Student Name _____

Teacher Name _____

School _____

System _____

ALGEBRA I

ITEM SAMPLER

Tennessee End of Course Assessment
Algebra I

PEARSON

Mathematics Reference Page

Abbreviations for Geometric Formulas

A = area	d = diameter	r = radius
B = area of base	h = height	s = length of side
b = base	ℓ = length	V = volume
C = circumference	P = perimeter	w = width

Perimeter (P) and Circumference (C)

Any Polygon: P = sum of side lengths

Rectangle: $P = 2\ell + 2w$

Circle: $C = 2\pi r$ or πd

$\pi \approx 3.14$ or $\dfrac{22}{7}$

Plane Figures — Area (A)

Triangle: $A = \dfrac{1}{2}bh$

Rectangle: $A = \ell w$

Circle: $A = \pi r^2$

$\pi \approx 3.14$ or $\dfrac{22}{7}$

Solid Figures — Volume (V)

Right Rectangular Prism: $V = Bh$ or $V = \ell w h$

Cube: $V = s^3$

Algebraic Formulas and Equations

$d = rt$ distance = rate × time

Distance Formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

d = distance between two points

Midpoint Formula: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$

Slope Formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Standard Form of a Linear Equation: $Ax + By = C$

Slope-Intercept Equation: $y = mx + b$

Point-Slope Equation: $y - y_1 = m(x - x_1)$

Pythagorean Theorem: $a^2 + b^2 = c^2$

Quadratics

For $ax^2 + bx + c = 0$: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant: $b^2 - 4ac$

Measurement Conversions

LENGTH

1 foot (ft) = 12 inches (in.)
1 yard (yd) = 3 feet
1 yard = 36 inches
1 mile = 1,760 yards
1 mile = 5,280 feet

CAPACITY

1 cup (c) = 8 fluid ounces (fl oz)
1 pint (pt) = 2 cups
1 quart (qt) = 2 pints
1 quart = 4 cups
1 gallon (gal) = 4 quarts

WEIGHT

1 pound (lb) = 16 ounces (oz)
1 ton (T) = 2,000 pounds

CONVERSION BETWEEN CUSTOMARY AND METRIC MEASUREMENT

1 yard = 0.9144 m
1 foot = 0.3048 m
1 inch = 2.54 cm
1 quart = 0.946 L
1 ounce = 28.35 g
1 lb = 0.45 kg

Contents

Introduction to Algebra I

Content of tests

The testing program titled the *Tennessee End of Course Assessment* was established to meet the Tennessee mandate for end of course assessments in Tennessee secondary schools. These tests measure the Tennessee Performance Indicators. Subject areas covered by the testing program include Mathematics, Language Arts, History, and Science.

Test development

For the *Tennessee End of Course Assessment*, a staff of writers—composed of both teachers and professional test developers experienced in each of the content areas—researched and wrote the items. Professional editors and content specialists carefully reviewed all items and test directions for content and accuracy. To provide a large pool of items for final test selection, the test developers created approximately twice as many items as were needed in the final editions of the tests.

After tryout tests were administered, student responses were analyzed. Professional content editors and researchers carefully reviewed items, their data, and test directions for content, suitability, and accuracy before including particular items and test directions in operational tests.

Test administration

Tennessee End of Course Assessments are given to students as they near the end of courses that are included in the program. Tests may be given midyear for block schedules or near the end of the school year.

Each test contains 65 multiple-choice questions.

Students will have ample time to read and answer each of the questions. The Algebra I test has been designed to be administered in one session and is not timed.

Calculator use is optional. Sharing calculators during testing is not permitted.

The following types of calculators/devices may **NOT** be used during the test:

- pocket organizers

- electronic writing pads or input devices

- Some examples of prohibited calculators are:

  ○ Casio models: CFX-9970G, Algebra FX 2.0

  ○ Hewlett-Packard models: HP-40G, HP-49G

  ○ Texas Instruments models: TI-89, TI-92, Voyage 200, TI-NSPIRE - the CAS version (The non-CAS version of TI-NSPIRE is allowable.)

- calculators that can communicate (transfer data or information) wirelessly with other student calculators/devices

- cell phones, PSPs, and/or iPods

Students may use any four-function, scientific, or graphing calculator that does not have any of the above features. The use of units that have a Computer Algebra System (CAS) is NOT allowed.

Tips for Taking the Test

Preparing for the test

- Review this Tennessee End of Course Item Sampler for Algebra I carefully and thoroughly.
- Acquire a Tennessee End of Course Practice Test for Algebra I, and take the test several times.
- Become familiar with the correct way to mark answers on the answer sheet. There is a sample answer sheet in the Practice Test.

Before the test

- Get a good night's sleep. To do your best, you need to be rested.

