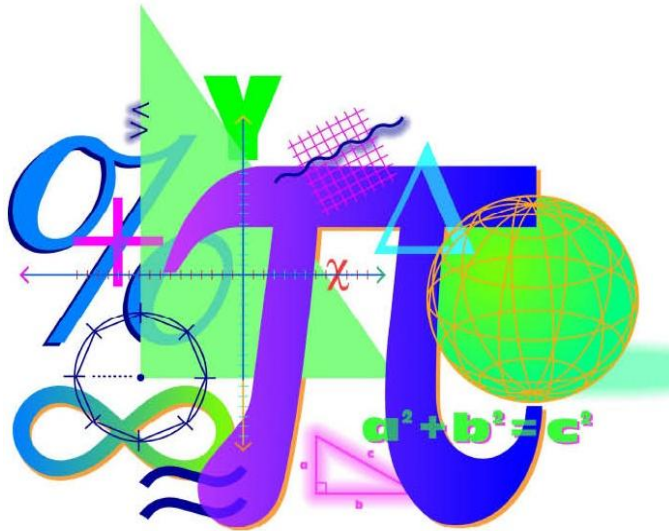# Spring 2012 Student Performance Analysis

Algebra I
Standards of Learning

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

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Representing and Evaluating Cube Roots and Square Roots

SOL A.1

The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables.

Suggested Practice for SOL A.1

Students need additional practice using replacement values to evaluate expressions with cube roots and square roots.

Evaluate:

a) $4\sqrt[3]{x} - \sqrt{y}$ where $x = 64$ and $y = 81$ **7**

b) $\sqrt[3]{x} + y$ where $x = 125$ and $y = {}^-12$ -7

c) $(y\sqrt[3]{x})^2$ where $x = 512$ and $y = 3$ **576**

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Suggested Practice for SOL A.1

Students need additional practice translating expressions with square and cube roots.

Translate into an algebraic expression:

a) The quotient of the square root of x and five $\qquad \dfrac{\sqrt{x}}{5}$

b) The cube root of the product of x and y, less twelve $\qquad \sqrt[3]{xy} - 12$

c) The sum of the square root of sixteen and the product of four and the cube root of eight

$$\sqrt{16} + 4\sqrt[3]{8}$$

Translate into a verbal expression:

d) $5\sqrt[3]{4x} - \sqrt{y}$ $\qquad$ Five times the cube root of the product of 4 and x less the square root of y

e) $y + \sqrt[3]{x}$ $\qquad$ A number y plus the cube root of a number x

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.2

Students need additional practice finding the quotient of a trinomial and a binomial and using exponent rules when negative numbers are involved.

Find the quotient:

a) $\dfrac{x^2 - 3x - 10}{x + 2}$ $\qquad (x - 5)$

b) $(2x^2 - 6x - 8) \div (x - 4)$ $\qquad 2(x + 1)$

Simplify:

c) $(2x^{-3})^2(4x^{-4})$ $\quad \dfrac{16}{x^{10}}$

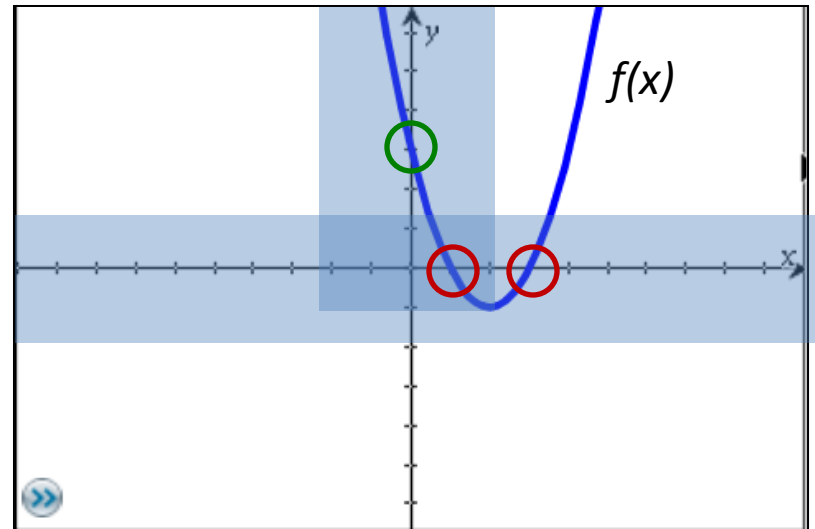d) $\dfrac{15x^{-5}y^7}{3x^2y^{-8}}$ $\quad \dfrac{5y^{15}}{x^7}$

e) $\left(\dfrac{x^3y^4}{x^{-2}y^{-4}}\right)^{-1}$ $\quad \dfrac{1}{x^5y^8}$

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Suggested Practice for SOL A.2

