End of Course

Introducing 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

A*lgebra II*

Reporting Category: Expressions and Operations

A. Standard of Learning: AII.1 The student will identify field properties, axioms of equality and inequality, and properties of order that are valid for the set of real numbers and its subsets, complex numbers, and matrices.

Builds On: Students begin working with properties in the grade 7 SOL and continue through the Algebra I SOL.

B. Standard of Learning: AII.2 The student will add, subtract, multiply, divide, and simplify rational expressions, including complex fractions.

Builds On: Students begin working with operations with fractions in the grade 3 SOL and continue through the Algebra I SOL.

A

1   If $q < 10$, which of the following statements is true?

A $q + 3 < 7$
B $q + 3 < 13$
C $4q > 40$
D $4q < 14$

2   Which of the following is an illustration of one of the associative properties?

F $(3x)y = y(3x)$

G $3a^2 + 0 = 3a^2$

H $2a(a - 2) = 2a^2 - 4a$

J $(2a + 1) + 2b = 2a + (1 + 2b)$

Instruction: Provide students an opportunity to identify the use of the addition property of inequality; and to identify illustrations of the associative property.

B

3   What is the product of the polynomials $(4c - 1)$ and $(3c + 5)$?

A $7c - 4$
B $12c^2 + 17c - 5$
C $12c^2 + 23c + 5$
D $7c^2 + 6c - 5$

4   $\dfrac{x^2 - 9}{x^2 - 6x + 9} =$

F $\dfrac{1}{6x}$

G $\dfrac{1}{x - 3}$

H $\dfrac{x + 3}{x - 3}$

J $\dfrac{x - 3}{x + 3}$

5   Which is equivalent to $\dfrac{\frac{1}{x} - \frac{4}{y}}{\frac{2}{x} + \frac{5}{y}}$?

A $\dfrac{x - 4y}{5x + 2y}$

B $\dfrac{y - 4x}{2y + 5x}$

C $\dfrac{x^2y^2}{(y - 4x)(2y + 5x)}$

D $2y^2 - 3xy - 20x^2$

Instruction: Provide students an opportunity to multiply binomials; to simplify a rational expression; and to simplify complex fractions.

Algebra II

A. Standard of Learning: AII.3 The student will

a) add, subtract, multiply, divide, and simplify radical expressions containing positive rational numbers and variables and expressions containing rational exponents.

Builds On: Students begin to work with radicals (square roots) in the grade 6 SOL and continue through the Geometry SOL.

> **A**
>
> 6 Which is equivalent to $2\sqrt{12} + 3\sqrt{3}$?
>
> F $16\frac{1}{2}$
>
> G $5\sqrt{15}$
>
> H $7\sqrt{3}$
>
> J $7\sqrt{6}$

Instruction: Provide students an opportunity to add radical expressions.

B. Standard of Learning: AII.3 The student will

b) write radical expressions as expressions containing rational exponents, and vice versa.

Builds On: Students begin to work with radicals (square roots) in the grade 6 SOL and continue through the Geometry SOL.

> **B**
>
> 7 Which is equivalent to $(\sqrt{5})^3$?
>
> A 5
>
> B $5^{\frac{1}{3}}$
>
> C $5^{\frac{2}{3}}$
>
> D $5^{\frac{3}{2}}$

Instruction: Provide students an opportunity to write a radical expression as an expression containing rational exponents.

Algebra II

A. Standard of Learning: AII.5 The student will identify and factor completely polynomials representing the difference of squares, perfect square trinomials, the sum and difference of cubes, and general trinomials.

Builds On: Students begin work with number factors in the grade 3 SOL and with polynomial factors in the Algebra I SOL.

> **A**
>
> 8   Which is a factor of $6a^2 + 5ab - 6b^2$?
>
> **F** $(2a + 3b)$
> **G** $(2a - 3b)$
> **H** $(3a + 2b)$
> **J** $(3a + 3b)$

Instruction: Provide students an opportunity to factor a trinomial with two variables and a leading coefficient greater than 1.

B. Standard of Learning: AII.17 The student will perform operations on complex numbers and express the results in simplest form. Simplifying results will involve using patterns of the powers of i.

Builds On: Students begin work with the operations on polynomials in the Algebra I SOL.

