End of Course

I*ntroducing the*

Virginia Standards of Learning

The complete set of items that appeared on the Spring 2000 Standards of Learning test taken by most public school students in Virginia is presented in the following pages. The intent of this release of these test questions is to provide parents and teachers additional information to accompany the Student Performance Report and/or the Parent Report.

The information accompanying each test question is broken into several components:

Reporting Category: Matches the score report and allows for identification of strengths and weaknesses indicated by student scores.

Standard of Learning: Presents the SOL used in developing the assessment question.

Builds On: Indicates what the student has studied in previous course work.

Instruction: Provides information for teachers to use as the SOL is incorporated into instruction.

The answer to each question can be found in the back of the booklet.

Virginia
Standards of Learning Assessments

Algebra I

End of Course

Reporting Category: Expressions and Operations

A. Standard of Learning: A.2 The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables. Students will choose an appropriate computational technique, such as mental mathematics, calculator, or paper and pencil.

Builds On: Work with variables and representation of verbal expressions begins with the mathematics SOL in fifth grade and continues through the sixth, seventh, and eighth grade SOL. The study of Order of Operations occurs in the seventh and eighth grade SOL.

A

1

x 2

6
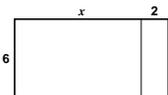
Which expression correctly represents the area of the rectangle above?

A $8x$
B $6(x + 2)$
C $(x + 2)(x + 6)$
D $x^2 + 2$

2   What is the value of $2a^2b + 5ab - 4$ if $a = {}^-4$ and $b = 5$?

F $^-264$
G $^-144$
H 3
J 56

3   What is the value of $\dfrac{a + b}{2b}$ if $a = 10$ and $b = 15$?

A $\dfrac{5}{6}$

B $\dfrac{5}{4}$

C 5

D 25

Instruction: Provide students opportunities to evaluate expressions for a given replacement set. Verbal quantitative situations should also include pictorial analysis.

A*lgebra I*

End of Course

A. Standard of Learning: A.10 The student will apply the laws of exponents to perform operations on expressions with integral exponents, using scientific notation when appropriate.

Builds On: Work with exponents begins in the mathematics SOL in fifth grade and continues to be studied through the sixth, seventh, and eighth grade SOL. Scientific notation and computation with integers is found in the seventh and eighth grade SOL.

B. Standard of Learning: A.11 The student will add, subtract, and multiply polynomials and divide polynomials with monomial divisors, using concrete objects, pictorial representations, and algebraic manipulations.

Builds On: Work with the Order of Operations and computation with integers occurs in the mathematics SOL in grades 7 and 8.

A

4 If $a \neq 0$, $(a^{-2})(a^2) =$

F $^-\dfrac{1}{2}$

G 1

H 0

J 2

5 The sun is about 1.5×10^8 kilometers from Earth. If light travels about 3×10^5 kilometers per second, about how many seconds does it take light from the sun to reach Earth?

A 5
B 50
C 500
D 5,000

Instruction: Provide students an opportunity to perform operations on expressions using the laws of exponents. Problems with scientific notation are seen as an application of these laws.

B

6 The area of a rectangle is given by $A = 6x^2y + 4y^2x$ and the width of the rectangle is $w = 2xy$. What is the length, l, of the rectangle if $l = \dfrac{A}{w}$?

F $l = 3x^2y + 2y^2x$
G $l = 6x^2y + 4y^2x + 2xy$
H $l = 4x + 2y$
J $l = 3x + 2y$

7 Which expression is equivalent to $\dfrac{6x^3 - 3x^2 + 5x}{3x}$?

A $x + 5$

B $^-2x^2 + 5x$

C $2x^2 - x + \dfrac{5}{3}$

D $2x - 3 + \dfrac{5}{3}$

8 Which expression is equivalent to $(3a + b)(2a - 4b)$?

F $5a - 3b$
G $6a^2 - 4b^2$
H $5a^2 - 10ab + 5ab^2$
J $6a^2 - 10ab - 4b^2$

Instruction: Provide students an opportunity to experience the various representations of polynomials and work with polynomials presented in contextual situations as well.