Students need additional practice identifying factors of the polynomial from the graph of the related quadratic function.

What are the apparent factors of the function *f(x)*?

$(x - 1)$ and $(x - 3)$

Related questions:
Identify all x- and y-intercepts of the function *f(x)*. (SOL A7.d)
Identify the domain and range of the function *f(x)*. (SOL A7.b)

the x-intercepts are 1 and 3, and the y-intercept is 3.

The domain is all real numbers and the range is any number greater than or equal to -1.

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 simplifying square roots of monomial expressions and cube roots of whole numbers.

Completely simplify:

a) $\sqrt{432x^6}$ $12x^3\sqrt{3}$

b) $\sqrt{16x^{10}y^{17}}$ $4x^5y^8\sqrt{y}$

c) $\sqrt[3]{3,375}$ 15

d) $\sqrt[3]{16}$ $2\sqrt[3]{2}$

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.4

Students need additional practice solving a literal equation for a given variable.

Solve each equation:

a) $A = \dfrac{1}{2}(ah - bh)$ for h $\qquad h = \dfrac{2A}{(a - b)}$

b) $Q = 3a + 5ac$ for a $\qquad a = \dfrac{Q}{(3 + 5c)}$

Suggested Practice for SOL A.4

Students need additional practice solving multi-step equations with the variable on both sides and with fractions. Students also need additional practice justifying steps in solving a linear equation.

Solve for *x*:

$$\frac{3}{4}(12x + 8) = \frac{2}{3}(6x + 9) \qquad x = 0$$

What property justifies the work between each step?

Step 1:	$3x + 3 = 4$	Given
Step 2:	$3x + 3 + (-3) = 4 + (-3)$	Addition Property of Equality
Step 3:	$3x + 0 = 4 + (-3)$	Additive Inverse Property
Step 4:	$3x + 0 = 1$	Substitution
Step 5:	$3x = 1$	Additive Identity Property
Step 6:	$\frac{3x}{3} = \frac{1}{3}$	Division Property of Equality or Multiplication Property of Equality
Step 7:	$x = \frac{1}{3}$	Multiplicative Inverse Property or Substitution

Suggested Practice for SOL A.4

Students need additional practice identifying a solution or root of a quadratic equation.

Find the solutions or roots of the function.

a) $f(x) = (3x + 4)(x - 2)$ $\dfrac{-4}{3}$ and 2

b) $f(x) = 5x^2 + 28x - 12$ $\dfrac{2}{5}$ and -6

Suggested Practice for SOL A.4

Students need additional practice finding the x value or the y value for a solution to a system of equations and identifying a system of equations with one real solution, no real solution, or infinitely many solutions.

Find the x-value of the solution to this equation:

$$\begin{cases} 4x + 2y = 18 \\ -6y = 4x + 2 \end{cases} \qquad x = 7$$

Identify whether this system of equations has one real solution, no real solution or infinitely many solutions:

$$\begin{cases} 6x - 4y = 4 \\ 4y - 6x = 2 \end{cases} \qquad \text{No real solution}$$

