to the equation: $9x^2 + 6x = 8$

a. $\left\{\dfrac{-3}{4}, \dfrac{3}{2}\right\}$

b. $\left\{\dfrac{3}{4}, \dfrac{-3}{2}\right\}$

c. $\left\{\dfrac{-4}{3}, \dfrac{2}{3}\right\}$

d. $\left\{\dfrac{4}{3}, \dfrac{-2}{3}\right\}$

Suggested Practice for SOL A.4d

Students need additional practice determining solutions to equations that have the following solutions: $x=0,$ an infinite number of real solutions, and no real solutions.

1. **What is the solution to $5(x + 4) + 16 = 2x + 3(x + 12)$?**

    There are an infinite number of real solutions.

2. **What describes the solution to $5(x + 6) + x = x + 30$?**

    a. There is an infinite number of real solutions.

    b. There are no real solutions.

    c. The only solution is $0.$

    d. The only solution is $5.$

Suggested Practice for SOL A.4d

Students need additional practice finding solutions to equations that contain rational expressions.

Find the solution to the equation shown: $\dfrac{9(x-4)}{6} = \dfrac{x+2}{2}$

a. $x = 0.5$

b. $x = 3.5$

c. $x = -5$

d. $x = 7$

Suggested Practice for SOL A.4d

Students need additional practice finding solutions to equations that require computation with positive and negative rational numbers.

Find the solution to the equation shown.

$$-2.6(x - 3) = 2.8 - 3x$$

$$x = -12.5$$

Suggested Practice for SOL A.4e

Students need additional practice finding the x-value of the solution of a system of equations presented both algebraically and graphically.
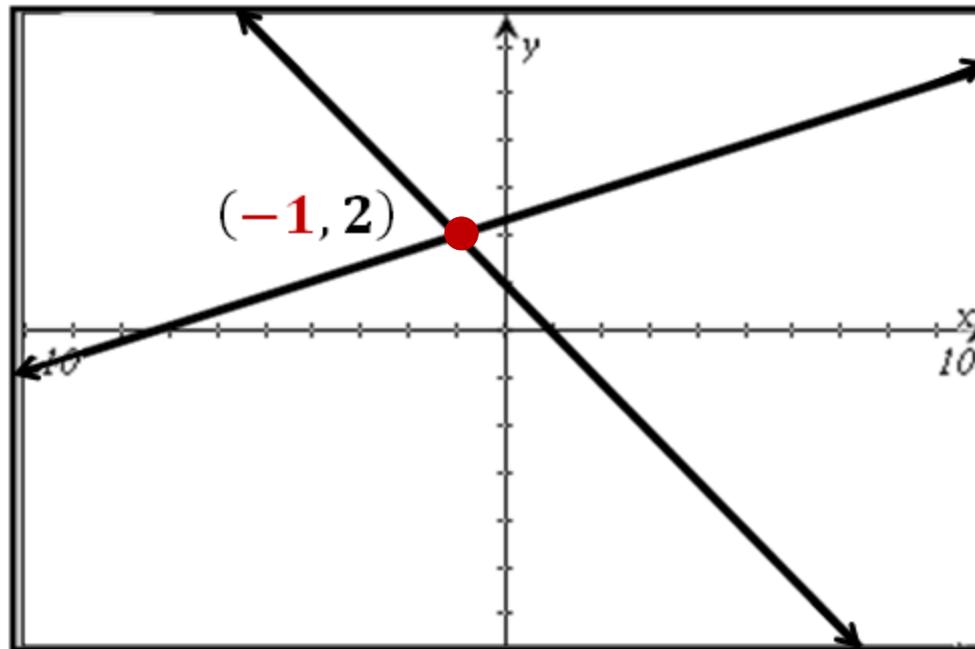
What is the x-value of the solution to this system of equations?

$$\begin{cases} -5x + 5y = 10 \\ 3x - 2y = -10 \end{cases}$$

$$x = -6$$

Suggested Practice for SOL A.4e

What appears to be closest to the x-value of the solution to this system of equations?

a. -7

c. 1

b. -1

d. 3

Suggested Practice for SOL A.4f

Students need additional practice finding solutions to systems of equations presented in a real-world situation.