Algebra I

A. Standard of Learning: A.12 The student will factor completely first- and second-degree binomials and trinomials in one or two variables. The graphing calculator will be used as both a primary tool for factoring and for confirming an algebraic factorization.

Builds On: Work with developing number sense and the understanding of mathematical facts necessary to be successful with factoring occurs throughout the K-8 mathematics SOL.

A

9 Which is the complete factorization of the trinomial $x^2 - x - 12$?

A $(x + 3)(x - 4)$
B $(x - 3)(x + 4)$
C $(x + 6)(x - 2)$
D $(x + 12)(x - 1)$

10 Which is the complete factorization of the trinomial $3x^2 + 10x - 8$?

F $(3x + 2)(x - 4)$
G $(x + 2)(3x - 4)$
H $(x - 2)(3x + 4)$
J $(3x - 2)(x + 4)$

Instruction: Provide students an opportunity to factor second degree polynomials with integral coefficients and a positive leading coefficient less than four.

B. Standard of Learning: A.13 The student will estimate square roots to the nearest tenth and use a calculator to compute decimal approximations of radicals.

Builds On: Work with square root begins with the mathematics SOL in grade 6 and increases in complexity through grade 8.

B

11 In kilometers, the approximate distance to the earth's horizon from a point h meters above the surface can be determined by evaluating the expression $\sqrt{12h}$. About how far is the apparent horizon to a person looking out to sea from the top of a cliff 350 meters above sea level?

A 21 km
B 65 km
C 130 km
D 225 km

12 Which is closest to the value of $\frac{\sqrt{17}}{\sqrt{10}}$?

F 0.8
G 1.3
H 1.7
J 2.6

Instruction: Provide students with opportunities to use the calculator to find square roots and make reasonable interpretations of the displayed values for a given situation. Word problems with square roots and the use of square roots in formulas should be included in instruction.

Algebra I

Reporting Category: Relations and Functions

A. Standard of Learning: A.5 The student will analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, if possible, and determine if the relation is a function.

Builds On: Work with patterns begins with the mathematics SOL in Kindergarten and progresses in difficulty through grade 8. Emphasis on a graphic interpretation of patterns occurs in the sixth, seventh, and eighth grade SOL.

A

13 Which of the following tables represents a function?

A

x	y
4	⁻2
4	0
4	2
4	4

B

x	y
1	⁻2
0	0
1	2
4	3

C

x	y
⁻1	1
0	0
1	1
2	4

D

x	y
2	⁻4
0	2
2	6
4	8

14

Which table *most* likely matches this graph?

F

x	y
2	0
2	2
0	1

G

x	y
1	0
2	3
3	1

H

x	y
0	2
3	⁻4
1	0

J

x	y
0	1
2	2
4	3

Instruction: Provide students with opportunities to analyze a table of ordered pairs and sets of ordered pairs to identify a pattern; to determine if a relation is a function from a table of ordered pairs; and to determine the table of ordered pairs for a given graph.

Algebra I

A. Standard of Learning: A.5 The student will analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, if possible, and determine if the relation is a function.

Builds On: Work with patterns begins with the mathematics SOL in Kindergarten and progresses in difficulty through grade 8. Emphasis on a graphic interpretation of patterns occurs in the sixth, seventh, and eighth grade SOL.

A

15 (0, ⁻3), (2, ⁻2), (4, ⁻1), (6, 0), . . .

These ordered pairs follow a pattern. If (10, *y*) is in this pattern, what is the value of *y*?

A 1
B 2
C 3
D 4

16

x	*y*
0	⁻5
2	⁻3
⁻2	⁻7
4	⁻1
⁻4	⁻9

Using the same relationship between *x* and *y* as the table, what is the value of *y* when *x* is 8?

F ⁻1
G 2
H 3
J 5

Instruction: Provide students with opportunities to analyze a table of ordered pairs and sets of ordered pairs to identify a pattern; to determine if a relation is a function from a table of ordered pairs; and to determine the table of ordered pairs for a given graph.