Solving Multi-Step 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
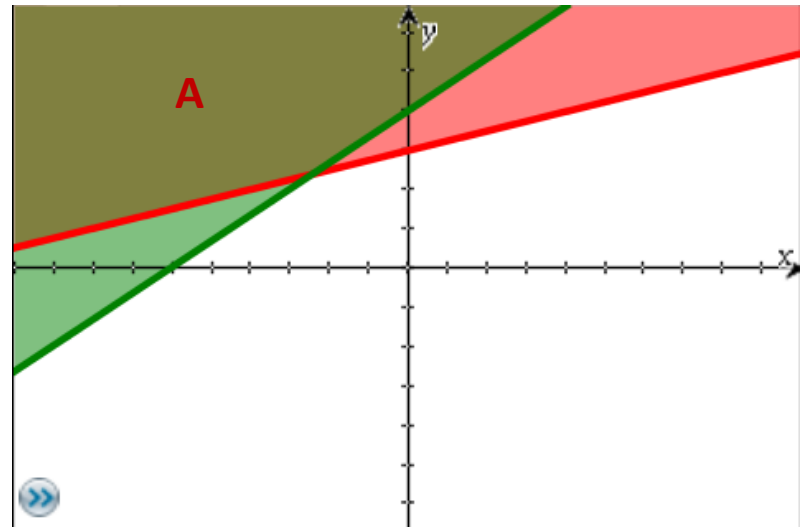
d) **Solving systems of inequalities**.

Suggested Practice for SOL A.5

Students need additional practice identifying solutions to a system of inequalities.

Graph the solution to the system of inequalities:

$$\begin{cases} 4y \geq x + 12 \\ 3y \geq 2x + 12 \end{cases}$$

a) Name two points that are in the solution set. **Any point located within region A.**

b) Select the point(s) that are part of the solution set:
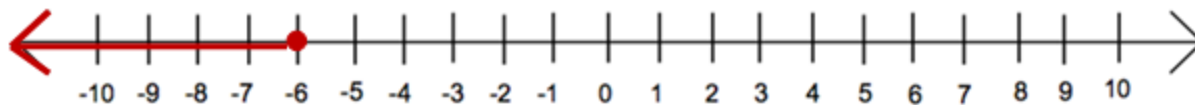   (-7,-2) (-6,0) (-6,1) (-4,2) (-4,4) (-3,0) (2,3) (4,4)

Suggested Practice for SOL A.5

Students need additional practice solving multistep linear inequalities which require a sign change.

Solve and graph on a number line: $2.2(5 - y) \geq 24.2$

$$y \leq -6$$

Identifying or Plotting Two Points on a Given Line and Writing Equations 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.6

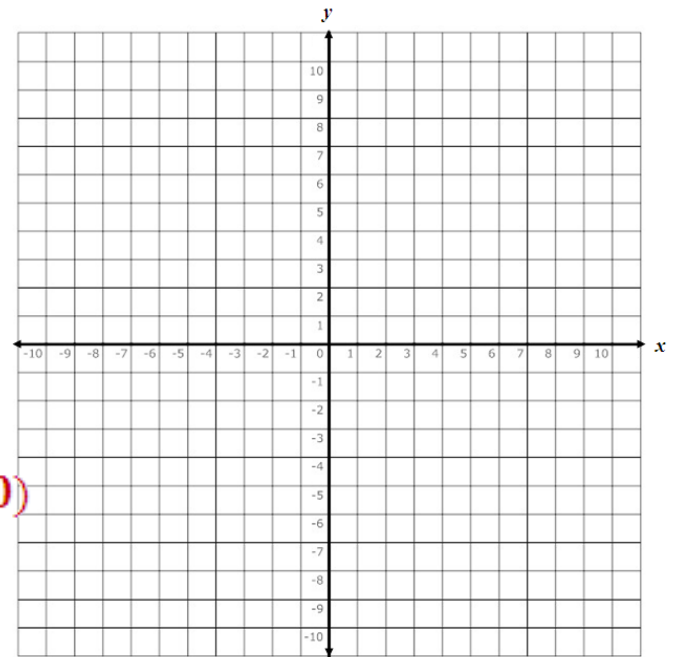**Students need additional practice plotting two points that lie on a line.**

Plot two points that lie on the line:

a) $-6 = -4x - 3y$

$(-6, 10), (-3, 6), (0, 2), (3, -2), (6, -6), (9, -10)$

b) $3x + 2y = 10$

$(-2, 8), (0, 5), (2, 2), (4, -1), (6, -4), (8, -7), (10, -10)$

A related question would be to ask students to name the slope of these two lines.