During the test

- Relax. It is normal to be somewhat nervous before the test. Try to relax and not worry.
- Listen. Listen to and read the test directions carefully. Ask for an explanation of the directions if you do not understand them.
- Plan your time. Do not spend too much time on any one question. If a question seems to take too long, skip it and return to it later. Answer all questions you are sure of first.
- Think. If you are not sure how to answer a question, read it again and try your best to answer the question. Rule out answer choices that you know are incorrect and choose from those that remain.

Directions for Using the Item Sampler

This Item Sampler for Algebra I provides specific information to students and teachers. It contains examples of different item types for each Performance Indicator that may be tested in any given end of course test administration. Performance Indicators have been grouped under Reporting Categories. These Reporting Categories will be used to report information regarding performance on the end of course tests to students, teachers, schools, and systems.

The items in this Item Sampler will not be found in the end of course tests. The number of items in this Item Sampler does not reflect the emphasis of content on the test. In order to identify the emphasis of content, the End of Course Assessment Practice Test for Algebra I should be used. The Practice Test gives a better representation of content emphasis across Reporting Categories and Performance Indicators.

An Answer Key is located on Page 31. Use it to check your answers. Review items that you get wrong.

Reporting Category: Mathematical Processes
Numbers 1 through 6

Performance Indicator: Interpret patterns found in sequences, tables, and other forms of quantitative information using variables or function notation.

1   Which function best represents the data shown in the table?

Shirt Cost

Number of Shirts, x	Total Cost, $f(x)$
1	11
2	20
3	29
4	38
5	47

A $f(x) = 9x$
B $f(x) = x + 9$
C $f(x) = 9x + 2$
D $f(x) = 2x + 9$

GM040008

Performance Indicator: Write an equation symbolically to express a contextual problem.

2   To calculate her target heart rate, Shayla subtracts her age, a, from 220 and then takes 70% of the difference. Which equation should Shayla use to calculate r, her target heart rate?

F $r = 0.7(a - 220)$
G $r = 0.7(220 - a)$
H $r = 0.7(220) - a$
J $r = 220 - 0.7(a)$

GM040094

Go On ▶

Performance Indicator: Apply properties to evaluate expressions, simplify expressions, and justify solutions to problems.

3 Simplify:

$$2(7x - 2y) + 6x - 7(x - 3y)$$

A $8x - y$

B $8x - 7y$

C $13x + 25y$

D $13x + 17y$

GM040009

Performance Indicator: Translate between representations of functions that depict real-world situations.

4 An airport taxi service can take passengers to three different locations. The costs are summarized in this table:

Airport Taxi Cost

Location	Distance (miles)	Cost
Business District	3	$10
Tourist District	4	$12
City Center	6	$16

Which equation correctly expresses the relationship between the cost, *c*, and the distance, *d*, of a taxi ride?

F $c = 3d - 2$

G $c = 3d + 1$

H $c = 2d - 4$

J $c = 2d + 4$

GM040096

Go On ▶

Performance Indicator: Recognize and express the effect of changing constants and/or coefficients in problem solving.

5 The total number of miles Raul runs, R, including a 0.5-mile warm-up, is given by the equation $R = 6t + 0.5$. The total number of miles Ben runs, B, including a 0.25-mile warm-up, is given by the equation $B = 5t + 0.25$. If t represents the time in hours after each runner's warm-up, which statement <u>best</u> compares Raul's speed to Ben's speed?

A Raul's speed is 1 mile per hour faster than Ben's.

B Raul's speed is 3 miles per hour faster than Ben's.

C Raul's speed is 1 mile per hour slower than Ben's.

D Raul's speed is 3 miles per hour slower than Ben's.

GM040119

Performance Indicator: Determine and interpret slope in multiple contexts including rate of change in real-world problems.

6 Richard works at an appliance store. The equation $y = 25x + 56$ represents his daily earnings, y, based on selling x appliances. What is represented by the slope in this equation?

F the total amount of money Richard earns each day

G the total number of appliances Richard sells each day

H the amount of money Richard earns if he sells no appliances

J the amount of money Richard earns for each appliance he sells

GM040015

Go On ▶

Reporting Category: Number and Operations
Numbers 7 through 9

Performance Indicator: Operate (add, subtract, multiply, divide, simplify, powers) with radicals and radical expressions including radicands involving rational numbers and algebraic expressions.

7   If the value of the variable y is positive, what is the sum of $5\sqrt{2y}$ and $\sqrt{2y}$?

     A $5\sqrt{2y}$
     B $6\sqrt{2y}$
     C $5\sqrt{4y}$
     D $6\sqrt{4y}$

     GM040054

Performance Indicator: Multiply, divide, and square numbers expressed in scientific notation.