End of Course

A*lgebra I*

A. Standard of Learning: A.15 The student will determine the domain and range of a relation given a graph or a set of ordered pairs and will identify the relations that are functions.

Builds On: Work with the terms of domain and range begins with the seventh grade mathematics SOL and continues in the eighth grade SOL when work with relations begins.

A

17 **What is the domain of the set of ordered pairs {(⁻5, ⁻4), (⁻4, 4), (2, 3), (4, 5)}?**

A {⁻5, ⁻4, 2, 4}
B {⁻4, 3, 4, 5}
C {⁻5, ⁻4, 4, 5}
D {⁻5, 2, 3, 4}

18

What is the domain of the function shown above?

F All integers
G All real numbers
H All natural numbers
J All whole numbers

19 **Which of the following is *not* a graph of a function?**

Instruction: Provide students an opportunity to determine the domain and range of a function for a given set of ordered pairs or from a graph, and to determine from a graph if a relation is a function.

Algebra I

A. Standard of Learning: A.16 The student will, given a rule, find the values of a function for elements in its domain and locate the zeros of the function both algebraically and with a graphing calculator. The value of f(x) will be related to the ordinate on the graph.

Builds On: Work with the terms of domain and range begins with the seventh grade mathematics SOL and continues in the eighth grade SOL when work with relations begins.

B. Standard of Learning: A.19 The student will analyze a relation to determine whether a direct or inverse variation exists and represent it algebraically and graphically, if possible.

Builds On: Work with relations begins with the mathematics SOL in grade 8.

B

23 a varies directly as b and $a = 12$ when $b = 4$. What is the constant of variation?

A $^-8$

B $\dfrac{1}{3}$

C 3

D 8

24 a varies directly as b and the constant of variation is $\dfrac{1}{4}$. Which equation represents the relationship?

F $a = \dfrac{1}{4}b$

G $a = 4b$

H $a = b + \dfrac{1}{4}$

J $a = b - \dfrac{1}{4}$

Instruction: Provide students with an opportunity to write an equation for a direct variation based on a set of data and to determine the constant of variation based on a set of data.

A

20 What is the range of the function $f(x) = 5 - 8x$ when the domain is $\{^-2, 2, 4\}$?

F $\{^-27, ^-11\}$

G $\{^-27, ^-11, 21\}$

H $\{^-2, 2, 4\}$

J $\left\{\dfrac{1}{8}, \dfrac{3}{8}, \dfrac{7}{8}\right\}$

21

x →Input→ [$f(x) = 2x - 5$] →Output→ $f(x)$
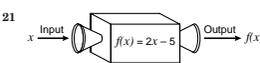
Using the function machine in the diagram, what is the output when 12 is input?

A 7
B 8.5
C 19
D 29

22 If $f(x) = \dfrac{2}{3}x - 6$, what is $f(12)$?

F 2
G 8
H 14
J 27

Instruction: Provide students with an opportunity to calculate the functional values (range) for a given function, in a variety of contexts, when provided values for the domain.

Algebra I

Reporting Category: Equations and Inequalities

A. Standard of Learning: A.1 The student will solve linear equations and inequalities in one variable, solve literal equations (formulas) for a given variable, and apply these skills to solve practical problems. Graphing calculators will be used to confirm algebraic solutions.

Builds On: Work with equations begins in the mathematics SOL for grade 2 when students complete numerical sentences involving basic facts for addition and subtraction and becomes more formal in the sixth, seventh, and eighth grade SOL.

B. Standard of Learning: A.3 The student will justify steps used in simplifying expressions and solving equations and inequalities. Justifications will include the use of concrete objects, pictorial representations, and the properties of real numbers.

Builds On: Work with the properties of real numbers begins with the mathematics SOL in grade 7.