Suggested Practice for SOL A.6

Students need additional practice identifying the equation of a line given a point and the x- or y-intercept.

Write the equation of a line that:

a)   Passes through the point (4,-2) and has an *x*-intercept of 3

b)   Passes through the point (5,1) and has a *y*-intercept of -3

c)   Graph the lines represented in a and b above.

$$y = -2x + 6 \text{ or } 2x + y = 6$$

$$y = \frac{4}{5}x - 3 \text{ or } -4x + 5y = -15$$
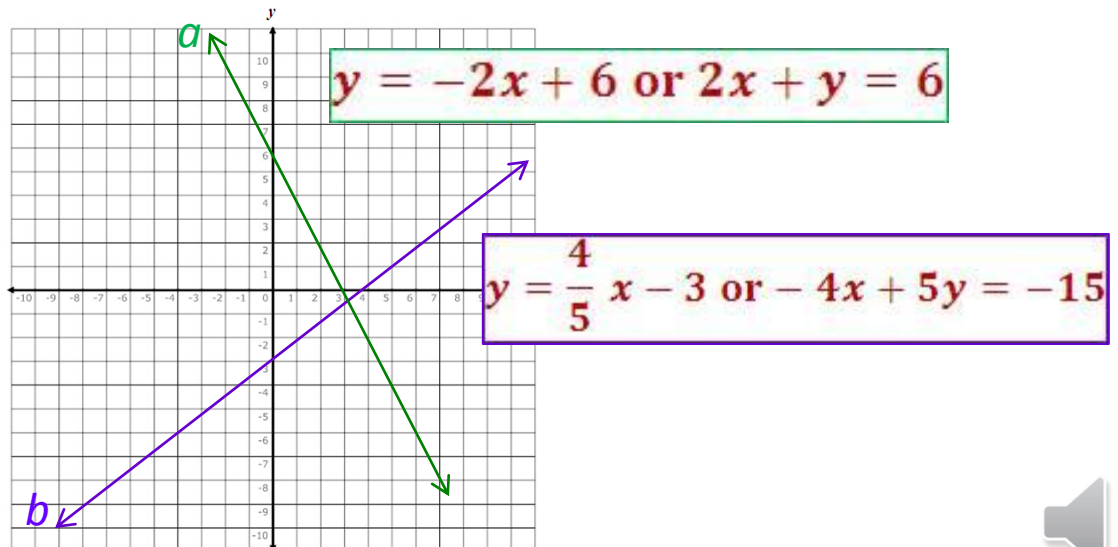
Investigating and Analyzing Functions

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.**

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Suggested Practice for SOL A.7

Students need additional practice plotting points where zeros of linear and quadratic functions are located.

Graph these functions on a coordinate plane and identify the zeros of the function:
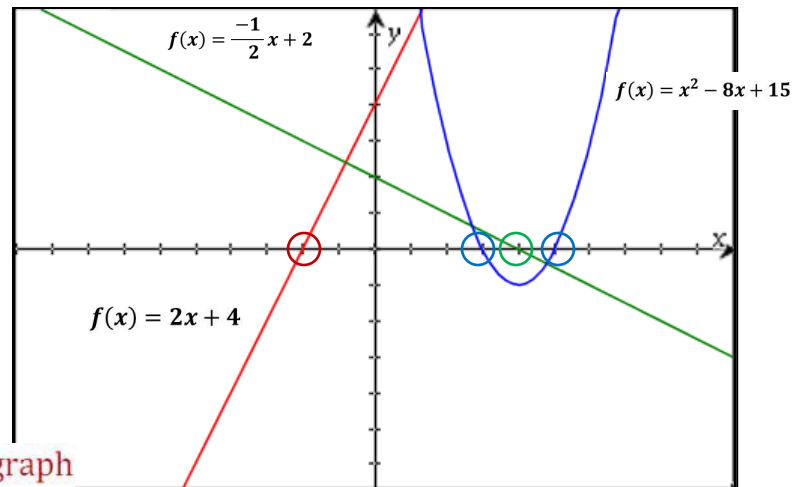
a) $f(x) = 2x + 4$