8   A light-year is about 9.46×10^{12} kilometers. The Andromeda galaxy is about 2.0×10^{6} light-years from Earth. How many kilometers is the Andromeda galaxy from Earth?

     F 1.892×10^{19}
     G 1.892×10^{18}
     H 1.146×10^{19}
     J 1.146×10^{18}

     GM040104

Performance Indicator: Describe and/or order a given set of real numbers including both rational and irrational numbers.

9   Which list shows the numbers arranged from greatest to least?
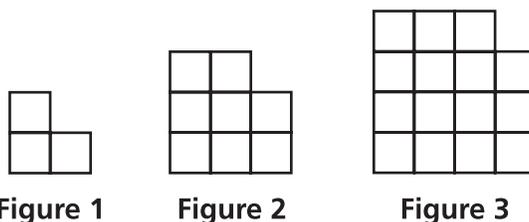
     A $\sqrt{11}$, 4.1, 4.065, 2.5
     B   4.1, 4.065, $\sqrt{11}$, 2.5
     C $\sqrt{11}$, 4.065, 4.1, 2.5
     D   4.1, 4.065, 2.5, $\sqrt{11}$

     GM040219

Go On ▶

Reporting Category: Algebra

Numbers 10 through 20

Performance Indicator: Express a generalization of a pattern in various representations including algebraic and function notation.

10 The first 3 figures in a pattern are shown.

Figure 1   Figure 2   Figure 3

☐ = 1 small square

Which function represents $f(n)$, the number of small squares in figure n?
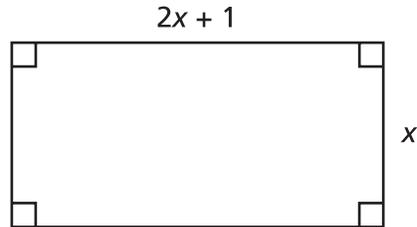
F $f(n) = n^2 - 1$

G $f(n) = 2n^2 + 1$

H $f(n) = (n + 1)^2 + 1$

J $f(n) = (n + 1)^2 - 1$

GM040156

Go On ▶

Performance Indicator: Operate with polynomials and simplify results.

11 The length and width of a rectangular garden are represented in the figure shown.

$$2x + 1$$

$$x$$

$$A = \ell w$$

Which equation represents the area (*A*) of the garden in terms of *x*?

A　$A = 2x^2 + 1$

B　$A = 2x^2 + x$

C　$A = 4x^2 + 4x + 1$

D　$A = 4x^3 + 4x^2 + x$

GM040306

Performance Indicator: Factor polynomials.

12 **Factor:** $x^3 + 3x^2 + 2x + 6$

F　$x(x^2 + 3x + 8)$

G　$x(x^2 + 3x + 2)$

H　$(x + 3)(x^2 + 2)$

J　$(x + 2)(x^2 + 3)$

GM040130

Go On ▶

Performance Indicator: Operate with, evaluate, and simplify rational expressions including determining restrictions on the domain of the variables.

13 Simplify $\dfrac{x^2 + 4x - 5}{x^2 - 5x + 6} \bullet \dfrac{x^2 - x - 6}{x^2 - 6x + 5}$ for all values of x for which the expression is defined.

A -1

B 1

C $\dfrac{x^2 + 7x + 10}{x^2 - 7x + 10}$

D $\dfrac{x^2 - 7x + 10}{x^2 + 7x + 10}$

GM040184

Go On ▶

Performance Indicator: Write and/or solve linear equations, inequalities, and compound inequalities including those containing absolute value.

14 Which statement represents the solution to this compound inequality?

$$-6x - 5 \leq -15 \text{ or } -3x + 28 \geq 52$$

F $\quad -8 \leq x \leq 1\frac{2}{3}$
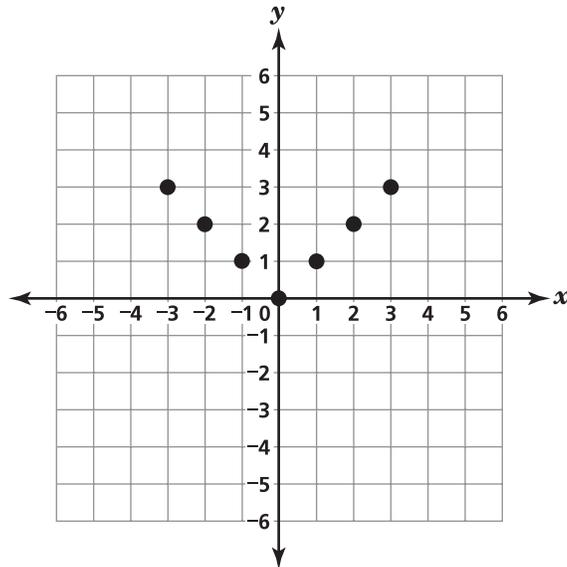
G $\quad -26\frac{2}{3} \leq x \leq 3\frac{1}{3}$

H $\quad x \leq -8 \text{ or } x \geq 1\frac{2}{3}$

J $\quad x \leq -26\frac{2}{3} \text{ or } x \geq 3\frac{1}{3}$

GM040237

Go On ▶

Performance Indicator: Interpret various relations in multiple representations.