B

28 The statement

"If $2(3a - 4) = 12$, then $6a - 8 = 12$"

is justified by the —

F   Associative property of multiplication
G   Multiplication property of equals
H   Addition property of equals
J   Distributive property

29 If $A < B$, which of the following statements *cannot* be true?

A $A + C < B + C$
B $A - C < B - C$
C $AC < BC$
D $^-A < {}^-B$

A

25 Using the distance formula, $d = rt$, what is the value of t when $d = 3{,}520$ and $r = 550$?

A   6.4
B   2,970
C   4,070
D   1,936,000

26 What is the solution to $2x - 4 < 6$?

F $x < 1$
G $x < 5$
H $x < 10$
J $x > 1$

27 A rectangle has a perimeter of 60 inches and length of 22 inches. What is the width of the rectangle?

A   176 in.
B   164 in.
C   14 in.
D   8 in.

Instruction: Provide students an opportunity to identify a property of real numbers used in simplifying expressions and solving equations and inequalities. Questions that require students to identify what CANNOT be done to simplify an expression or solve an equation or inequality based on the properties of real numbers should also be included in instruction.

Instruction: Provide students an opportunity to solve multi-step inequalities in one variable; to solve a literal equation (formula) for a specified variable; and to apply skills for solving linear equations to practical situations.

Algebra I

A. Standard of Learning: A.6 The student will select, justify, and apply an appropriate technique to graph a linear function in two variables. Techniques will include slope-intercept, x- and y-intercepts, graphing by transformation, and the use of the graphing calculator.

Builds On: Work with graphing coordinates begins in the mathematics SOL in fifth grade and progresses through grades 6 and 7 to graphing lines in grade 8.

A

30 Which equation is represented by this line?

F $y = x - 2$

G $y = \dfrac{x}{2} + 2$

H $y = x + 2$

J $y = 2x + 2$

31 Which line on the graph below has y-intercept 3 and x-intercept ⁻2?

A

B

C

D

Instruction: Provide students with an opportunity to determine the graph of a line when given the x- and y- intercept.

Algebra I

End of Course

A. Standard of Learning: A.7 The student will determine 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. The graphing calculator will be used to investigate the effect of changes in the slope on the graph of the line.

Builds On: Work with graphing coordinates begins in the mathematics SOL in fifth grade and progresses through grades 6 and 7 to graphing lines in grade 8.

A

32 What is the slope of the line represented by $2x - 3y = 4$?

F $\frac{3}{2}$

G $\frac{2}{3}$

H $\frac{-2}{3}$

J $^-2$

33 Which describes the slope of the line that passes through ($^-7$, 3) and (8, 5)?

A Positive
B Negative
C Zero
D Undefined

34

Which line on the graph has undefined slope?

F A
G B
H C
J D

Instruction: Provide students an opportunity to determine the slope of a line and to determine if the slope is positive, negative, zero, or undefined when given a graph, two points, or an equation.

Algebra I

A. Standard of Learning: A.8 The student will write an 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.

Builds On: Work with graphing coordinates begins in the mathematics SOL in fifth grade and progresses through grades 6 and 7 to graphing lines in grade 8.

A

35 Which is an equation of a line that has a slope of $-\dfrac{1}{2}$ and contains the point (2, 3)?

  A $y = 2x - \dfrac{1}{2}$

  B $y = -\dfrac{x}{2} + 4$

  C $y = \dfrac{x}{2} + 3$

  D $y = 3x + 2$

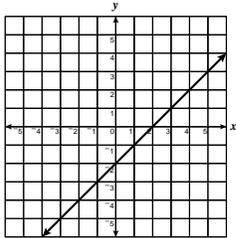**37** Which is an equation for the line that passes through (0, 2) and (⁻2, 0)?

  A $y = {}^-x$
  B $y = x + 2$
  C $y = {}^-x - 2$
  D $y = x - 2$

36

Which is most likely an equation for the line shown?

  F $y = {}^-x$
  G $y = x - 2$
  H $y = {}^-x + 4$
  J $y = 2x - 2$

Instruction: Provide students with an opportunity to write an equation of a line given the graph of a line, two points on a line, or the slope and one point on a line.