James bought a total of 15 bottles of drinks for his team.

- **Each drink was either a bottle of water or a bottle of juice.**

- **He spent $1.50 on each bottle of water.**

- **He spent $3.00 on each bottle of juice.**

- **James spent a total of $28.50.**

How many bottles of juice did James buy?

<p style="text-align:center; color:red;">**4 bottles of juice**</p>

Solving Multistep Inequalities and Systems of Inequalities

SOL A.5

The student will solve multistep linear inequalities in two variables, including

a) solving multistep linear inequalities algebraically and graphically;

b) justifying steps used in solving inequalities, using axioms of inequality and properties of order that are valid for the set of real numbers and its subsets;

c) solving real-world problems involving inequalities; and

d) solving systems of inequalities.

Suggested Practice for SOL A.5d

Students need additional practice identifying ordered pairs that are solutions to a system of inequalities.

1. **Which ordered pairs are solutions to this system of inequalities?**

$$\begin{cases} -3x + y \geq -5 \\ 2x + y < 4 \end{cases}$$

$\boxed{(-1, -6)}$ $\boxed{(0, -5)}$ $(0, 4)$ $\boxed{(0.5, -2)}$ $(0.75, 3)$

2. **Which ordered pair is a solution to this system of inequalities?**

$$\begin{cases} x < 5 \\ y \geq 2x + 2 \end{cases}$$

a. $(5, 12)$ b. $\boxed{(4, 11)}$ c. $(3, 6)$ d. $(2, 5)$

Determining Slope of a Line

SOL A.6

The student will graph linear equations and linear inequalities in two variables, including

a) **determining the slope of a line when given** an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined; and

b) writing the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

Suggested Practice for SOL A.6a

Students need additional practice finding slope.

1. **Find the slope of the line passing through the points** $(8,1)$ **and** $(6,9)$.

$$m = -4$$

2. **Line** p **line has an** x**-intercept of** 5 **and a** y**-intercept of** 3. **Find the slope of line** p.

$$m = \frac{-3}{5}$$

Extension: What is an equation for line p**?**

Two possible answers: $3x + 5y = 15$ $y = -\frac{3}{5}x + 3$

Investigating and Analyzing Functions

SOL A.7
The student will investigate and analyze function (linear and quadratic) families and their characteristics both algebraically and graphically, including

a)   determining whether a relation is a function;

b)   domain and range;

c)   zeros of a function;

d)   x- and y-intercepts;

e)   finding the values of a function for elements in its domain; and

f)   making connections between and among multiple representations of functions including concrete, verbal, numeric, graphic, and algebraic.

Suggested Practice for SOL A.7c

Students need additional practice identifying the zeros of a function.

1. **Which function appears to have two distinct zeros?**

   a. $f(x) = x^2 + 6x + 9$

   b. $f(x) = 0.5x + 4$

   c. $f(x) = x^2 - 9$

   d. $f(x) = \dfrac{4x - 9}{3}$

2. **What are all the zeros of the function** $f(x) = 12x^2 - 5x - 2$ **?**

$$\left\{ -\frac{1}{4}, \frac{2}{3} \right\}$$

Suggested Practice for SOL A.7e

Students need additional practice identifying the values of a function for given domain values.

Find the values of $f(x) = 9x^2 + 1$ for the domain values of $\{-3, 6\}$.

$$\left\{ \boxed{82}, \boxed{325} \right\}$$

$$f(-3) = 9(-3)^2 + 1 \qquad\qquad f(6) = 9(6)^2 + 1$$

$$f(-3) = 9(9) + 1 \qquad\qquad f(6) = 9(36) + 1$$

$$f(-3) = 81 + 1 \qquad\qquad f(6) = 324 + 1$$

$$f(-3) = 82 \qquad\qquad f(6) = 325$$

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Analyzing Direct and Inverse Variations

SOL A.8
The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.

Suggested Practice for SOL A.8

Students need additional practice identifying a direct variation equation that represents a real-world situation.

