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INTRODUCTION

This bulletin provides specific information about the *Alabama High School Graduation Exam*, Third Edition (AHSGE). Educators representing each state school board district as well as both city and county school systems served on the committees that determined the standards and objectives; determined the eligible content for the test; and reviewed, revised, and approved the actual items.

The standards and objectives for the AHSGE are also found in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for the Alabama High School Graduation Exam*, Bulletin 1997, No. 16, and *Standards and Objectives (Social Studies) for the Alabama High School Graduation Exam*, Bulletin 1998, No. 13. The standards and objectives for mathematics are specifically referenced in this document.

Teachers must be familiar with this document if they teach content that relates to the objectives measured on the graduation exam in the middle grades or in the high school grades. Further, teachers must use this document in focusing instruction for students who have demonstrated weaknesses on objectives measured on the pre-graduation examination and the AHSGE.

An item specification has a distinct purpose and provides essential information concerning the testing of an objective. Item specifications for mathematics will follow this order:

STANDARD	Broad area of content to be assessed
OBJECTIVE	Specific skill within a standard to be assessed
ELIGIBLE CONTENT	Clarification and elaboration of an objective (where applicable)
SAMPLE ITEMS	Item formats to test each objective

The sample items in this bulletin will **not** be found on the pre-graduation examination or the AHSGE. The number of sample items in this bulletin does not necessarily reflect the weight of the content on the test. In order to identify the weight of the content, the following chart shows the number of items for each mathematics objective.

	OBJECTIVES	NUMBER OF ITEMS
I-1	Apply order of operations	4
I-2	Add and subtract polynomials	4
I-3	Multiply polynomials	4
I-4	Factor polynomials	4
II-1	Solve multi-step equations	4
II-2	Solve quadratic equations	4
II-3	Solve systems of linear equations	4
II-4	Solve multi-step inequalities	4
III-1	Identify functions	4
III-2	Find the range of functions	4
IV-1	Find perimeter, circumference, area, volume	4
IV-2	Find the distance, midpoint, slope	4
V-1, 4	Graph: Linear Equations; Common Relations	6
V-2	Graph lines given certain conditions	4
V-3	Determine solution sets of inequalities	4
VI-1	Translate: Verbal or Symbolic Graph: Equations or Inequalities	6
VII-1	Apply properties and relationships between angles	4
VII-2	Apply Pythagorean Theorem	4
VII-3	Apply properties of similar polygons	4
VII-4	Apply properties of geometric figures	4
VII-5	Determine measures of central tendency	4
VII-6	Determine probabilities	4
VII-7	Solve problems: Direct Variation	4
VII-8	Solve problems: Algebraic Concepts	4
	TOTAL	100

The content of the mathematics subject-area test is approximately 75% Algebra I and 25% pre-geometry.

A calculator will be provided for each student although a calculator is not needed in order to solve the problems. The state-provided calculator is a four-function calculator with additional percent, $+/-$, and square root keys. Each key performs a single function. The calculator must be returned to the Test Administrator after the student has completed the test. Therefore, each student is provided with the opportunity to practice using the state-provided calculator during the week prior to testing. Each student will be provided a Calculator Practice Booklet and a teacher will instruct the student on how to use the calculator.

Each test booklet contains a reference page of formulas for use during the test. The reference page from the test booklet must be returned to the Test Administrator after the student has completed the test. Therefore, a copy of the reference page is included in this bulletin which can be duplicated as needed.

• REFERENCE PAGE •

Use the information below to answer questions on the Alabama High School Graduation Exam.

Some Abbreviations Used in Formulas

b_1, b_2 = bases of a trapezoid
 b = base of a polygon
 h = height or altitude
 l = length
 w = width



symbol for a right angle

$m\angle$ = the measure of an angle

A = area
 C = circumference
 r = radius
 d = diameter
 $\pi = 3.14$
 P = perimeter
 D = distance
 M = midpoint
 m = slope

$S.A.$ = surface area
 V = volume
 B = area of the base
 S = sum of interior angles of a convex polygon
 n = number of sides of a convex polygon

Formulas

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

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

Parallelogram: $A = bh$

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

Rectangle: $A = lw$

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

Trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$

Circle: $C = \pi d$
 $C = 2\pi r$
 $C = \pi r^2$

Sum of Measures of Interior Angles of a Convex Polygon: $S = 180(n - 2)$

Distance = rate • time

Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Interest = principal • rate • time

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

	Surface Area	Volume
Rectangular Prism	$S.A. = Ph + 2B$ or $S.A. = 2(wh + lh + lw)$	$V = Bh$ or $V = lwh$
Cylinder	$S.A. = 2\pi rh + 2\pi r^2$	$V = \pi r^2 h$

Forms of Equations

Standard form of an equation of a line: $Ax + By = C$

Slope-intercept form of an equation of a line: $y = mx + b$

Point-slope form of an equation of a line: $y - y_1 = m(x - x_1)$

ITEMS

BY

STANDARD AND OBJECTIVE

STANDARD I: The student will be able to perform basic operations on algebraic expressions.
OBJECTIVE

1. Apply order of operations.

ELIGIBLE CONTENT

- One, two, or no variables may be used.
- One set of parentheses may be used.
- Determining the absolute value of a term may be required.
- Squaring the quantity in parentheses may be required.
- No more than four terms may be included.
- Adding or subtracting negative integers may be required.
- Decimals to the tenths' place may be used.¹⁻¹₁₆

SAMPLE ITEMS

1 Simplify: $(4, 1)$

- * **A** -19
- B** -4
- C** 71
- D** 85

2 Simplify: $x - y - (x - 2y)$

- * **A** y
- B** $-3y$
- C** $x + 3y$
- D** $2x - 3y$

3 Simplify: $5 \cdot 4^2 \div 8 + (2^3 - 7)$

- A** -5
- B** 4
- C** 9
- * **D** 11

4 Simplify: $2x + \frac{10x + 4x}{2}$

- A** $8x$
- * **B** $9x$
- C** $11x$
- D** $14x$

5 Simplify: $6.4 - |14.7 + 0.5|$

- A** -7.8
- B** 8.8
- * **C** -8.8
- D** 21.6

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

2. Add and subtract polynomials.

ELIGIBLE CONTENT

- Using the distributive property may be required.
- Unlike denominators may be used.

SAMPLE ITEMS

1 Simplify: $15x^2 + xy - 9x^2 - 3xy$

- * **A** $6x^2 - 2xy$
- B** $6x^4 - 2x^2y^2$
- C** $24x^2 - 4xy$
- D** $24x^4 - 4x^2y^2$

2 Simplify: $2(t^2 + 5) - 3(t^2 + 5)$

- A** $t^2 + 5$
- * **B** $-t^2 - 5$
- C** $-t^2 + 10$
- D** $-t^2 + 25$

3 Simplify: $2.5x^2 - 7.5 + 0.5x^2 + 2$

- A** $3x^2 + 1$
- * **B** $3x^2 - 5.5$
- C** $3x^2 - 5$
- D** $6x^2 + 1$

4 Simplify: $\frac{2x+1}{2} + \frac{12x+3}{6}$

- * **A** $3x + 1$
- B** $3x + 4$
- C** $14x + 1$
- D** $14x + 4$

5 Simplify: $\frac{1}{3}x + \frac{1}{3}y + 4(\frac{1}{6}x + \frac{1}{4}y)$

- A** $x + \frac{2}{3}y$
- * **B** $x + \frac{4}{3}y$
- C** $\frac{1}{2}x + \frac{4}{3}y$
- D** $x + \frac{1}{3}y$

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

3. Multiply polynomials.

ELIGIBLE CONTENT

- Multiplying two quantities in parentheses may be required.
- Squaring a quantity in parentheses may be required.
- Adding or subtracting may be required.
- Raising a quantity to a power may be required.
- Fractions may be used.
- Adding exponents may be required.