15 Observe the relation.

Which is <u>not</u> an equivalent representation for this relation for the set of integers?

A $y = x^2$

B $\{(-3, 3), (-2, 2), (-1, 1), (0, 0), (1, 1), (2, 2), (3, 3)\}$

C
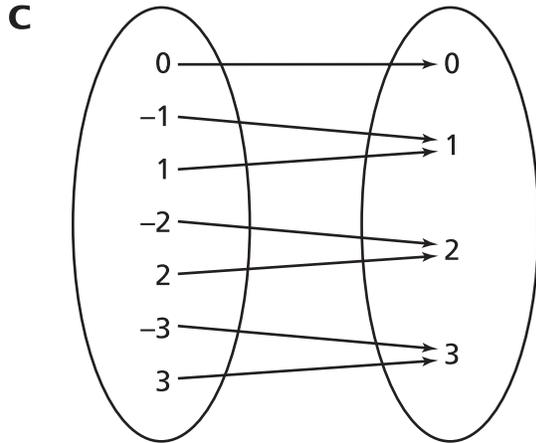
D

x	y
0	0
−1	1
1	1
−2	2
2	2
−3	3
3	3

GM040284

Go On ▶

Performance Indicator: Determine domain and range of a relation, determine whether a relation is a function and/or evaluate a function at a specified rational value.

16 The height, h, in feet, of an object t seconds after it is dropped from the roof of a building 100 feet high is represented by the function $h(t) = 100 - 16t^2$. What is the height of a ball 1.5 seconds after being dropped from the roof of this building?

    F   24 feet

    G   64 feet

    H   76 feet

    J   84 feet

GM040290

Performance Indicator: Determine the equation of a line and/or graph a linear equation.

17 Which equation <u>best</u> represents the graph of the line?
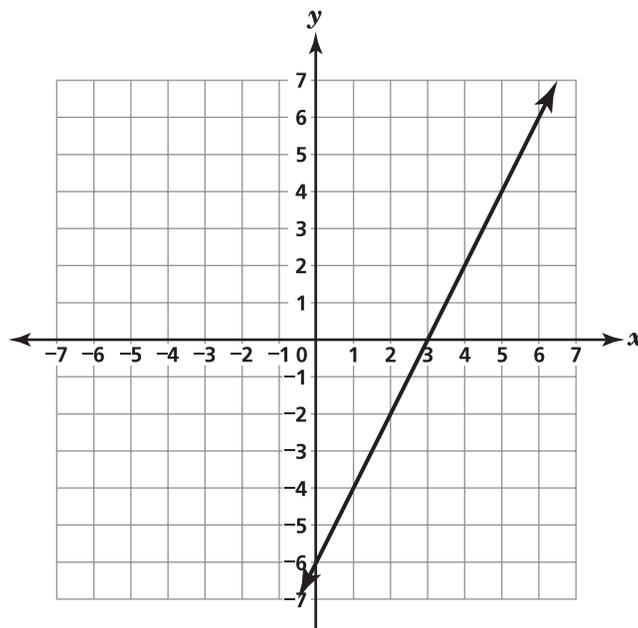
    A $2x - y = 6$

    B $2x + y = 6$

    C $6x + y = 3$

    D $3x - 6y = 0$

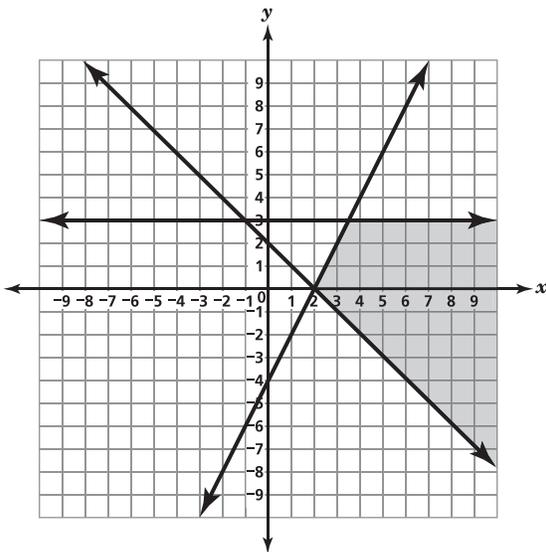GM040151

Go On ▶

Performance Indicator: Solve systems of linear equations/inequalities in two variables.