The number of calories, c, burned while walking is directly proportional to the distance, d, a person walks. Tom burned 180 calories walking a distance of 2 miles. Which equation represents this relationship?

a. $c = 180 + d$

b. $c = 90d$

c. $d = 90 + c$

d. $d = 180c$

Suggested Practice for SOL A.8

Students need additional practice creating a direct variation from a set of ordered pairs.

Create a direct variation using two of the ordered pairs from those shown.

$$\{(-5, -2), \boxed{}, \boxed{}\}$$

$$\boxed{(-10, -4)} \quad (-2, -5) \quad (4, 10) \quad (2, 5) \quad \boxed{(5, 2)}$$

Suggested Practice for SOL A.8

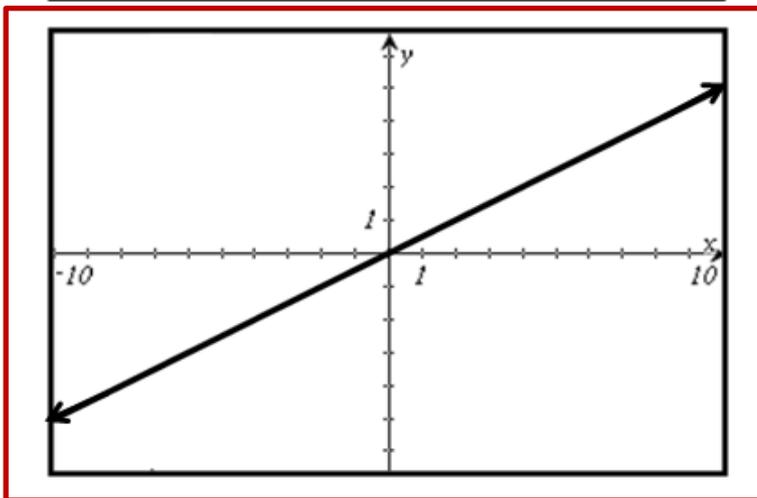**Students need additional practice identifying a direct variation graphically.**
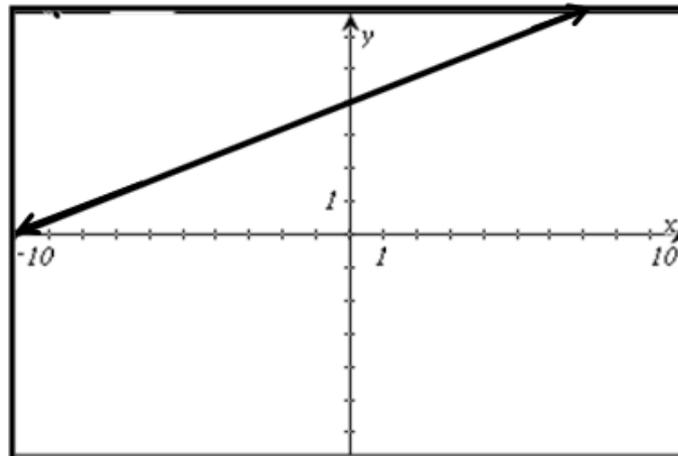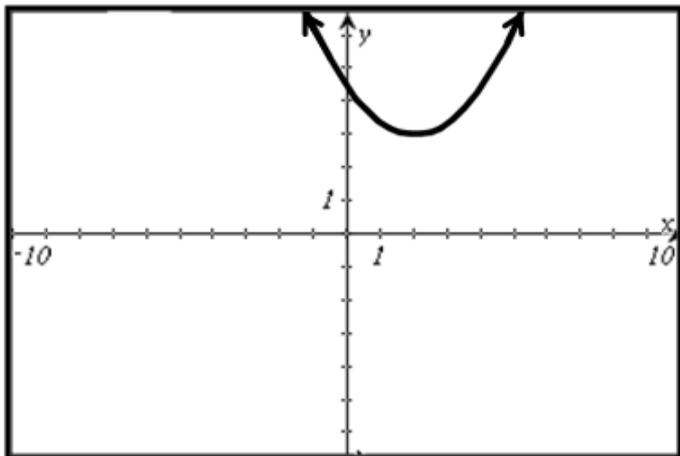
Point A lies on the graph of a direct variation. Identify two other points with integral coordinates that lie on the graph of the direct variation.
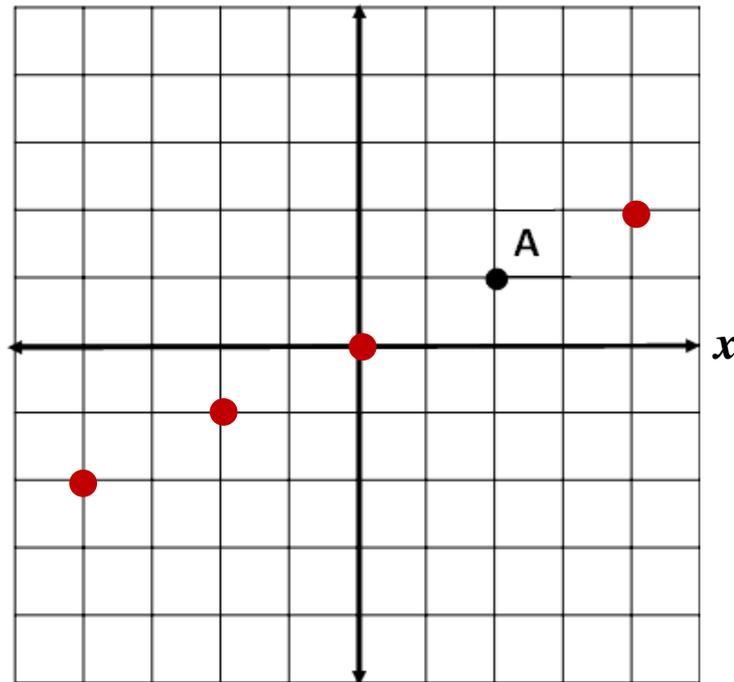
Any two of the points shown on the graph in red are correct responses.