> **B**
>
> 9   Which is equivalent to $(4 - 2i)(5 + 3i)$?
>
> **A**   26
> **B**   12
> **C** $14 + 2i$
> **D** $26 + 2i$
>
> 10   Which expression is equivalent to $(6 + 2i) - (4 + 3i)$?
>
> **F** $2 - i$
> **G** $2 + i$
> **H** $2 + 5i$
> **J** $10 - i$

Instruction: Provide students an opportunity to multiply complex numbers and to subtract complex numbers.

Algebra II

Reporting Category: Relations and Functions

A. Standard of Learning: AII.8 The student will recognize multiple representations of functions (linear, quadratic, absolute value, step, and exponential functions) and convert between a graph, a table, and symbolic form. A transformational approach to graphing will be employed through the use of graphing calculators.

Builds On: Students begin to study relations and functions in the grade 7 SOL and progress through to a study of linear and quadratic functions in the Algebra I SOL.

B. Standard of Learning: AII.9 The student will find the domain, range, zeros and inverse of a function, the value of a function for a given element in its domain, and the composition of multiple functions. Functions will include those that have domains and ranges that are limited and/or discontinuous. The graphing calculator will be used as a tool to assist in investigation of functions, including exponential and logarithmic.

Builds On: Students begin to work with the terms domain and range in the grade 7 SOL and progress to finding the zeros of a function in the Algebra I SOL.

A

11

x	$f(x)$
⁻2	9
0	⁻1
2	⁻3

The table shows some elements of a function. Which equation is *most* likely a rule for the function?

A $f(x) = {}^-x - 1$
B $f(x) = 2x^2 - 1$
C $f(x) = x^2 - 2x - 1$
D $f(x) = x^2 - 3x - 1$

12

x	y
0	1
1	3
⁻1	$\frac{1}{3}$
2	9
⁻2	$\frac{1}{9}$
3	27
⁻3	$\frac{1}{27}$

Which function includes all the ordered pairs in the table?

F $y = 2x + 1$
G $y = 2x^2 + 1$
H $y = 3^x$
J $y = {}^-3^x$

Instruction: Provide students an opportunity to analyze a table of values and determine the rule of the function.

B

13 Which is a zero of the function $f(x) = 3x - 12$?

A ⁻12
B 0
C 3
D 4

14 If the domain of $f(x) = 2x^2 - 3$ is limited to {⁻3, ⁻1, 1, 3}, what is the range?

F {⁻21, ⁻5, ⁻1, 15}
G {⁻21, 15}
H {⁻1, 15}
J {1, 5, 15, 21}

15   $f(x) = x^2 - 2x$
     $g(x) = x - 3$

Which of the following expressions represents $g(f(x))$?

A $x^3 - 5x^2 + 6x$
B $x^2 - 2x - 3$
C $x^2 - 3x - 3$
D $x^2 - 8x + 9$

Instruction: Provide students an opportunity to find the zero of a linear function; to determine the range of a function when given the domain; and to find a composition of two functions.

Algebra II

A. Standard of Learning: AII.15 The student will recognize the general shape of polynomial functions, locate the zeros, sketch the graphs, and verify graphical solutions algebraically. The graphing calculator will be used as a tool to investigate the shape and behavior of polynomial functions.

Builds On: Students begin working with polynomial functions in the Algebra I SOL.

B. Standard of Learning: AII.16 The student will investigate and apply the properties of arithmetic and geometric sequences and series to solve problems, including writing the first n terms, finding the nth term, and evaluating summation formulas. Notation will include Σ (Sigma) and a_n.

Builds On: Students begin analyzing numeric and geometric patterns in the grade 4 SOL and progress in complexity through the Algebra I SOL.

A

16

Which is an apparent zero of the function shown?

F $^-4$
G $^-2$
H   0
J   2

17

This is a portion of the graph of a polynomial function. If written in order of descending powers, which could be the first term of the polynomial?

A x^2
B x^3
C x^4
D x^5

B

18   What is the sum of the series defined by $\sum_{n=0}^{4} (3 - 2n)$?

F $^-5$
G $^-3$
H $^-1$
J   0

19   Two geometric means between 2 and 54 are —

A   4 and 12
B   6 and 12
C   6 and 18
D $19\frac{1}{3}$ and $36\frac{2}{3}$

20   If $a_n = 2^{n-1}$, then $a_4 =$

F   15
G   8
H   7
J   6

Instruction: Provide students an opportunity to recognize the graph of a polynomial function; and to find the zero of a function on a graph.