SAMPLE ITEMS

1 Simplify: $\frac{3y}{2} \cdot \frac{2y}{3}$

A $\frac{4}{9}$

B $\frac{9}{4}$

C y

* D y^2

2 Simplify: $(4x)(2y) - (3x)(-y)$

A $5xy$

* B $11xy$

C $\frac{1}{5}$

D $x - y$

3 Simplify: $\frac{1}{5}(x + 14) = 24$

A $12x^2 + x + 6$

B $12x^2 - 6$

C $12x^2 - 6x - 6$

* D $12x^2 + x - 6$

4 Simplify: $\frac{1}{5}x + 14 = 24$

A x^2

B $y = \frac{x}{2} + 1$

C $x^2 - 8x - 16$

* D $x^2 - 16$

5 Simplify:

$$\frac{2x^2 + 9}{25}$$

A $\frac{16x^2 + 9}{25}$

* B $\frac{16x^2 + 24x + 9}{25}$

C $\frac{4x + 5}{5}$

D $\frac{4x^2 + 7x + 3}{5}$

6 Simplify:

$$4$$

* A $x^2 - 15x + 54$

B $-\frac{11}{2}$

C -4

D -10

7 Simplify:

$$3x^2(3x)^2$$

A $9x^2$

B $18x^4$

C $27x^2$

* D $27x^4$

8 Which of these is equivalent to $(x^2y)^3$?

A x^2y^3

B x^5y^3

C x^5y^4

* D x^6y^3

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

4. Factor polynomials.

ELIGIBLE CONTENT



- The following factoring may be required:
 - **difference of two squares**
 - greatest common monomial
 - trinomial
 - common binomial
- **Options will be factored completely.**

SAMPLE ITEMS

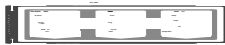
1 Factor: $9x^2 - 9$

- A $9(x - 1)$
- B $9(x - 1)^2$
- C $3(x + 3)(3x - 1)$
- * D $9(x + 1)(x - 1)$

2 Factor: 

- A $4x(x + 1)$
- B 
- * C $(4x + 1)(x + 1)$
- D 

3 Factor: 

- A 
- B $2m(m - 2)(m - 2)$
- C $2m(m + 4)(m + 1)$
- * D $2m(m - 4)(m - 1)$

4 Factor: $x^2 - x - 2$

- * A $(x + 1)(x - 2)$
- B $(x - 1)(x - 2)$
- C $(x + 1)(x + 2)$
- D $(x - 1)(x + 2)$

5 Factor: $2x^2 - 5x - 12$

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

6 Factor: $81a^4 - 16$

- A $(9a^2 + 4)(9a^2 + 4)$
- * B $(9a^2 + 4)(3a - 2)(3a + 2)$
- C $(3a + 2)(3a + 2)(3a - 2)(3a - 2)$
- D $(3a - 2)(3a - 2)(3a - 2)(3a - 2)$

7 What is the greatest common factor of $24xy^2$ and $16x^2y$?

- A $4xy$
- * B $8xy$
- C $2x^2y^2$
- D $8x^2y^2$

STANDARD II: **The student will be able to solve equations and inequalities.**

OBJECTIVE

1. Solve multi-step equations of first degree.

ELIGIBLE CONTENT

- One set of parentheses may be used.
- Finding the sum or difference of terms containing the same variable may be required.
- Adding or subtracting a variable to or from both sides of the equation may be required.
- The solution to the equation may be a fraction.
- Coefficients may be simple fractions.

SAMPLE ITEMS

3

1 Solve: $-2x - 7 = -x + 13$

- * A -20
- B -6
- C -2
- D 20

2 Solve: $\frac{2x + 1}{3} = 5$

- A 2
- B 6
- * C 7
- D 8

Solve: $\frac{x}{3} = \frac{x - 6}{4}$

- * A -18
- B -6
- C 6
- D 24

4

Solve: $2(-x + 3) = 14$

- A -10
- B $-\frac{11}{2}$
- * C -4
- D 4

5 Solve: $4x + 1 = 7$

A $\frac{7}{5}$

* B $\frac{3}{2}$

C 2

D 24

STANDARD II: **The student will be able to solve equations and inequalities.**

OBJECTIVE

2. Solve quadratic equations that are factorable.

ELIGIBLE CONTENT

- Factoring of the type $ax^2 + bx = 0$ may be required.
- The following factoring may be required:
 - difference of two squares
 - greatest common monomial
 - trinomial
 - common binomial

SAMPLE ITEMS

1 Solve: $16x^2 - 1 = 0$

- * **A** $\frac{1}{4}, -\frac{1}{4}$
- B** $\frac{1}{16}, -\frac{1}{16}$
- C** $4, -4$
- D** $16, -16$

2 Solve: $3x^2 - 2x - 5 = 0$

- * **A** $\frac{5}{3}, -1$
- B** $\frac{3}{5}, -1$
- C** $\frac{5}{3}, 1$
- D** $-\frac{5}{3}, 1$

3 Solve: $4x(x+1) - (x+1) = 0$

- A** $0, \frac{1}{4}$
- B** $1, \frac{1}{4}$
- C** $-1, 0$
- * **D** $-1, \frac{1}{4}$

4 Solve: $3x^2 - 9x = 0$

- A** $3, 9$
- B** $0, -3$
- * **C** $0, 3$
- D** $0, 9$

5 Solve: $5x^2 - 12 = 11x$

* **A** $-\frac{4}{5}, 3$

B $\frac{4}{5}, -3$

C $-\frac{6}{5}, 2$

D $\frac{6}{5}, -2$

STANDARD II: **The student will be able to solve equations and inequalities.**

OBJECTIVE

3. Solve systems of two linear equations.

ELIGIBLE CONTENT

- Solving for the values of both x and y may be required.
- The options may be four graphs with lines plotted and the intersection point labeled with its ordered pair.

SAMPLE ITEMS

1

What is the solution of the following system of linear equations?

$$4x + 3y = 5$$

$$-3x - 6y = 0$$

A $(-1, 2)$

B $(1, -2)$

* C $(2, -1)$

D $(2, 1)$

2

What is the solution of the following system of linear equations?

$$y = 3x$$

$$2x + y = 15$$

A $(0, 15)$

* B $(3, 9)$

C $(5, 5)$

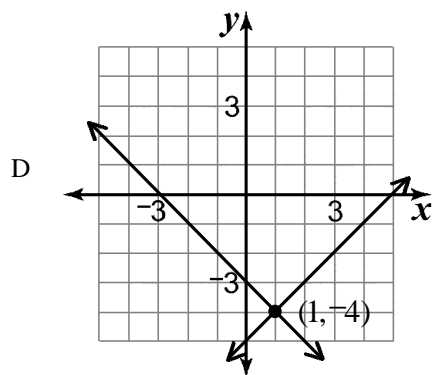
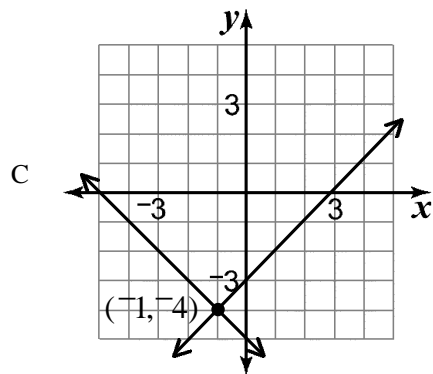
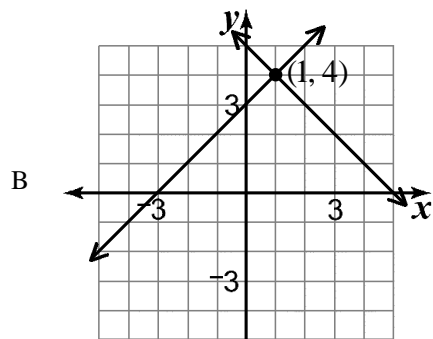
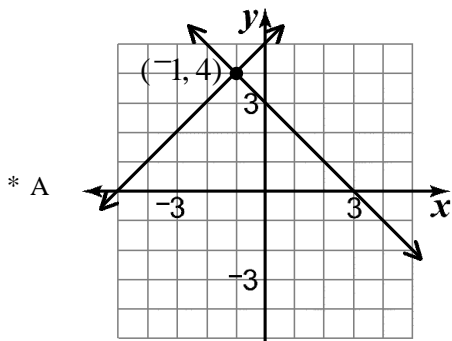
D $(15, 45)$

3

Which of these graphs could be used to find the solution for the following system of equations?

$$x + y = 3$$

$$y = x + 5$$



STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE

4. Solve multi-step inequalities of first degree.

ELIGIBLE CONTENT

- A negative coefficient may be used.