Algebra I

A. Standard of Learning: A.9 The student will solve systems of two linear equations in two variables, both algebraically and graphically, and apply these techniques to solve practical problems. Graphing calculators will be used as both a primary tool of solution and to confirm an algebraic solution.

Builds On: Work with equations begins in the mathematics SOL for grade 2 when students complete numerical sentences involving basic facts for addition and subtraction, and it becomes more formal in the sixth, seventh, and eighth grade SOL.

B. Standard of Learning: A.14 The student will solve quadratic equations in one variable both algebraically and graphically. Graphing calculators will be used both as a primary tool in solving problems and to verify algebraic solutions.

Builds On: Work with equations begins in the mathematics SOL for grade 2 when students complete numerical sentences involving basic facts for addition and subtraction, and it becomes more formal in the sixth, seventh, and eighth grade SOL. Work with developing number sense and understanding of mathematical facts necessary to be successful with factoring occurs throughout the K-8 mathematics SOL.

A

38 One competitor in a 100-mile bicycle race took a total of 5 hours to complete the course. His average speed in the morning was 23 miles per hour. His average speed in the afternoon was 13 miles per hour. How many hours did he ride in the morning, and how many hours did he ride in the afternoon?

F   Morning - 2.5 hours, afternoon - 2.5 hours
G   Morning - 3 hours, afternoon - 2 hours
H   Morning - 3.5 hours, afternoon - 1.5 hours
J   Morning - 4 hours, afternoon - 1 hour

39 $\begin{cases} 2x - 6 = 2y \\ 3 - 2x = y \end{cases}$

What is the solution to this system of equations?

A $x = {}^-2, y = {}^-3$
B $x = 0, y = {}^-3$
C $x = 1, y = {}^-2$
D $x = 2, y = {}^-1$

40 The length of a rectangle is 2 centimeters longer than its width. The perimeter is 16 centimeters. What are the length and width of the rectangle?

F   7 cm, 5 cm
G   6 cm, 4 cm
H   5 cm, 3 cm
J   4 cm, 2 cm

Instruction: Provide students an opportunity to write and solve a system of linear equations in two variables, either algebraically or graphically, and use these techniques to solve practical problems.

B

41 The number of seconds to complete a chemical reaction was determined to be given by the equation $s = 250 - 5T - T^2$ where s is the number of seconds and T is the temperature in degrees Celsius at which the reaction occurred. If a chemical reaction was complete in 200 seconds, what was the temperature at which the reaction occurred?

A   5° C
B   7° C
C   10° C
D   12° C

42 $x^2 - x - 6 = 0$

Which is the solution set for the equation above?

F $\{^-3, 2\}$
G $\{^-2, 3\}$
H $\{^-6, 5\}$
J $\{^-5, 6\}$

Instruction: Provide students with an opportunity to solve quadratic equations both algebraically and graphically and solve problems using the appropriate technique.

A*lgebra I*

Reporting Category: Statistics

A. Standard of Learning: A.4 The student will use matrices to organize and manipulate data, including matrix addition, subtraction, and scalar multiplication. Data will arise from business, industrial, and consumer situations.

Builds On: Work with matrices begins with the mathematics SOL in eighth grade.

A

43 The matrices show the membership by grades in the Science Club (S) and the Art Club (A) at Beacon Hill, Rockwood, and Whitney middle schools.

	Beacon Hill		Rockwood		Whitney	
	S	A	S	A	S	A
Gr 6	4	5	8	4	8	6
Gr 7	9	3	10	5	9	2
Gr 8	12	7	14	8	14	4

Which shows the total number of students in each club at each grade level at the three schools?