Instruction: Provide students an opportunity to find the sum of a series written with Σ notation; to find two geometric means between two numbers; and to find the fourth term in a series.

A*lgebra II*

A. Standard of Learning: AII.20 The student will identify, create, and solve practical problems involving a combination of direct and inverse variations.

Builds On: Students begin working with direct and inverse variations in the Algebra I SOL.

> **A**
>
> 21 The time it takes to travel a given distance varies inversely as the average rate of travel. Averaging 42 miles per hour, it takes Andre 5 hours to drive to Donnegal. If it took him 4 hours and 20 minutes to reach Donnegal on his last trip, what was his average rate of travel?
>
> A 36.4 mi./hr
> B 46.7 mi./hr
> C 48.5 mi./hr
> D 49.4 mi./hr

Instruction: Provide students an opportunity to solve a distance problem involving inverse variation.

Reporting Category: Equations and Inequalities

B. Standard of Learning: AII.4 The student will solve absolute value equations and inequalities graphically and algebraically. Graphing calculators will be used both as a primary method of solution and to verify algebraic solutions.

Builds On: Students begin solving equations in the grade 6 SOL and solving inequalities in the grade 7 SOL and progress through the Algebra I SOL.
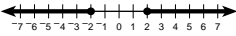
> **B**
>
> 22 Which is the solution to $|3x - 2| = 6$?
>
> F $\dfrac{-4}{3} \leq x \leq \dfrac{8}{3}$
>
> G $x = \dfrac{-4}{3}$ or $x = \dfrac{8}{3}$
>
> H $x = \dfrac{-8}{3}$ or $x = \dfrac{8}{3}$
>
> J $x \leq \dfrac{-4}{3}$ or $x \geq \dfrac{8}{3}$
>
> 23 (number line from $^-7$ to 7)
>
> Which of the following inequalities has the solution indicated on the number line above?
>
> A $|x| \leq 2$
> B $|x| \geq 2$
> C $|x - 2| \leq 4$
> D $|x + 2| \geq 0$

Instruction: Provide students an opportunity to solve absolute value equations; and to determine an absolute value inequality from a line graph.

A*lgebra II*

A. Standard of Learning: AII.6 The student will select, justify, and apply a technique to solve a quadratic equation over the set of complex numbers. Graphing calculators will be used for solving and confirming algebraic solutions.

Builds On: Students begin solving quadratic equations in the Algebra I SOL.

A

24 What is the solution set for $x^2 + 6x - 16 = 0$?

   F {0, 4}
   G {⁻8, 2}
   H {⁻3, 5}
   J {⁻2, 8}

26 Which is the solution set for $2x^2 + 2x + 1 = 0$?

   F $\left\{\pm\dfrac{1}{2}\right\}$

   G $\left\{\dfrac{-1}{2} \pm \dfrac{1}{2}i\right\}$

   H $\left\{\dfrac{-1}{2} \pm i\right\}$

   J {⁻1 ± *i*}

25 Which is the solution set for $x^2 - 4x = 8$?

   A {2 ± 2*i*}
   B {2 ± 2√3}
   C {4, 2}
   D {⁻4, 2}

Instruction: Provide students an opportunity to find the solution set for a quadratic equation; and to find the complex number solution set for quadratic equations.

Algebra II

A. Standard of Learning: AII.7 The student will solve equations containing rational expressions and equations containing radical expressions algebraically and graphically. Graphing calculators will be used for solving and confirming algebraic solutions.

Builds On: Students begin solving equations in the grade 6 SOL and progress through the Algebra I SOL.

A

27 A pendulum L inches in length takes t seconds to make one full cycle according to the equation

$$t = 2\pi\sqrt{\frac{L}{384}}$$

To the nearest hundredth, how many seconds would it take a pendulum 12 inches long to make one full cycle?

- **A** 0.01 sec
- **B** 0.20 sec
- **C** 1.11 sec
- **D** 35.53 sec

28 The length, s, (in feet) of the skid mark left by an automobile traveling at r miles per hour can be approximated by the relation $r = 2\sqrt{5s}$. If a car is going 80 miles per hour when the brakes are applied, about how many feet long would the skid mark be?