SAMPLE ITEMS

1 Solve: $3k - 7(k + 5) - 5 < 0$

A $k < -10$

* **B** $k > -10$

C $k < 0$

D $k > 0$

2 Solve: $\frac{2}{3}x \geq -4$

A $x \geq -\frac{8}{3}$

B $x \leq -\frac{8}{3}$

* **C** $x \geq -6$

D $x \leq -6$

3 Solve: $3x + 5 < x - 3$

* **A** $x < -4$

B $x > -4$

C $x < 1$

D $x > 1$

4 Solve: $4(x - 2) \geq -2(3 - 3x)$

A $x \geq -1$

* **B** $x \leq -1$

C $x \geq 1$

D $x \leq 1$

STANDARD III: The student will be able to apply concepts related to functions.

OBJECTIVE

1. Identify functions.

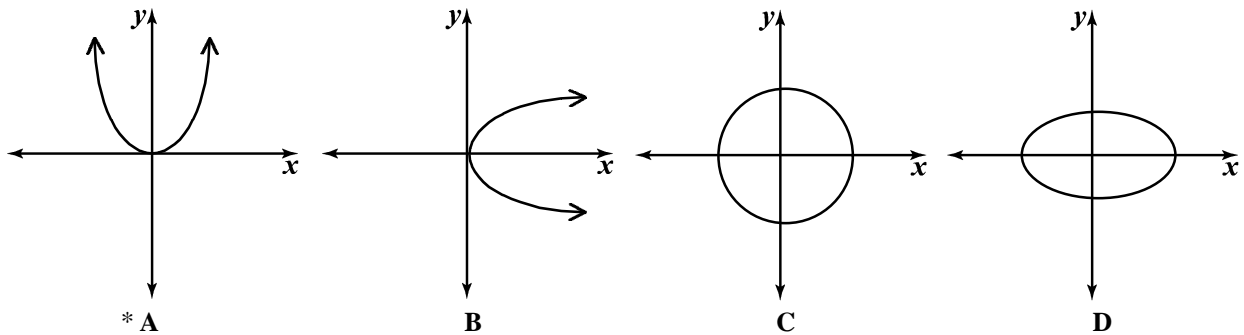
ELIGIBLE CONTENT

- The options may be graphs, ordered pairs, tables, or mappings.
- The options may be equations when given a table of values or ordered pairs.
- The options may be tables of values or ordered pairs when given an equation.
- Functions may be expressed using either the terminology " $f(x) =$ " or " $y =$ ".

SAMPLE ITEMS

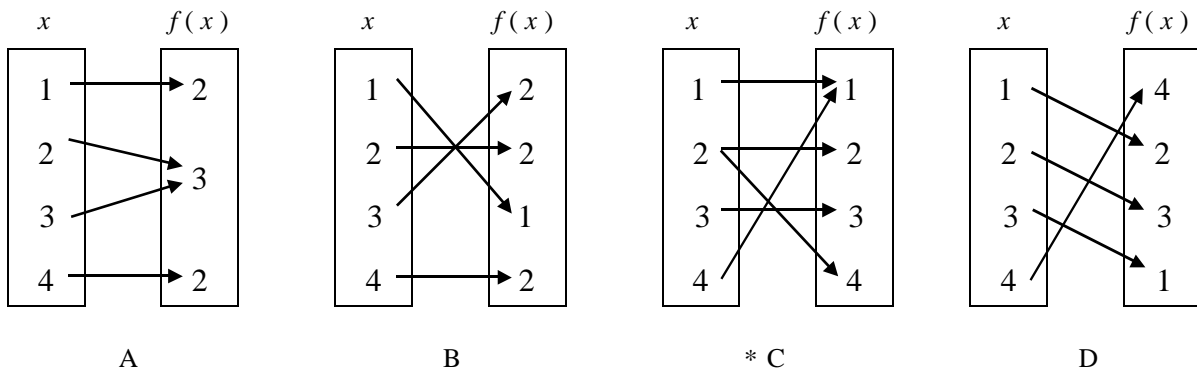
1

Which of these graphs represents a function?



2

Which of these mappings is NOT a function?



3

Which of these equations represents the data in the table?

x	y
1	-1
2	-5
-2	11

- A** $y = -4x + 1$
*** B** $y = -4x + 3$
C $y = -2x - 5$
D $y = -2x + 11$

4Which of these tables represents the function $y = -3x - 5$?

x	y
0	-8
1	2
-1	-2

A

x	y
1	-2
2	-11
-2	1

B

x	y
0	-5
1	-8
-1	-8

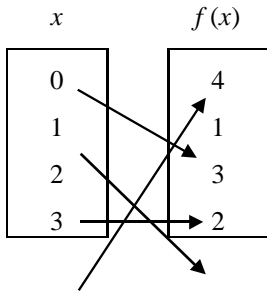
C

x	y
0	-5
1	-8
-1	-2

*** D**

5

Which of these functions describes the mapping below?



- * **A** $f(x) = x + 1$
B $f(x) = x - 1$
C $f(x) = 2x + 1$
D $f(x) = 2x - 1$

6

Which of these tables represents the function $f(x) = |x| + 1$?

x	$f(x)$
-2	-3
-1	-2
0	-1
1	0

A

x	$f(x)$
-2	-1
-1	0
0	1
1	2

B

x	$f(x)$
-2	3
-1	2
0	1
1	0

C

x	$f(x)$
-2	3
-1	2
0	1
1	2

*** D**

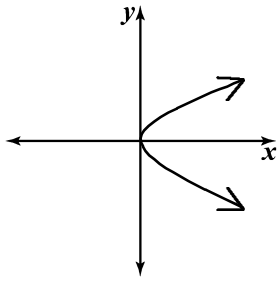
7

Which of the following relations describes a function?

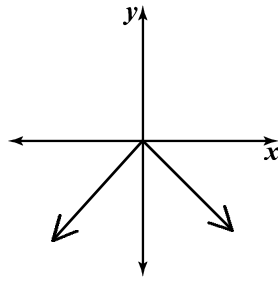
- A** $\{(-1, 3), (3, 6), (2, 5), (3, 9)\}$
B $\{(14, 44), (13, 44), (13, 35), (17, 69)\}$
* **C** $\{(6, 13), (5, 5), (7, 16), (3, 13)\}$
D $\{(18, 18), (15, 20), (18, 19), (3, 9)\}$

8

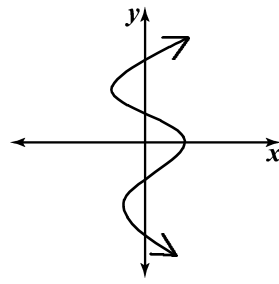
Which of these graphs represents a function?



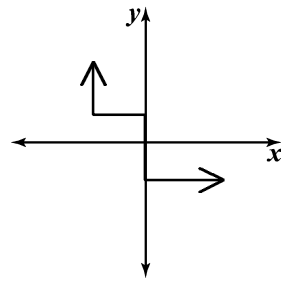
A



* B



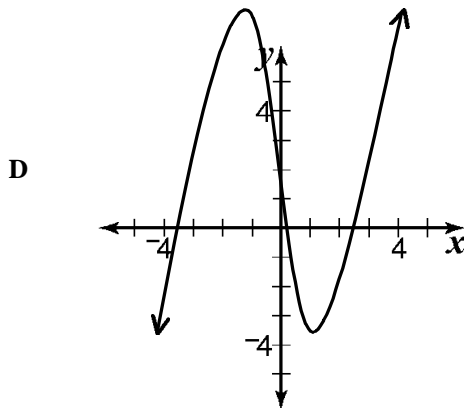
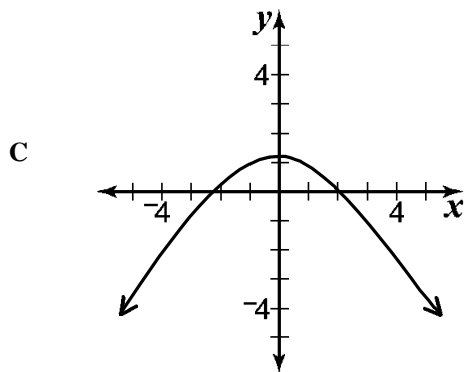
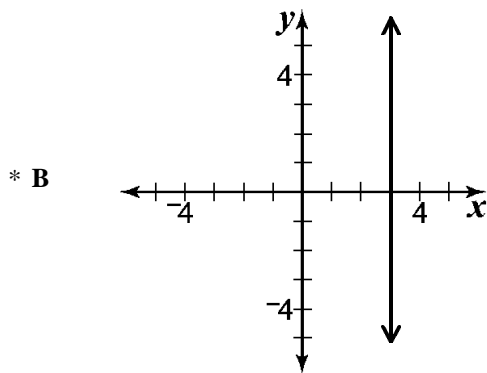
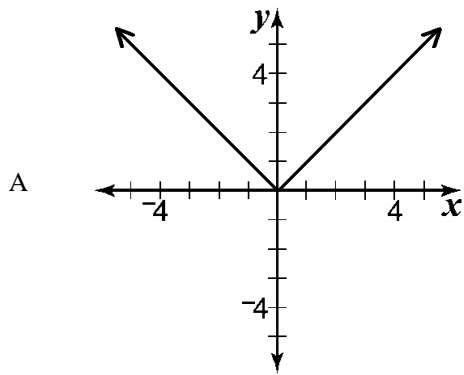
C



D

9

Which of these graphs does NOT represent a function?