Suggested Practice for SOL A.8

Identify the graph that represents a direct variation.
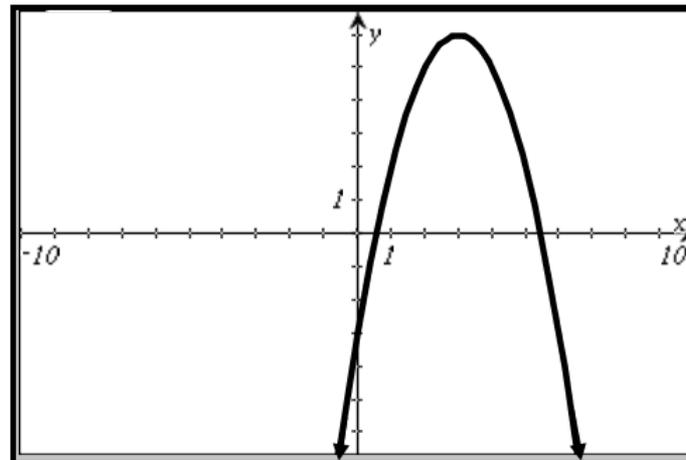
Suggested Practice for SOL A.8

Students need additional practice identifying an inverse variation equation that represents a real-world situation.

The number of days, d, it takes workers to set-up for the Summer Music Festival varies inversely as the number of workers, w. The Summer Music Festival was set-up in 2 days by 50 workers. Which equation represents this situation?

a. $100 = d + w$

b. $100 = dw$

c. $d = 50 + w$

d. $d = 50w$

Extension: How many days would it take 60 workers to set up for the Summer Music Festival?

Answer: It would take $1\frac{2}{3}$ days or 1 day and 16 hours.

Interpret Standard Deviation

SOL A.9
The student, given a set of data, will interpret variation in real-world contexts and calculate and interpret mean absolute deviation, standard deviation, and z-scores.

Suggested Practice for SOL A.9

Students need additional practice solving problems involving standard deviation.

A data set is shown.

$$\{2, \boxed{3, 3, 4, 4, 4, 5, 5,} 6, 6\}$$

If the standard deviation of the data set is approximately 1.25, how many of these elements are within one standard deviation of the mean?

$$4.2 - 1.25 = 2.95 \qquad 4.2 + 1.25 = 5.45$$

Values within one standard deviation of the mean are greater than or equal to 2.95 and less than or equal to 5.45.