- **F** 320 ft
- **G** 410 ft
- **H** 640 ft
- **J** 1,280 ft

29 What value of y is the solution to the equation $\frac{4y - 10}{3} + \frac{6y + 8}{2} = 9$?

- **A** $y = \frac{28}{5}$
- **B** $y = \frac{25}{13}$
- **C** $y = \frac{8}{5}$
- **D** $y = \frac{23}{24}$

30 Which is the solution set for $\sqrt{x + 10} = 3\sqrt{2x + 3}$?

- **F** $\{1\}$
- **G** $\{^-1\}$
- **H** $\left\{\frac{1}{2}\right\}$
- **J** $\left\{\frac{1}{5}\right\}$

31 Which equation is *not* equivalent to $\frac{1}{3} - \frac{1}{12} = \frac{1}{x}$?

- **A** $4x - x = 12$
- **B** $\frac{3}{12} = \frac{1}{x}$
- **C** $4x - 12x = 12$
- **D** $\frac{x}{3} - \frac{x}{12} = 1$

Instruction: Provide students an opportunity to solve a problem with a formula containing a radical; to determine an equation equivalent to a rational equation; to solve a rational equation; and to solve a radical equation.
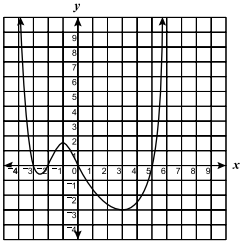
Algebra II

Reporting Category: Analytical Geometry

A. Standard of Learning: AII.10 The student will investigate and describe the relationships between the solution of an equation, zero of a function, x-intercept of a graph, and factors of a polynomial expression through the use of graphs.

Builds On: Students begin to study the solutions of an equation, zero of a function, x-intercept of a graph, and factors of a polynomial expression in the Algebra I SOL.

A

32

If the graph represents a polynomial $y = P(x)$, which is the apparent solution set for $P(x) = 0$?

F $\{^-3, ^-2, 0, 5\}$
G $\{^-2.5, ^-1, ^-3\}$
H $\{^-0.5, 1.5, 0, ^-3\}$
J $\{^-3, ^-2.5, ^-2, ^-1, 0, 3, 5\}$

33   Which is a zero of $f(x) = x^2 + x - 6$?

A $^-3$
B $^-2$
C 0
D 3

34   A certain third-degree polynomial function has zeros at $^-3$, 2, and 3. Which could *not* be a factor of the expression that defines the function?

F $x + 3$
G $x + 2$
H $x - 3$
J $x - 2$

Instruction: Provide students an opportunity to determine what is not a factor when given the zeros of a function; to find one zero of a quadratic equation; and to identify the solution set of a function from a graph.

Algebra II

A. Standard of Learning: AII.18 The student will identify conic sections (circle, ellipse, parabola, and hyperbola) from his/her equations. Given the equations in (h, k) form, students will sketch graphs of conic sections, using transformations.

Builds On: Students begin to relate equations and graphs in the grade 8 SOL and continue through the Algebra I SOL.

A

35 For a new design, a furniture company projects its profits on the sale of n chairs using the equation $p(n) = 6n^2 + 8n - 4{,}000$. Which form would a graph of the function have?

A   A line
B   A parabola
C   An ellipse
D   A hyperbola

36 Which could be the graph of $\frac{(x-2)^2}{16} + \frac{(y+3)^2}{9} = 1$?

F

G

H

J

37 When graphed, which of the following equations would produce a hyperbola?

A $x + y = 8$
B $x^2 - y^2 = 8$
C $y = x^2 + 8$
D $x^2 + y^2 = 8$
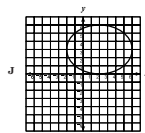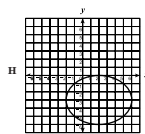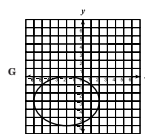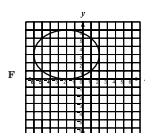
Instruction: Provide students with an opportunity to identify what conic section is formed by a given equation; to identify an ellipse based on the equation; and to choose an equation when told the type of graph.

A*lgebra II*

Reporting Category: Systems of Equations/Inequalities

A. Standard of Learning: AII.11 The student will use matrix multiplication to solve practical problems. Graphing calculators or computer programs with matrix capabilities will be used to find the product.