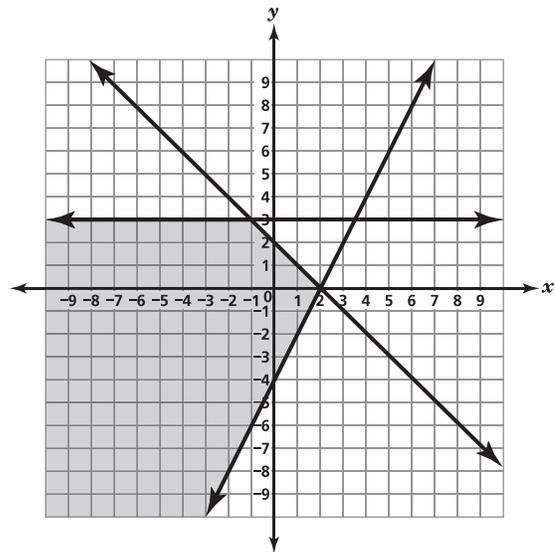**18** Which graph <u>best</u> represents the solution to the system of linear inequalities?
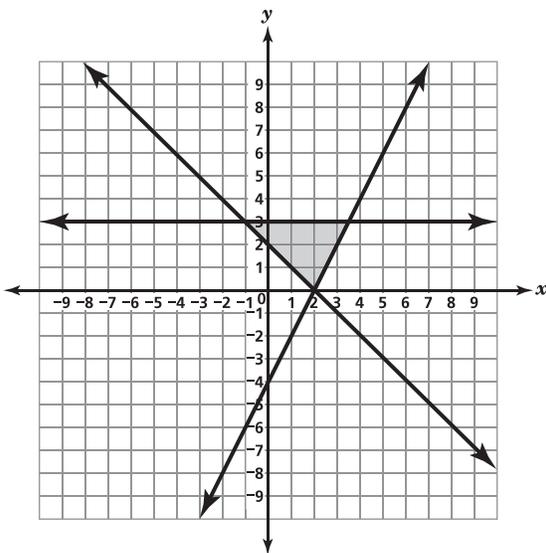
$$4x - 2y \leq 8$$
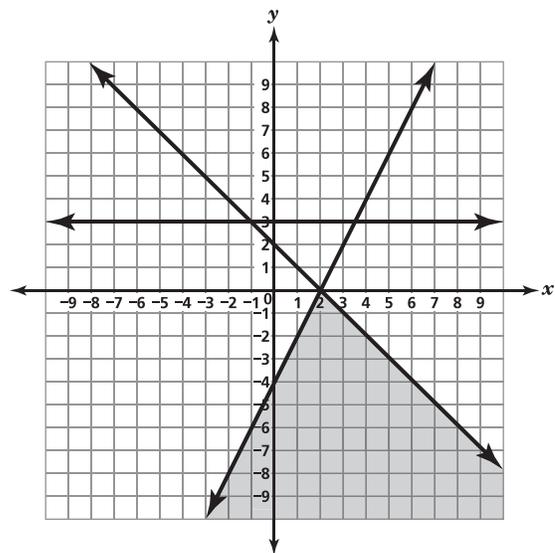$$x + y \geq 2$$
$$y \leq 3$$

F

H

G

J

Performance Indicator: Find the solution of a quadratic equation and/or zeros of a quadratic function.

19 **Solve:** $x^2 + 15 = -10x - 10$

A $x = 5$

B $x = -5$

C $x = \sqrt{15}$

D $x = -\sqrt{15}$

GM040030

Performance Indicator: Analyze nonlinear graphs including quadratic and exponential functions that model a contextual situation.

20 A model rocket is launched from the ground after a 3-second countdown. The vertical distance, d, in meters, of the rocket as it travels over time, t, in seconds, is represented by the parabola shown.