STANDARD III: **The student will be able to apply concepts related to functions.**

OBJECTIVE

2. Find the range of functions when given the domain.

ELIGIBLE CONTENT

- The domain of a function may be a single value or a set of values.
- A set of ordered pairs may be used.
- Functions may be expressed using either the terminology " $f(x) =$ " or " $y =$ ".

SAMPLE ITEMS

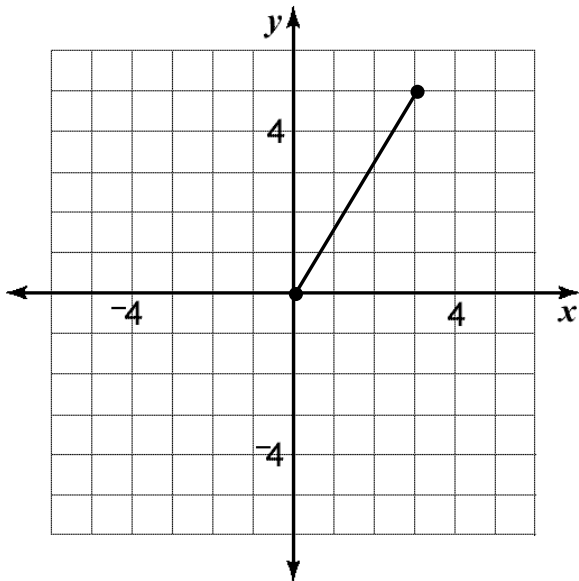
- 1** What is the range of this function?
 $\{(-3, 4), (0, 0), (1, -2), (3, 2)\}$
- A** $\{-2, 4\}$
B $\{-3, 3\}$
*** C** $\{-2, 0, 2, 4\}$
D $\{-3, 0, 1, 3\}$

- 2** What is the range of $y = 3x^2 - 5$
if the domain is $\{-2, 0, 1\}$?
- A** $\{2, 0, -1\}$
B $\{2, 3, 5\}$
C $\{4, 0, 1\}$
*** D** $\{7, -5, -2\}$

- 3** If $f(x) = -x^2 + 2x - 3$, what is $f(4)$?
- * A** -11
B -3
C 13
D 21

4

What is the range of the function shown on the graph?



- A $3 \leq y \leq 5$
- B $2 \leq y \leq 5$
- C $0 \leq y \leq 3$
- * D $0 \leq y \leq 5$

STANDARD IV: **The student will be able to apply formulas.**

OBJECTIVE

1. Find the perimeter, circumference, area, or volume of geometric figures.

ELIGIBLE CONTENT

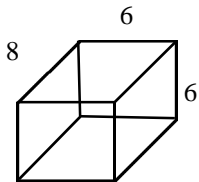
- The value of pi (π) will be 3.14.
- Options may be left in terms of π .
- Unnecessary dimensions may be included.
- Drawings may be used.
- Finding volume or surface area of a rectangular prism may be required.
- Extracting a square root may be required.
- Determining the area of a circle when given the diameter in the drawing may be required.
- The formulas will be given in the problems.

SAMPLE ITEMS

1

What is the total surface area of the rectangular prism shown below?

Use $SA = 2(wh + lh + lw)$.



- A 80
- B 132
- * C 264
- D 288

2

The dimensions of a new football field are 55 yards by 120 yards. Three inches of topsoil will be added to the field. What is the volume of topsoil needed to cover the field?

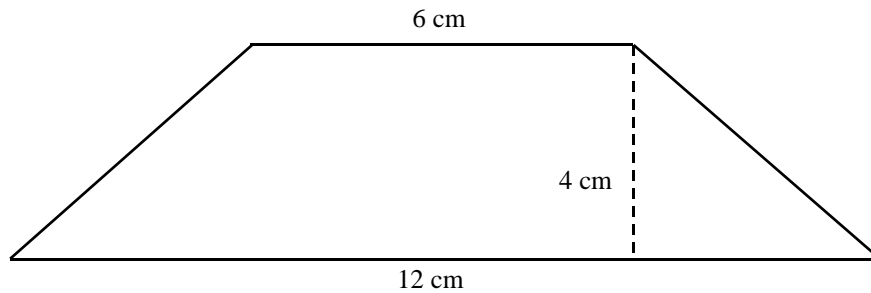
Use $V = lwh$.

- A 275 cubic yards
- * B 550 cubic yards
- C 13,200 cubic yards
- D 19,800 cubic yards

3


What is the area of this figure?

Use $A = \frac{1}{2}h(b_1 + b_2)$.



- A 18 square centimeters
- B 24 square centimeters
- * C 36 square centimeters
- D 48 square centimeters

4

A painter was hired to paint a fence. The total length of the fence is 50 feet. Each board is 8 feet tall, $\frac{1}{2}$ foot wide, and  foot thick. Only one side of the fence is going to be painted. What is the area of the part of the fence that will be painted?

Use $A = lw$.

- A 20 square feet
- B 40 square feet
- C 200 square feet
- * D 400 square feet

5

If a circular pool has a diameter of 20 feet, what is the area of the pool to the nearest square foot?

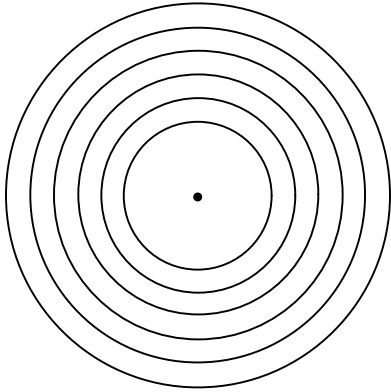
Use $A = \pi r^2$ and $\pi = 3.14$

- A 31 square feet
- B 63 square feet
- * C 314 square feet
- D 1256 square feet

6

A target has a center circle with a three-inch radius and five outer rings. Each ring is one inch wide. What is the circumference of the largest circle?

Use $C = 2\pi r$.

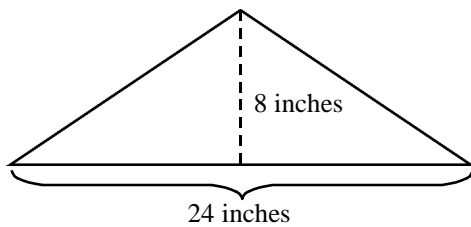


- A 6π inches
- B 11π inches
- * C 16π inches
- D 18π inches

7

What is the area of the triangle shown in the diagram below?

Use $A = \frac{1}{2}bh$.



- A **48 square inches**
- * B **96 square inches**
- C **192 square inches**
- D **384 square inches**

STANDARD IV: **The student will be able to apply formulas.**

OBJECTIVE

2. Find the distance, midpoint, or slope of line segments when given two points.

ELIGIBLE CONTENT

- Radicals may be used.
- Radicals will be simplified.
- Lines graphed on the coordinate plane may be included.
- Determining the slope of a line given a line on the coordinate plane with two points labeled with their ordered pairs may be required.
- Determining the slope of a line or midpoint of a line segment given two points on a line on the coordinate plane without any coordinates labeled may be required.
- The formulas will be given in the problems.