Builds On: Students begin to work with matrices in the grade 8 SOL and perform operations with matrices in the Algebra I SOL.

A

38

Richmond

Charlottesville

Virginia Beach

The matrix D_{tf} shows the number of non-stop daily flights between three cities as shown in the directed graph above.

$$\begin{array}{c} \quad \begin{array}{ccc} & \text{To} & \\ \text{C} & \text{R} & \text{V} \end{array} \\ \text{From} \begin{array}{c} \text{C} \\ \text{R} \\ \text{V} \end{array} \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 0 & 1 & 0 \end{bmatrix} = D_{tf} \end{array}$$

Squaring this matrix gives the number of 1-stop routes between these three cities. Which matrix shows the number of possible 1-stop routes?

F $\begin{bmatrix} 0 & 2 & 2 \\ 2 & 0 & 4 \\ 0 & 2 & 0 \end{bmatrix}$

G $\begin{bmatrix} 2 & 2 & 1 \\ 2 & 5 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

H $\begin{bmatrix} 1 & 1 & 2 \\ 0 & 3 & 1 \\ 1 & 0 & 2 \end{bmatrix}$

J $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 4 \\ 0 & 1 & 0 \end{bmatrix}$

39 $Q = [^-1 \quad ^-3]$

$R = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Which matrix is the product $Q \cdot R$?

A $[^-5]$

B $[^-6]$

C $[^-2 \quad ^-3]$

D $\begin{bmatrix} ^-2 & ^-6 \\ ^-1 & ^-3 \end{bmatrix}$

Instruction: Provide students an opportunity to find the product matrix when given two matrices; and to square a matrix.

Algebra II

End of Course

A. Standard of Learning: AII.12 The student will represent problem situations with a system of linear equations and solve the system using the inverse matrix method. Graphing calculators or computer programs with matrix capability will be used to perform computations.

Builds On: Students begin to work with matrices in the grade 8 SOL and perform operations with matrices in the Algebra I SOL.

A

40 If $\begin{cases} x + y = 1 \\ 2y + z = 3 \\ x + y - z = 4 \end{cases}$ then $\begin{bmatrix} x \\ y \\ z \end{bmatrix} =$

F $\begin{bmatrix} -2 \\ 3 \\ -3 \end{bmatrix}$

G $\begin{bmatrix} 4 \\ 10 \\ 0 \end{bmatrix}$

H $\begin{bmatrix} \frac{3}{2} & -\frac{1}{2} & 0 \\ 0 & 1 & \frac{1}{2} \\ 1 & 0 & 1 \end{bmatrix}$

J $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 6 & 3 \\ 4 & 4 & -4 \end{bmatrix}$

41 If $A = \begin{bmatrix} 7 & 4 \\ 3 & 2 \end{bmatrix}$, then the matrix $A^{-1} =$

A $\begin{bmatrix} 0.143 & 0 \\ 0 & 0.5 \end{bmatrix}$

B $\begin{bmatrix} 1 & -2 \\ -1.5 & 3.5 \end{bmatrix}$

C $\begin{bmatrix} 7 & -4 \\ 3 & -2 \end{bmatrix}$

D $\begin{bmatrix} -7 & -4 \\ -3 & -2 \end{bmatrix}$

Instruction: Provide students an opportunity to find the inverse of a matrix; and to find the solution matrix for a system of three linear equations.

A*lgebra II*

A. Standard of Learning: AII.13 The student will solve systems of linear inequalities and linear programming problems and describe the results both orally and in writing. A graphing calculator will be used to facilitate solutions to linear programming problems.

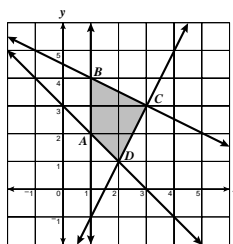**Builds On:** Students begin working with systems of equations in the Algebra I SOL.

A

42 Which graph shows a solution to the following system?

$$\begin{cases} y \le 3 \\ 3y \ge x + 6 \\ 2x + y \ge {}^-4 \end{cases}$$

F

G

H

J
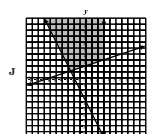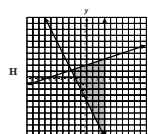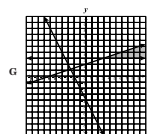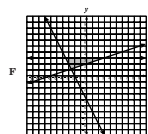
43

This graph of a linear programming model consists of polygon *ABCD* and its interior. Under these constraints, at which point does the *minimum* value of $3x - 2y$ occur?