There are 7 data elements within one standard deviation from the mean.

Suggested Practice for SOL A.9

Students need additional practice solving problems involving standard deviation.

1. A data set has a mean of 45. An element of this data set has a value of 50 and a z-score of 0.75. What is the standard deviation for this data set, rounded to the nearest hundredth?

   6.67

2. Use two of the three numbers shown in the list to complete this sentence.

   A data set could have a variance of **81** and a standard deviation of **9** .
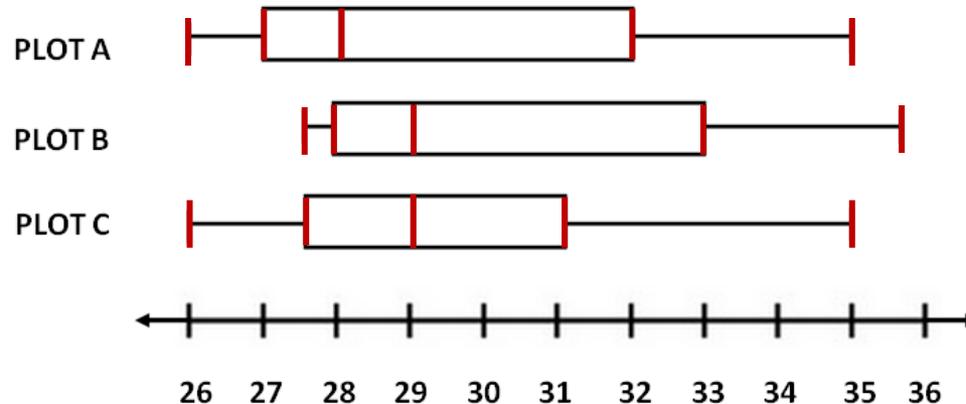
9	40.5	81

Analyzing Box-and-Whisker Plots

SOL A.10
The student will compare and contrast multiple univariate data sets, using box-and-whisker plots.

Suggested Practice for SOL A.10

Students need additional practice identifying and comparing the ranges, interquartile ranges, and medians of box-and-whisker plots.

1. **Which two plots appear to have the same value for the range?**

   Plots A and C

2. **Which two plots appear to have the same value for the interquartile range?**

   Plots A and B

3. **Which two plots appear to have the same value for the median?**

   Plots B and C

Suggested Practice for SOL A.10

Which statement appears to be true regarding the box-and-whisker plots shown?
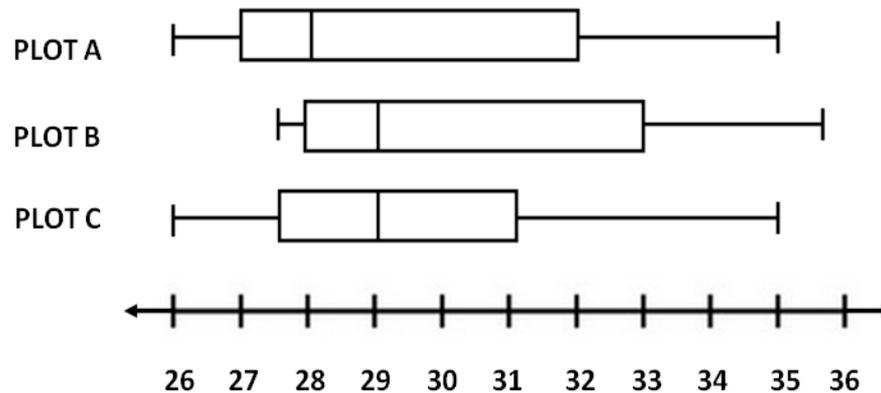
a. The interquartile range of the data for plot A is greater than the interquartile range of the data for plot B.
b. The upper extreme of the data for plot A is greater than the upper extreme of the data for plot C.
c. The range of the data in plot A is the same as the range of the data in plot C.
d. The median of the data in plot A is greater than the median of the data in plot B.

Using the Curve of Best Fit

SOL A.11
The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions.

Suggested Practice for SOL A.11

Students need additional practice determining the linear or quadratic curve of best fit.