SAMPLE ITEMS

1 The endpoints of \overline{AB} are $(2, 5)$ and $(-6, 9)$.
What are the coordinates of the midpoint
of \overline{AB} ?

Midpoint formula: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

- A $(-4, 2)$
- * B $(-2, 7)$
- C $(4, 7)$
- D $(7, -2)$

2 What is the distance between $(4, -2)$
and $(4, -8)$?

Distance formula:

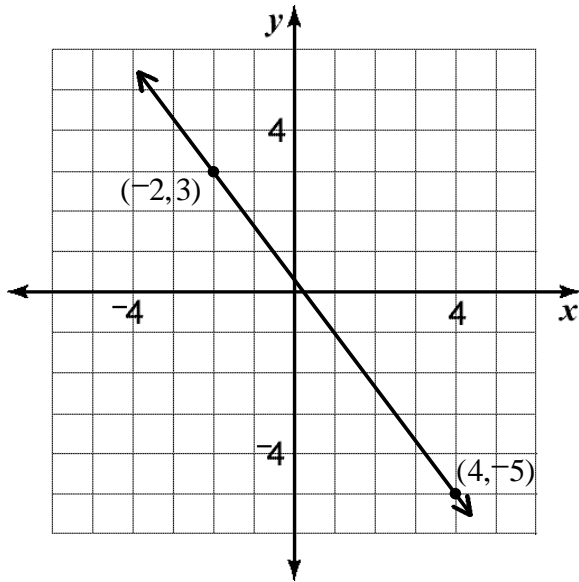
$$\frac{3}{5}, \quad - \quad 1$$

- A $\sqrt{6}$
- B $2\sqrt{5}$
- * C 6
- D 10

3

What is the slope of the line shown in the graph?

Slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

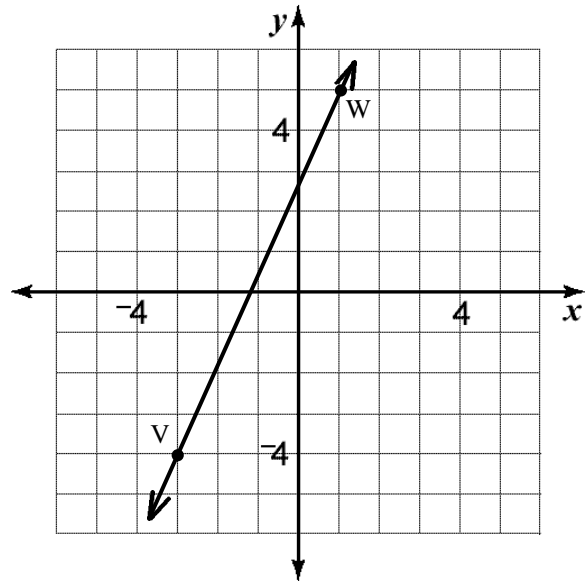


- A -4
- B -1
- * C $-\frac{4}{3}$
- D $-\frac{1}{3}$

4

What is the midpoint of segment VW shown in the graph?

Midpoint formula: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$



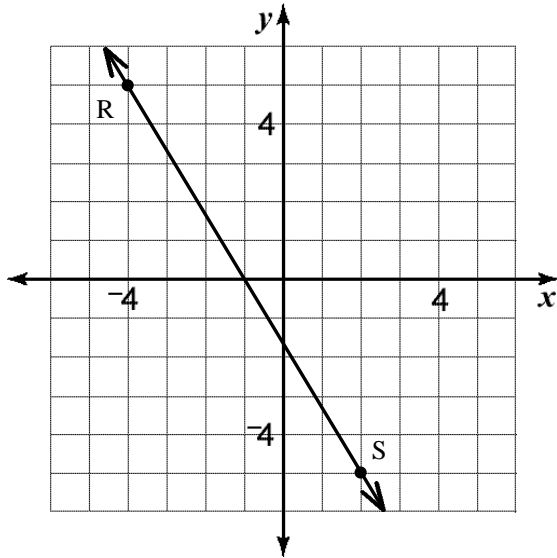
- A $\left(-\frac{7}{3}, 3\right)$
- * B $\left(-1, \frac{1}{2}\right)$
- C $\left(\frac{1}{2}, -1\right)$
- D $\left(3, -\frac{7}{2}\right)$

5

What is the length of segment RS shown in the graph below?

Distance formula:

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



- A $2\sqrt{26}$
- * B $2\sqrt{34}$
- C 11
- D 12

STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

1. Graph or identify graphs of linear equations.
4. Identify graphs of common relations.

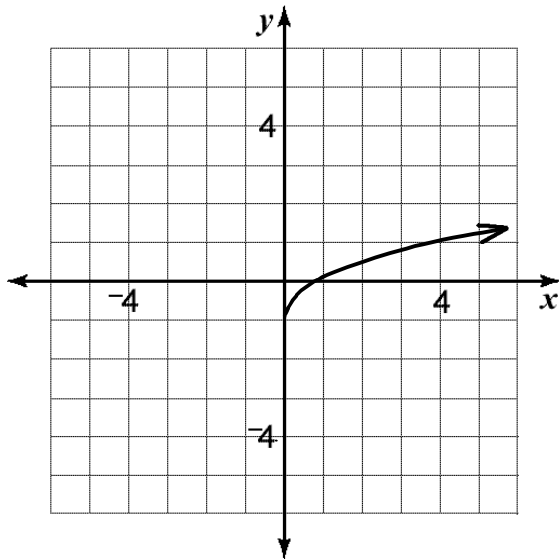
ELIGIBLE CONTENT

- Equations may be expressed in terms of $f(x)$.
- The options may be four graphs.
- The options may be four equations.
- The common relations are:
 - $x = \text{constant}$
 - $y = \text{constant}$
 - $y = x$
 - $y = \sqrt{x}$
 - $x = y^2$
 - $y = |x|$

Sample items begin on next page.

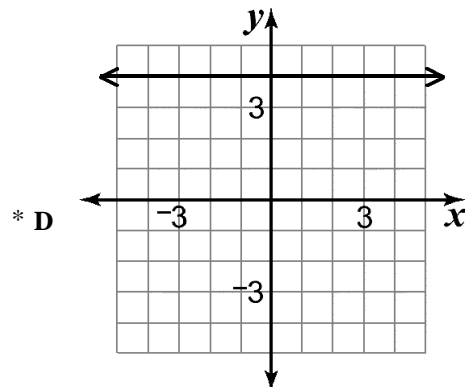
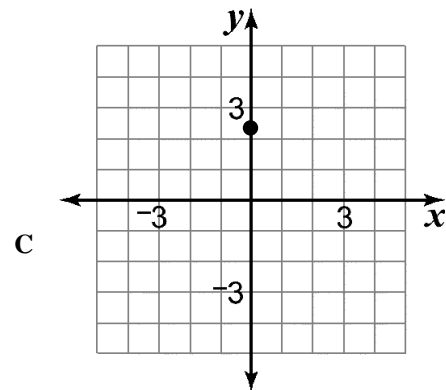
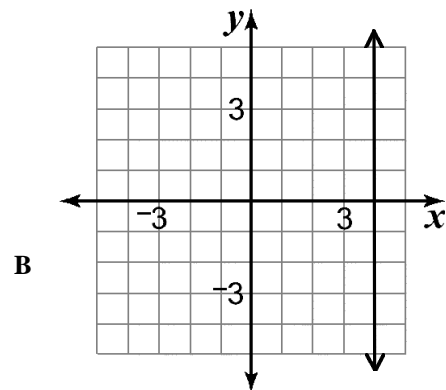
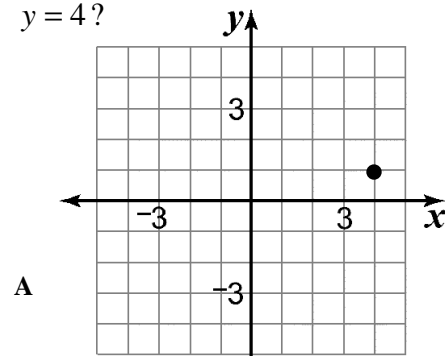
1

Which of these equations represents the graph below?