A *A*
B *B*
C *C*
D *D*

Instruction: Provide students an opportunity to determine the minimum value of a linear programming model's graph; and to graph a system of linear inequalities.

End of Course

Algebra II

A. Standard of Learning: AII.14 The student will solve nonlinear systems of equations, including linear-quadratic and quadratic-quadratic, algebraically and graphically. The graphing calculator will be used as a tool to visualize graphs and predict the number of solutions.

Builds On: Students begin working with graphs of liens in the grade 8 SOL and with graphs of quadratics in the Algebra I SOL.
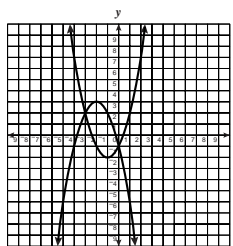

A

44 What is the solution set to the following system of equations?

$$\begin{cases} y + 2x = 2 \\ x^2 + 3y = 22 \end{cases}$$

F {(−8, 18) and (2, −2)}
G {(−8, 2) and (18, −2)}
H {(−2, 2) and (18, −8)}
J {(8, −14) and (−2, 6)}

45

This is a portion of the graph of a system of equations. Which is *most* likely the solution set for the system?

A {(0, −1), (−3, 2)}
B {(−1, 2), (−2, 3)}
C {(1, 2), (2, 7)}
D {(−3.7, 0), (0.4, 0)}

Instruction: Provide students an opportunity to identify the solution set for a system of quadratic-quadratic equations from a graph; and to solve a system of linear-quadratic equations.

Algebra II

Reporting Category: Statistical Analysis

A. Standard of Learning: AII.19 The student will collect and analyze data to make predictions, write equations, and solve practical problems. Graphing calculators will be used to investigate scatterplots to determine the equation for a curve of best fit.

Builds On: Students begin to collect, analyze data, and make predictions based on the data in the grade 2 SOL and progress to an investigation of scatterplots in the Algebra I SOL.

A

46 In 1940 the life expectancy at birth in the general public was 62.9 years. By 1980 it had risen to 73.7 years. Assuming a linear relation, which is the *best* prediction of life expectancy in the year 2000?

F 76.4
G 79.1
H 79.9
J 84.5

**47** Whammy cereal comes in several different size boxes. The chart shows some sizes and the cost of each.

Ounces	6	8	16	32
Price	$2.20	$2.80	$5.22	$9.98

One box sells for $3.69. To the nearest ounce, how many ounces does it contain?

A 10
B 11
C 12
D 13

48 The chart shows city real estate taxes paid by four families and the assessed value of their homes.

Family	Hardy	Jacobs	Rosinni	Martinez
Value	$50,000	$80,000	$100,000	$150,000
Taxes	$1,100	$2,000	$2,600	$4,100

The Morgan family's house has an assessed value of $90,000. How much city real estate tax should they expect to pay?

F $1,900
G $2,250
H $2,300
J $2,400

49
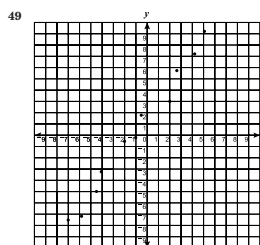
Which equation *most* closely fits the data in this scatterplot?

A $3y = 4x - 2$

B $3y - 6 = 4x$

C $y = 2 - \dfrac{3x}{4}$

D $3y + 4x = 6$

50 Matt made a scatterplot comparing the mathematics scores of ten classmates with their history scores.
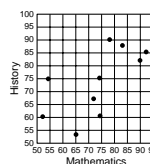
Kelly had a mathematics score of 85. Using a line of best fit, which is the *best* prediction for her history score?

F Between 60 and 65
G Between 70 and 75
H Between 80 and 85
J Between 90 and 95

Instruction: Provide students an opportunity to predict a value from the graph of a scatterplot based on a line of best fit; to solve a practical problem using the line of best fit; to use a table of values to predict an amount; and to identify an equation for a scatterplot graph.

Correct Answers

ALGEBRA II TEST

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