Model Rocket
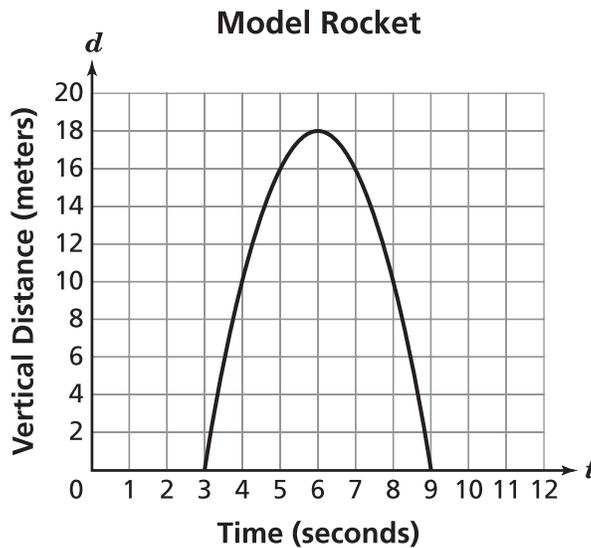
Once the rocket has traveled for 1.25 seconds, in how many more seconds does it return to the same vertical distance?
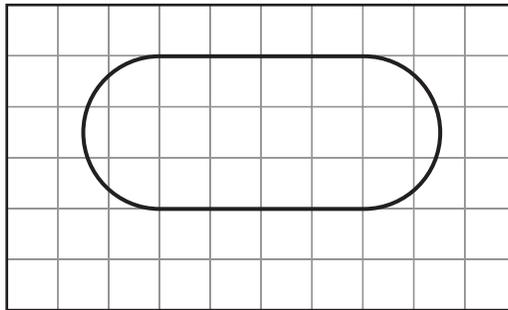
F 1.75

G 3.00

H 3.50

J 6.50

GM040274

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Reporting Category: **Geometry and Measurement**
Numbers 21 through 24

Performance Indicator: Develop and apply strategies to estimate the area of any shape on a plane grid.

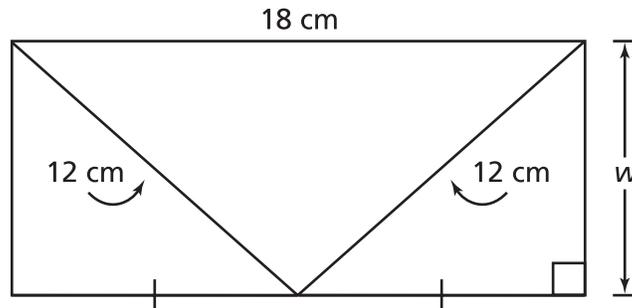**21**   Which is closest to the area of the figure?

☐ = 1 square unit

A   7 square units
B   12 square units
C   19 square units
D   21 square units

GM040031

Go On ▶

Performance Indicator: Solve contextual problems using the Pythagorean Theorem.

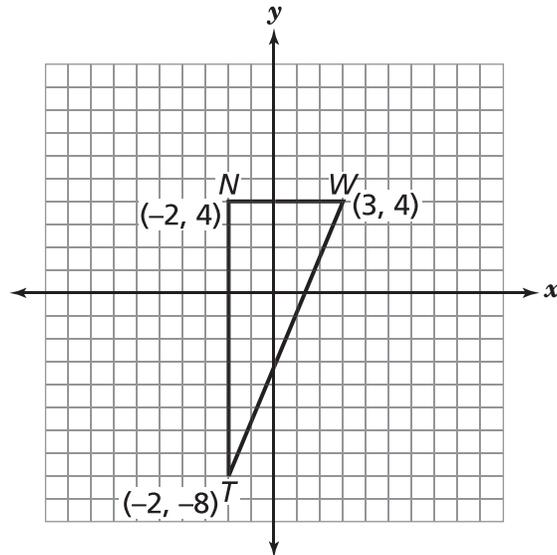**22** Andrew designed a rectangular envelope using the measurements shown.

18 cm

12 cm   12 cm w

What is w, the width of the envelope, in centimeters (cm)?

F $3\sqrt{7}$
G $6\sqrt{5}$
H $6\sqrt{13}$
J $12\sqrt{2}$

GM040076

Go On ▶

Performance Indicator: Solve problems involving the distance between points or midpoint of a segment.

23   Which value is closest to the perimeter of △*NWT*, in units?

A   13

B   17

C   21

D   30

GM040244

Performance Indicator: Convert rates and measurements.

24   One type of fabric regularly costs $6.99 per yard. When the fabric is on sale, it costs $4.89 per yard. Which is closest to the difference in the cost per inch for the fabric when it is on sale compared to its regular price?

F   5.8 cents per inch

G   11.7 cents per inch

H   13.6 cents per inch

J   17.5 cents per inch

GM040167

Go On ▶

Reporting Category: Data Analysis, Statistics, and Probability
Numbers 25 through 29

Performance Indicator: Interpret displays of data to answer questions about the data set(s) (e.g., identify pattern, trends, and/or outliers in a data set).

25 A total of 200 votes were cast in an election. The circle graph shows the percentage of votes received by each candidate running for class president.