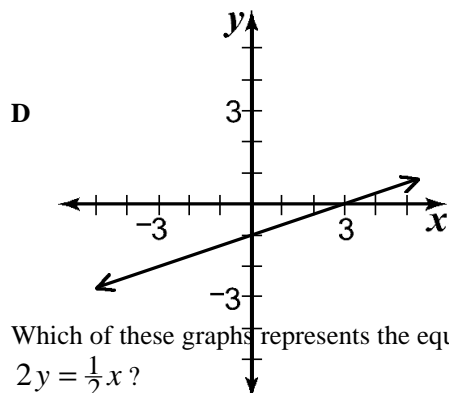
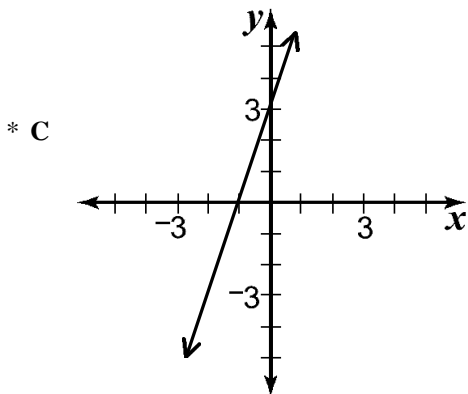
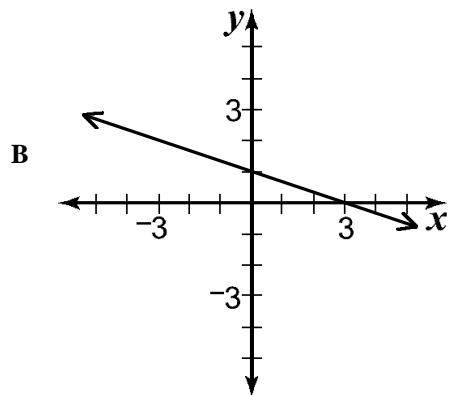
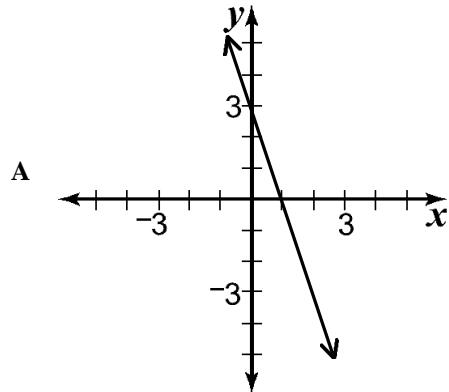
- A $y = x$
 B $y = x^2$
 * C $y = \sqrt{x}$
 D $y = |x|$

2

Which of these graphs represents the equation $y = 4$?

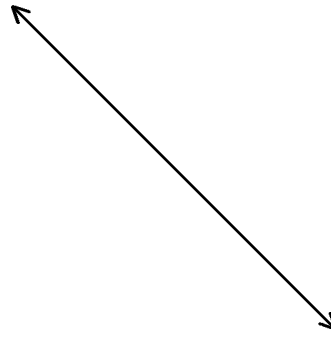
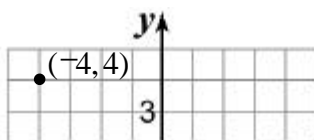
3

Which of these graphs represents the equation $f(x) = 3x + 3$?



4

Which of these graphs represents the equation $2y = \frac{1}{2}x$?



A

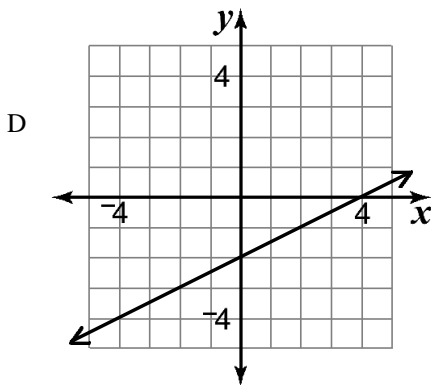
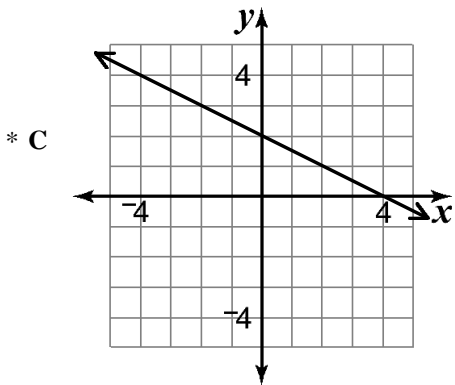
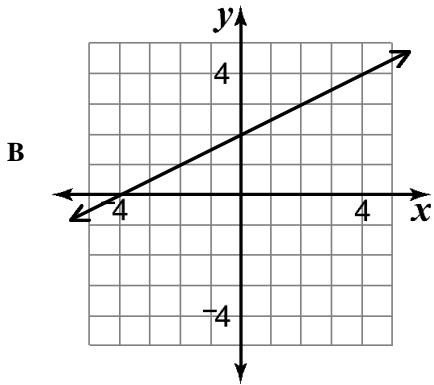
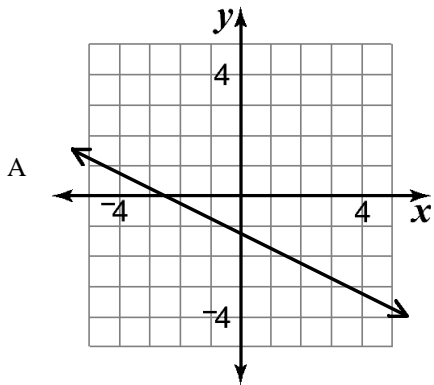
B

* C

D

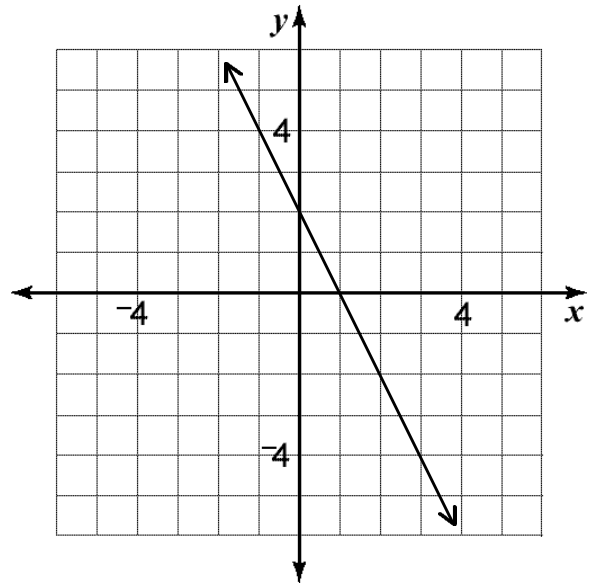
5

Which of these graphs represents the equation $y = -\frac{1}{2}x + 2$?



6

What is the equation of the line shown in the graph below?



A $y = 2x + 2$

B $y = -\frac{1}{2}x + 2$

* C $y = -2x + 2$

D $(-1, -4)$

STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

2. Graph lines given certain conditions.

ELIGIBLE CONTENT

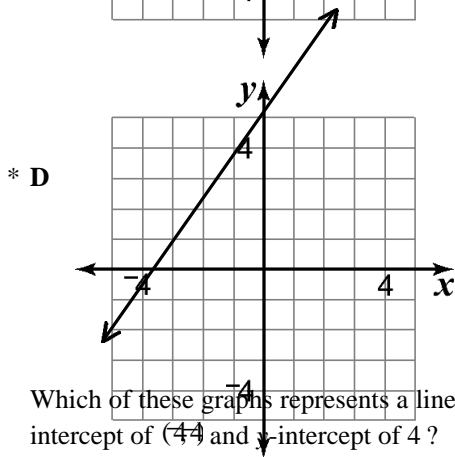
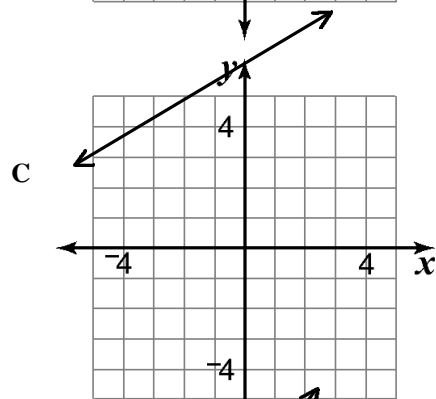
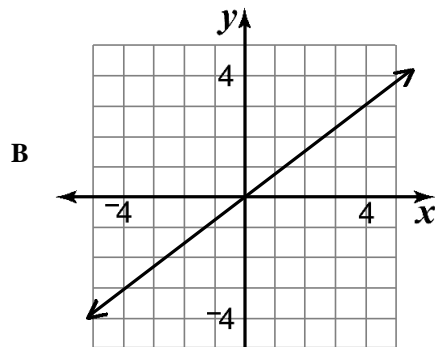
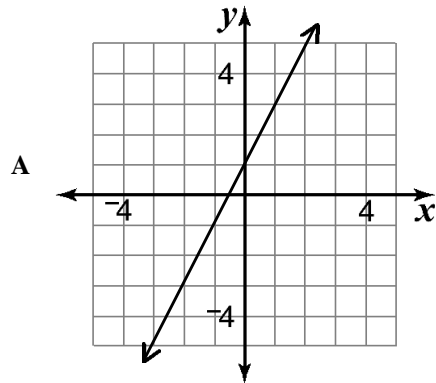
- The following conditions may be included:
 - two points
 - x- and y-intercepts
 - point and slope
 - slope and y-intercept

SAMPLE ITEMS

Sample items begin on next page.