A $[40 \quad 49 \quad 43]$

B $\begin{bmatrix} 20 & 15 \\ 28 & 10 \\ 40 & 19 \end{bmatrix}$

C $\begin{bmatrix} 25 & 15 \\ 32 & 17 \\ 31 & 12 \end{bmatrix}$

D $\begin{bmatrix} 9 & 12 & 19 \\ 12 & 15 & 22 \\ 14 & 11 & 18 \end{bmatrix}$

44

$$[A] = \begin{bmatrix} 2 & 4 \\ -1 & 1 \\ -6 & -1 \end{bmatrix}$$

$0.5[A] = ?$

F $\begin{bmatrix} 2 & 4 \\ 0.5 & 1 \\ -3 & -1 \end{bmatrix}$

G $\begin{bmatrix} 1 & 2 \\ -0.5 & 0.5 \\ -3 & -0.5 \end{bmatrix}$

H $\begin{bmatrix} 1 & 2 \\ -1 & 0.5 \\ -6 & -0.5 \end{bmatrix}$

J $\begin{bmatrix} 3 \\ 0 \\ -3.5 \end{bmatrix}$

Instruction: Provide students with an opportunity to add matrices and use scalar multiplication with a given matrix.

Algebra I

A. Standard of Learning: A.17 The student will, given a set of data points, write an equation for a line of best fit, using the median fit method, and use the equation to make predictions.

Builds On: Work with analyzing data and making inferences and work with median begins in the mathematics SOL in sixth, seventh, and eighth grades.

A

45 Using the median fit method, which scatterplot most likely has a line of best fit represented by $y = \bar{\ }x + 5$?

A

B

C

D

46

Which equation best represents the data shown on the scatterplot?

F $y = \dfrac{x}{2} - 1$

G $y = \dfrac{1}{2}x - 3$

H $y = x - 3$

J $y = 2x - 5$

Instruction: Provide students an opportunity to write an equation for the median fit line from a scatterplot; and to identify a scatterplot when given the equation for the median fit line.

End of Course

Algebra I

A. Standard of Learning: A.18 The student will compare multiple one-variable data sets, using statistical techniques that include measures of central tendency, range, stem-and-leaf plots, and box-and-whisker graphs.

Builds On: Work with stem-and-leaf plots begins in the fifth grade mathematics SOL, and with box-and-whisker graphs in sixth grade. Work with the measures of central tendency begins in fifth grade, progressing in difficulty through the sixth, seventh, and eighth grades.

A

47 Mari and Marc are bowling a 3-game match to determine the top bowler for their league. Marc averaged 163 for his three games. Mari bowled 171 and 145 for her first two games. What is the least she must bowl for her third game if she is to win the championship?

   A 150
   B 164
   C 174
   D 180

48

Stem	Leaf
5	3 4
6	2 4 8
7	0 1 2 5 7 7 9
8	4 5 6 7
9	1 2 4 6

This is a stem-and-leaf plot of a group of test scores. What is the median score?

   F 73
   G 76
   H 77
   J 77.5

49 In which data set is the median value equal to the mean value?

   A {2, 4, 7, 9, 11}
   B {7, 9, 10, 11, 16}
   C {6, 12, 18, 24, 27}
   D {33, 40, 46, 52, 59}

50 This is a box-and-whisker plot of a set of scores.

In which quartile would a score of 76 fit in this set?

   F 1st
   G 2nd
   H 3rd
   J 4th

Instruction: Provide students an opportunity to compare measures of central tendency using numerical data; and to work with data displayed in a stem-and-leaf plot and/or a box-and-whisker graph.

Correct Answers

ALGEBRA I TEST

1. B	**2.** J	**3.** A	**4.** G	**5.** C	**6.** J	**7.** C	**8.** J	**9.** A	**10.** J
11. B	**12.** G	**13.** C	**14.** H	**15.** B	**16.** H	**17.** A	**18.** G	**19.** D	
20. G	**21.** C	**22.** F	**23.** C	**24.** F	**25.** A	**26.** G	**27.** D	**28.** J	
29. D	**30.** H	**31.** B	**32.** G	**33.** A	**34.** G	**35.** B	**36.** G	**37.** B	
38. H	**39.** D	**40.** H	**41.** A	**42.** G	**43.** B	**44.** G	**45.** C		
46. G	**47.** C	**48.** H	**49.** D	**50.** J					