Election Results
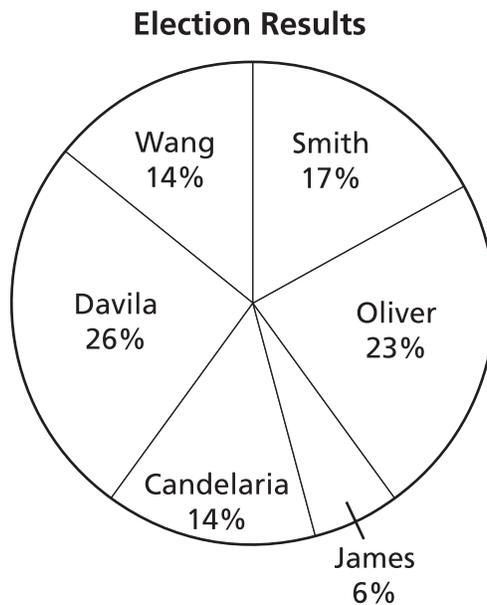
Which statement is <u>not</u> supported by the data in the graph?

A   Davila wins the election with 26 votes.

B   James has less than half the number of votes as Candelaria.

C   Almost half of the votes went to Davila and Oliver combined.

D   Smith and James combined have the same number of votes as Oliver.

GM040246

Go On ▶

Performance Indicator: Identify the effect on mean, median, mode, and range when values in the data set are changed.

26 The range of a data set is 12. Every value in the data set is multiplied by 3 to create a new data set. What is the range of the new data set?
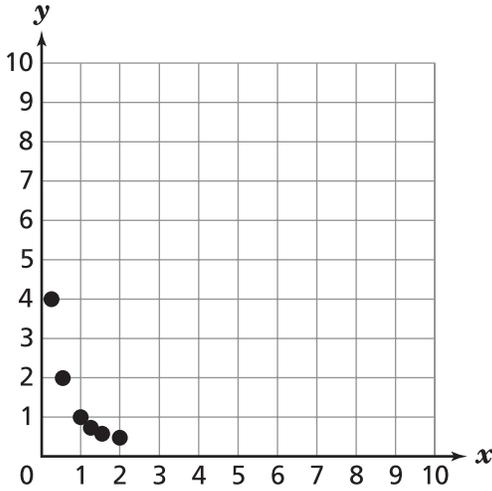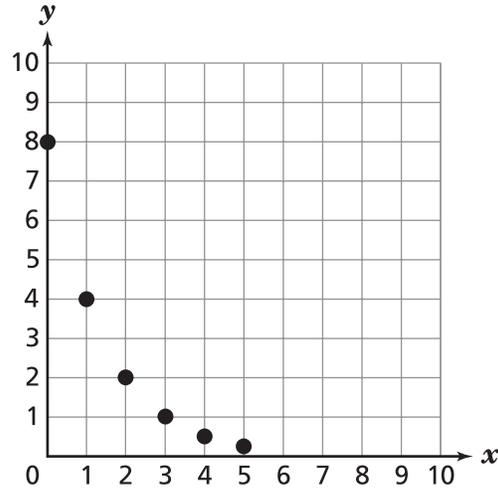
F   4

G   15

H   27

J   36

GM040295

Go On ▶

Performance Indicator: Using a scatterplot, determine if a linear relationship exists and describe the association between variables.
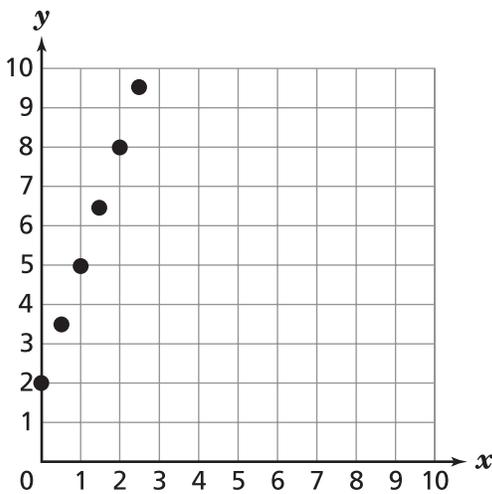
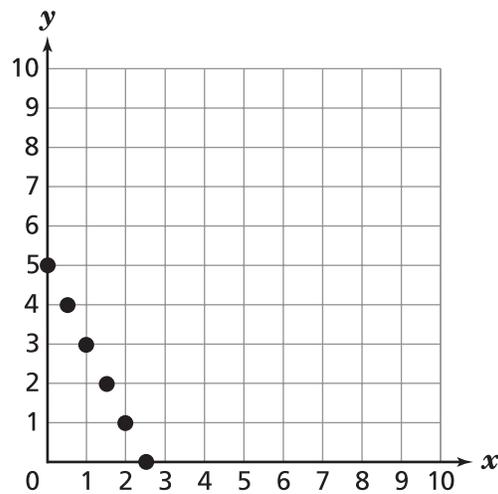**27** Which scatterplot shows a negative linear relationship between the variables *x* and *y*?