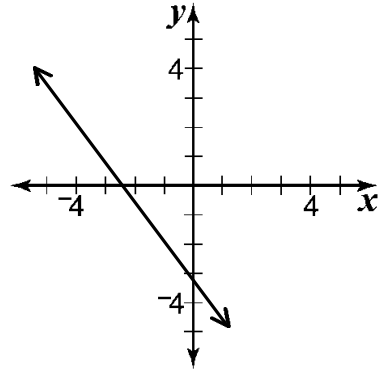
2

Which of these graphs represents a line passing through the points $(2, 5)$ and $(4, 4)$?

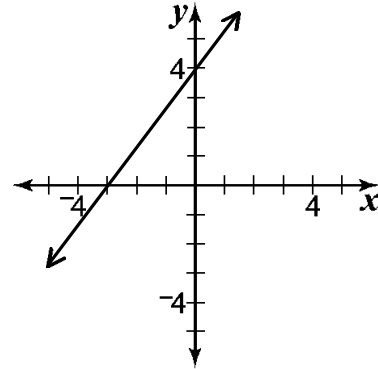


Which of these graphs represents a line with x -intercept of (-4) and y -intercept of 4 ?

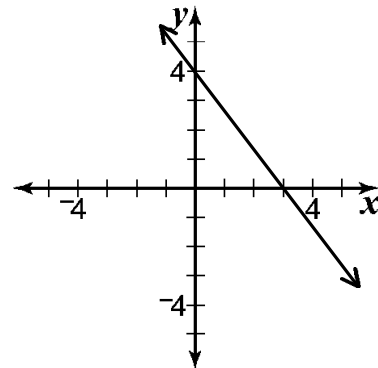
A



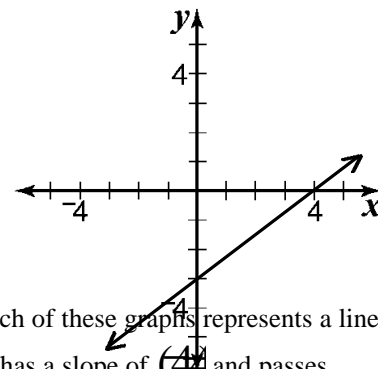
* B



C

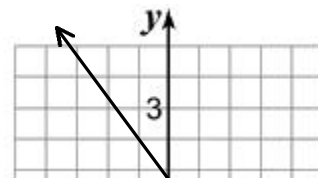


D



3

Which of these graphs represents a line that has a slope of $(\frac{1}{4})$ and passes through $(4, 1)$?



A

A

*

B

B

* C

C

D

D

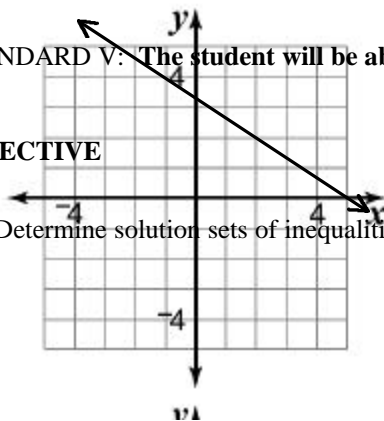
4

Which of these graphs represents a line with a slope of -2 and a y-intercept of 3?

STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

3. Determine solution sets of inequalities.

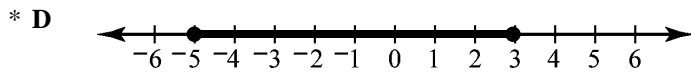
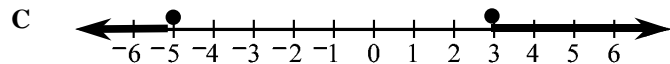
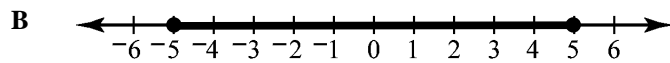
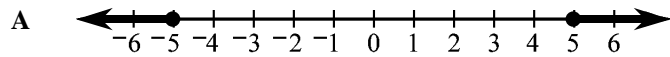


ELIGIBLE CONTENT

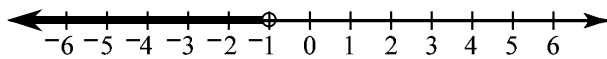
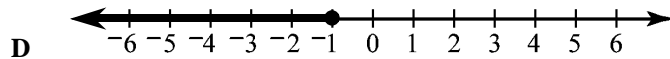
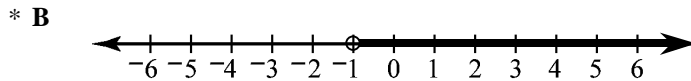
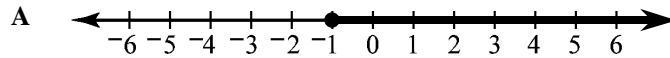
- Compound inequality may be included.
- Solving inequality may be required.
- Options will be graphs.

SAMPLE ITEMS

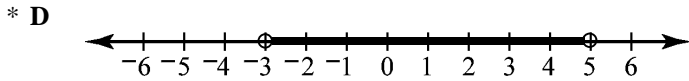
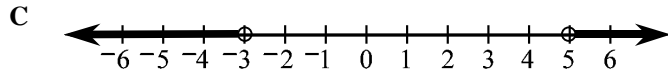
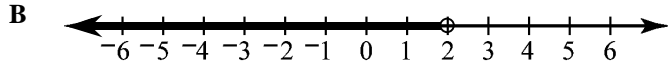
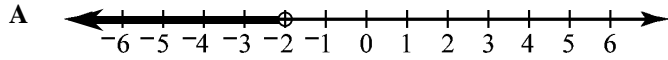
1 Which of these graphs represents the solution of $x < -2$?



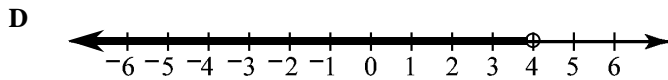
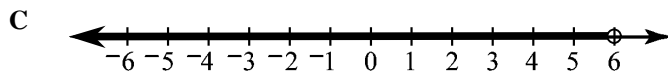
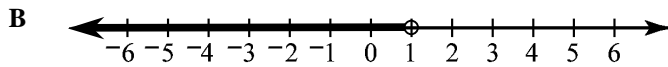
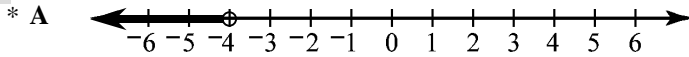
2 Which of these graphs represents the solution of $x > 0$?



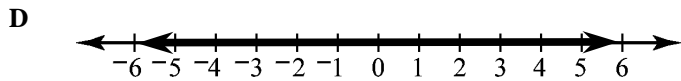
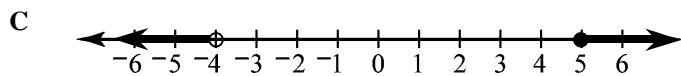
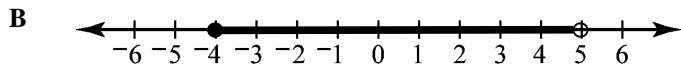
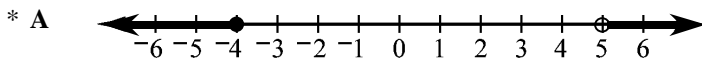
3 Which of these graphs represents the solution of $x - 1 > 2$?



4 Which of these graphs represents the solution of $x + 5 < 1$?



5 Which of these graphs represents the solution of $(x - 4) > (x + 4)$?



STANDARD VI: The student will be able to represent problem situations.

OBJECTIVE

1. Translate verbal or symbolic information into algebraic expressions; or identify equations or inequalities that represent graphs or problem situations.