the zero is -2, located at $(-2,0)$ on the graph

b) $f(x) = \dfrac{-1}{2}x + 2$

the zero is 4, located at $(4,0)$ on the graph

c) $f(x) = x^2 - 8x + 15$

the zeros are 3 and 5, located at $(3,0)$ and $(5,0)$ on the graph

Analyzing Direct and Inverse Variations

SOL A.8
The student, given a situation, 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 selecting or plotting ordered pairs to make a relation that is a direct variation.
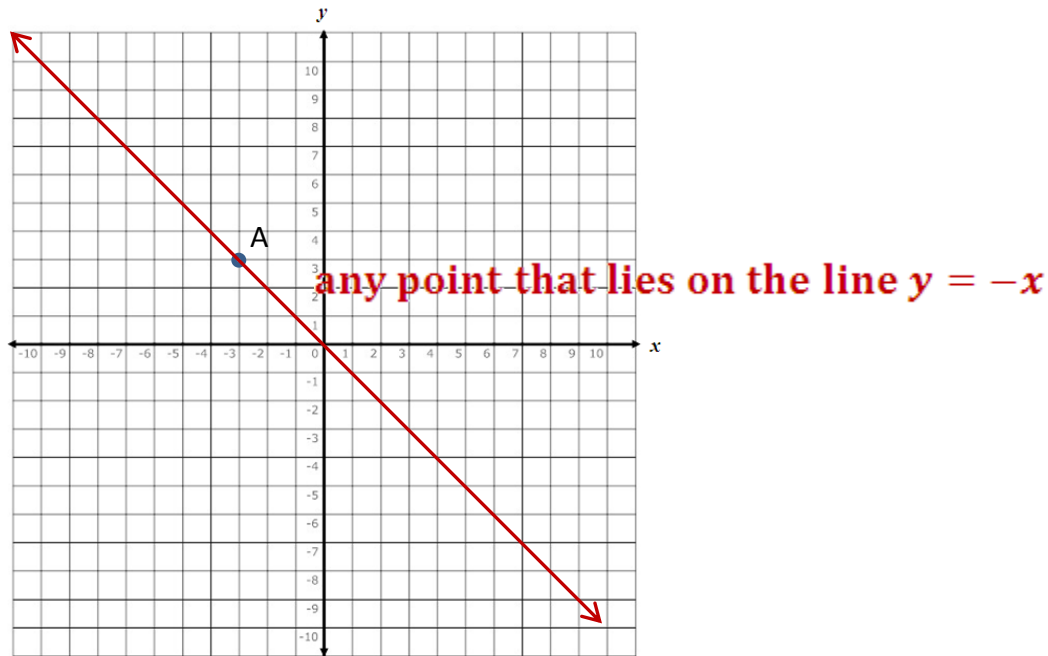
Select three of these points that will create a relation that is a direct variation.

$$(1, 10) \quad \boxed{(3.5, 7)} \; \boxed{(4, 8)} \quad (8, 4) \quad \boxed{(8, 16)} \quad (10, 6)$$

Suggested Practice for SOL A.8

Point A (-3,3) lies on a line that represents a direct variation equation. Plot three other points on that line.

any point that lies on the line $y = -x$

Suggested Practice for SOL A.8

Students need additional practice identifying an equation that represents a real world direct or inverse variation and identifying the type of variation.

This chart shows how the cost per person to rent a vacation home varies with the number of people in a group.

Cost Per Person to Rent a Vacation Home

Number of People in Group	Cost Per Person ($)
5	530.00
8	331.25
10	265.00
20	132.50

Which statement is true about the relationship?

a) It is a direct variation relationship because $y = 2650x$.

b) It is a direct variation relationship because $y = \dfrac{2650}{x}$.

c) It is an inverse variation relationship because $y = 2650x$.

d) It is an inverse variation relationship because $y = \dfrac{2650}{x}$.

Interpret Standard Deviation and Z-Scores

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 finding values within a given standard deviation of the mean.

A teacher gave a quiz. The following stem-and-leaf plot shows the scores of the students in her class.

Quiz Scores

STEM	LEAF
4	0
5	0 0
6	0 0 0
7	0 0 0 0
8	0 0 0
9	0 0
10	0

Key: 6|0 equals 60

The mean score of this data set is 70 and the standard deviation (rounded to the nearest tenth) is 15.8.