A

C

B

D

GM040311

Go On ▶

Performance Indicator: Generate the equation of a line that fits linear data and use it to make a prediction.

28 A relationship between t, the winning time for the men's 100-meter run in the Olympic Games, and y, the number of years after 1900, is shown in the table.

100-Meter Run Results

Year of Olympic Games	Years after 1900, y	Winning Time, t (in seconds)
1900	0	11.0
1912	12	10.8
1924	24	10.6
1936	36	10.3
1948	48	10.3
1960	60	10.2
1972	72	10.14
1984	84	9.99
1996	96	9.84

If the trend continues, which is the best prediction for the winning time, in seconds, for the 100-meter run in the 2020 Olympics?

F 8.94

G 9.30

H 9.54

J 9.82

GM040144

Go On ▶

Performance Indicator: Determine theoretical and/or experimental probability of an event and/or its complement including using relative frequency.

29 The names of 17 high school students are written on same-size pieces of paper and placed in a hat for a drawing. Eight of the students whose names are placed in the hat are seniors, four are juniors, and five are sophomores.

What is the probability that the first slip of paper drawn from the hat does <u>not</u> have the name of a sophomore student written on it?

A $\dfrac{5}{17}$

B $\dfrac{8}{17}$

C $\dfrac{12}{17}$

D $\dfrac{13}{17}$

GM040251

STOP

Reporting Category 1: Mathematical Processes

Item Number	Correct Answer	Performance Indicator
1	C	3102.1.1 Interpret patterns found in sequences, tables, and other forms of quantitative information using variables or function notation.
2	G	3102.1.2 Write an equation symbolically to express a contextual problem.
3	D	3102.1.3 Apply properties to evaluate expressions, simplify expressions, and justify solutions to problems.
4	J	3102.1.4 Translate between representations of functions that depict real-world situations.
5	A	3102.1.5 Recognize and express the effect of changing constants and/or coefficients in problem solving.
6	J	3102.1.6 Determine and interpret slope in multiple contexts including rate of change in real-world problems.

Reporting Category 2: Number and Operations

Item Number	Correct Answer	Performance Indicator
7	B	3102.2.1 Operate (add, subtract, multiply, divide, simplify, powers) with radicals and radical expressions including radicands involving rational numbers and algebraic expressions.
8	F	3102.2.2 Multiply, divide, and square numbers expressed in scientific notation.
9	B	3102.2.3 Describe and/or order a given set of real numbers including both rational and irrational numbers.

Reporting Category 3: Algebra

Item Number	Correct Answer	Performance Indicator
10	J	3102.3.1 Express a generalization of a pattern in various representations including algebraic and function notation.
11	B	3102.3.2 Operate with polynomials and simplify results.
12	H	3102.3.3 Factor polynomials.
13	C	3102.3.4 Operate with, evaluate, and simplify rational expressions including determining restrictions on the domain of the variables.
14	H	3102.3.5 Write and/or solve linear equations, inequalities, and compound inequalities including those containing absolute value.
15	A	3102.3.6 Interpret various relations in multiple representations.
16	G	3102.3.7 Determine domain and range of a relation, determine whether a relation is a function and/or evaluate a function at a specified rational value.
17	A	3102.3.8 Determine the equation of a line and/or graph a linear equation.
18	G	3102.3.9 Solve systems of linear equations/inequalities in two variables.
19	B	3102.3.10 Find the solution of a quadratic equation and/or zeros of a quadratic function.
20	H	3102.3.11 Analyze nonlinear graphs including quadratic and exponential functions that model a contextual situation.

Reporting Category 4: Geometry and Measurement

Item Number	Correct Answer	Performance Indicator
21	C	3102.4.1 Develop and apply strategies to estimate the area of any shape on a plane grid.
22	F	3102.4.2 Solve contextual problems using the Pythagorean Theorem.
23	D	3102.4.3 Solve problems involving the distance between points or midpoint of a segment.
24	F	3102.4.4 Convert rates and measurements.

Reporting Category 5: Data Analysis, Statistics, and Probability

Item Number	Correct Answer	Performance Indicator
25	A	3102.5.1 Interpret displays of data to answer questions about the data set(s) (e.g., identify pattern, trends, and/or outliers in a data set).
26	J	3102.5.2 Identify the effect on mean, median, mode, and range when values in the data set are changed.
27	D	3102.5.3 Using a scatterplot, determine if a linear relationship exists and describe the association between variables.
28	H	3102.5.4 Generate the equation of a line that fits linear data and use it to make a prediction.
29	C	3102.5.5 Determine theoretical and/or experimental probability of an event and/or its complement including using relative frequency.