This set of ordered pairs shows a relationship between x and y.

$$\{(-3, 20), (-1, -3), (0, -6), (2, 6), (4, 40), (6, 102)\}$$

Which equation best represents this relationship?

a. $y = 9.31x + 14.09$

b. $y = -11.5x - 6$

c. $y = 2x^2 + x + 6$

d. $y = 3x^2 + 0.02x - 6.39$

Extension: Using the curve of best fit, what is the value of y, rounded to the nearest whole number, when the value of x is 8?

Answers will vary depending on how the numbers in the curve of best fit are rounded. Using the equation in option d, y = 186.

Suggested Practice for SOL A.11

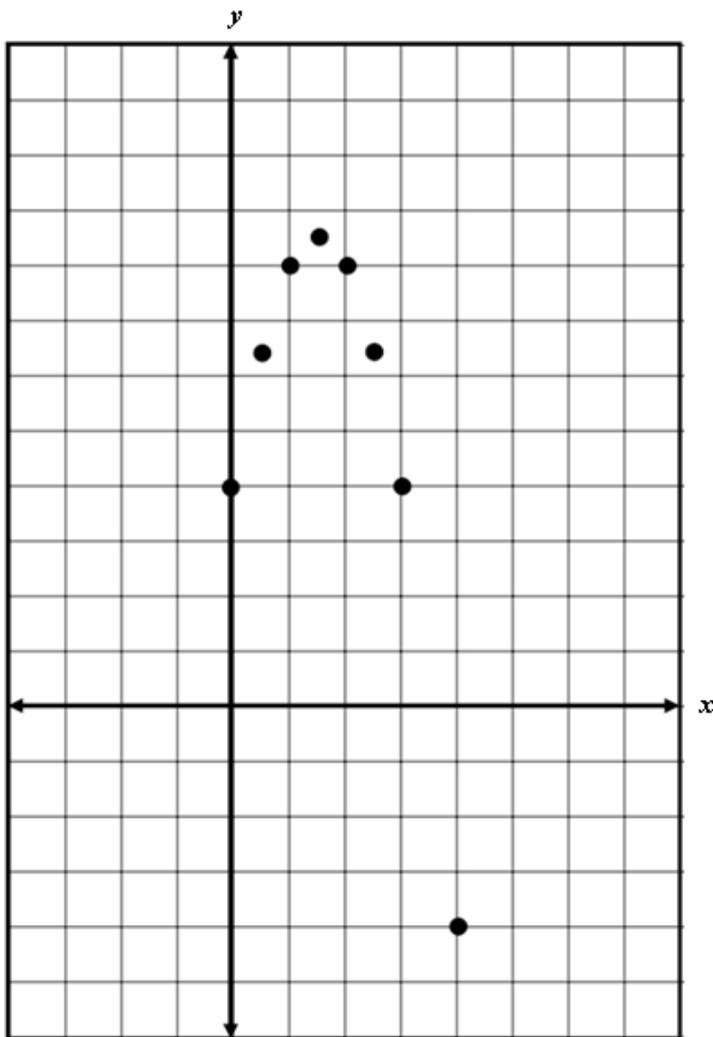**Students need additional practice determining the linear or quadratic curve of best fit and making predictions.**

This set of ordered pairs shows a relationship between x and y.

$$\{(0, -2), (3, 7), (6, 16), (6, 15), (8, 21), (10, 28), (11, 31)\}$$

Using the line of best fit, which is closest to the output when the input is 5?

a. 2.7

b. 11.5

c. 12.7

d. 15.0

Suggested Practice for SOL A.11

*Units on grid are one.

Which equation best models the relationship shown on the grid?

a. $y = 2x + 8$

b. $y = -2x + 8$

c. $y = 2x^2 + 6x + 4$

d. $y = -2x^2 + 6x + 4$

Practice Items

This concludes the student performance information for the spring 2014 Algebra I SOL test.

Additionally, test preparation **practice items** for Algebra I can be found on the Virginia Department of Education Web site at:

http://www.doe.virginia.gov/testing/sol/practice_items/index.shtml#math

Contact Information

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