Which scores are within one standard deviation of the mean?

Any student who scored a 60, 70 or 80 scored within one standard deviation of the mean.

Suggested Practice for SOL A.9

Students need additional practice identifying an interval in which an element lies.

A data set has a mean of 16.5 and a standard deviation of 3. The element x has a z-score of 1.5. In which interval does the element lie?

$$10.5 \leq x < 13.5$$

$$13.5 \leq x < 16.5$$

$$16.5 \leq x < 19.5$$

$$\boxed{19.5 \leq x < 22.5}$$

$$22.5 \leq x < 25.5$$

Suggested Practice for SOL A.9

Students need additional practice finding an element of a data set given the mean, standard deviation, and z-score.

A data set has a mean of 34 and a standard deviation of 4.5. An element in the data set has a z-score of -1.2.

a) Without doing a calculation, state whether this element is less than, equal to, or greater than 34.

b) Determine the element of the data set.

  a) Less than 34 (the mean) because the z-score is negative.

 b) The element is 28.6

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 analyzing changes to a data set when a data point is added or removed, and analyzing two box-and-whisker plots to draw a conclusion about the distribution of the data.

This box-and-whisker plot represents nine pieces of data. No number is repeated.
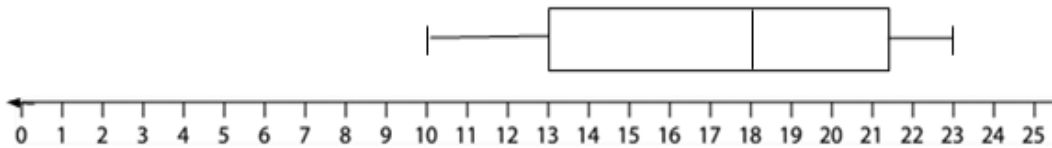
The number 23 is removed from the data set and a new box-and-whisker plot is drawn. Compared to the values in the original box-and-whisker plot, describe the changes to each of these values (increases, decreases or stays the same):

a)   the lower extreme   It stays the same.

b)   the lower quartile   It stays the same.

c)   the median   It decreases.

d)   the upper quartile   It decreases.

e)   the upper extreme   It decreases.

Suggested Practice for SOL A.10

Each of these box-and-whisker plots represent a data set with 10 distinct elements. Which statements about these plots appear to be true?
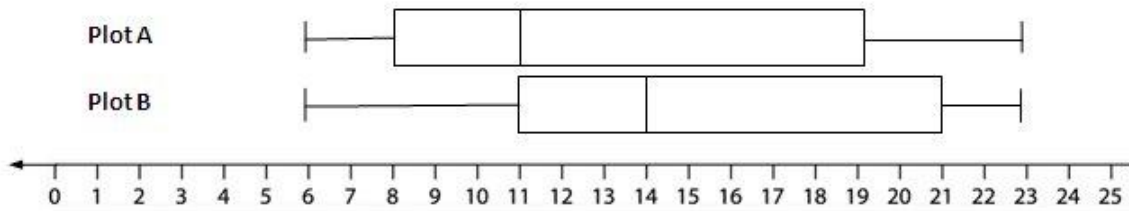
a) There are more elements in the lower quartile of plot B than plot A, because the left whisker of plot B is longer than the left whisker of plot A.

b) Since both data sets have 10 distinct elements, the box of plot A and the box of plot B contain the same number of elements.

c) There are fewer elements in the upper quartile of plot B than plot A, because the right whisker of plot B is shorter than the right whisker of plot A.

d) The interquartile range of plot A is greater than the interquartile range of plot B.

e) The range of both plots are equal.

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 making predictions using the linear or quadratic curve of best fit.

Determine the quadratic curve of best fit for the data. Then estimate what the value of y will be when x = -4.

$$\{(-3, 2), (0, 5), (1, 7.3), (-1, 3.3), (-6, 5), (-7, 7.3)\}$$

$$y = 0.33x^2 + 1.99x + 4.98$$

$$\text{when } x = -4, y = 2.3$$

Practice Items

This concludes the student performance information for the spring 2012 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