ELIGIBLE CONTENT

- Determining an equation or expression when given a verbal description may be required.
- Graphing inequalities using a number line may be required.
- Determining the equation of a line given two ordered pairs may be required.
- Determining the equation of a line given the line graphed on the coordinate plane may be required.

SAMPLE ITEMS

1 Which of these equations represents this statement?

Fourteen more than $\frac{1}{5}$ of a number x is equal to 24.

- A $(14 + \frac{1}{5})x = 24$
- B $\frac{1}{5}(x + 14) = 24$
- * C $\frac{1}{5}x + 14 = 24$
- D $14 + \frac{1}{5} + x = 24$

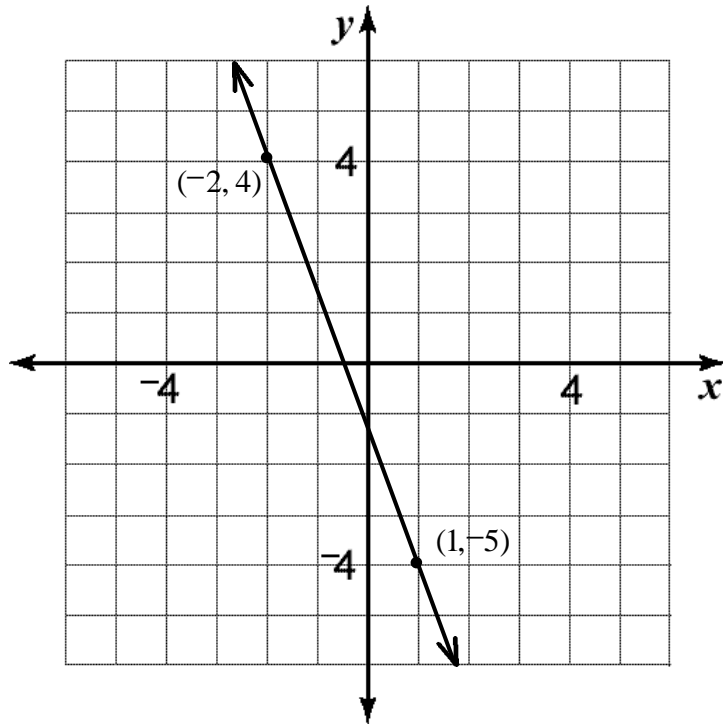
2 When pouring concrete, a good rule for estimating the number of workers needed is to have one worker for every 2 cubic yards of concrete plus one other worker. Which of these equations represents this rule?

- A $y = 2x + 1$
- * B $y = \frac{x}{2} + 1$
- C $\frac{1}{2}$
- D $y = \frac{2x + 1}{2}$

3 What is the equation of the line passing through the points (1, 2) and (3, 4)?

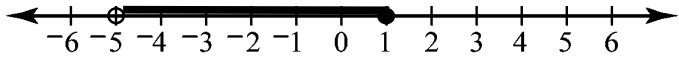
- * A $y = x + 1$
- B $y = x - 1$
- C $x + y = 1$
- D $x + y = 2$

4 What is the equation of the line shown in the graph below?



- A $y = -x - 2$
- B $y = -2x + 3$
- * C $y = -3x - 2$
- D $y = -3x + 2$

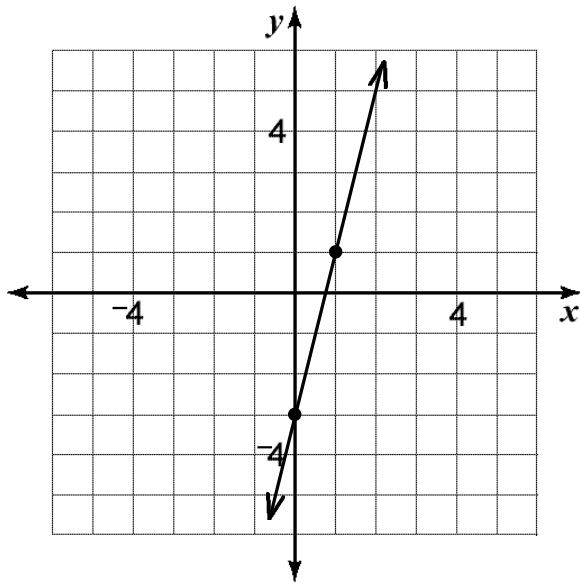
5 Which of these inequalities describes this graph?



- A $-5 < x < 1$
- * B $-5 < x \leq 1$
- C $-5 \leq x \leq 1$
- D $-5 \leq x < 1$

6

What is the equation of the line shown in the graph below?



- * A $y = 4x - 3$
- B $y = 4x + 3$
- C $y = -4x - 3$
- D $y = -4x + 3$

7

Which of these statements is the same as $x^2 + 2x = 8$?

- * A A number x squared plus 2 times the number x is 8.
- B The sum of 2 times a number x and the number x is 8.
- C Two times a number x squared plus the number x is 8.
- D Two times the sum of a number x squared and the number x is 8.

8

What is the equation of a line with slope $\frac{1}{3}$ that passes through the point $(-1, -2)$?

- A $y = \frac{1}{3}x - \frac{1}{3}$
- * B $y = \frac{1}{3}x - \frac{5}{3}$
- C $y = 3x + 1$
- D $y = 3x + 5$

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

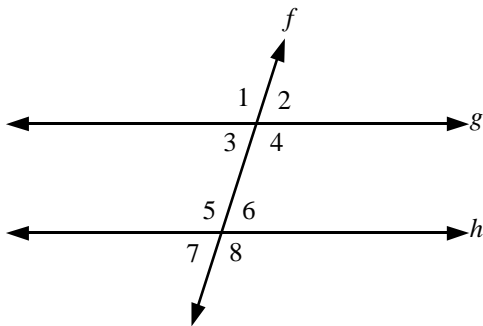
1. Apply properties of angles and relationships between angles.

ELIGIBLE CONTENT

- The following properties and relationships may be included:
 - vertical angles
 - adjacent angles
 - supplementary angles
 - complementary angles
 - linear pair (adjacent supplementary angles)
 - relationships among the measures of angles formed by two parallel lines and a transversal
- Word problems may be used.
- The knowledge of the sum of measures of angles may be used.
- Determining measurements of angles when the measurements of angles are expressed as algebraic expressions may be required.

SAMPLE ITEMS

- 1** Given: Line g is parallel to line h .
If $m\angle 3 = 72^\circ$, what is the sum of $m\angle 8$ and $m\angle 5$?



- A 72°
 B 108°
 C 114°
 * D 216°

- 2** A convex polygon has 9 sides. What is the sum of the measures of the interior angles?

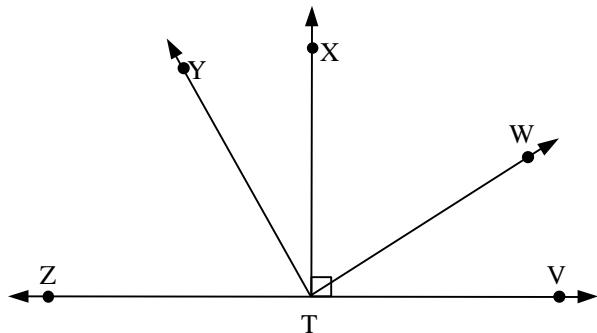
- * A 1260°
 B 1618°

- C 1620°
 D 1980°

- 3** The measure of an angle in degrees is $3x$. Which of these represents the measure of its supplement?

- A $3x + 90$
 B $3x + 180$
 C $90 - 3x$
 * D $180 - 3x$

- 4** In the diagram below, $m\angle WTV = 30^\circ$, $m\angle YTV = 120^\circ$, and $m\angle XTV = 90^\circ$.



6

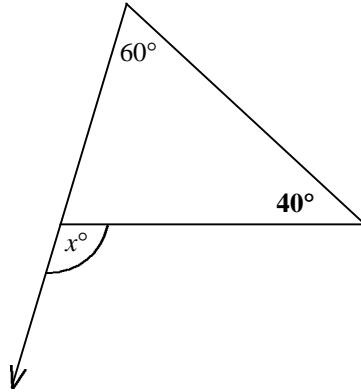
Which of these angles has the same measure as $\angle WTV$?

- A $\angle XTW$
- * B $\angle YTX$
- C $\angle YTW$
- D $\angle ZTY$

What is the supplement of an angle that measures 60° ?

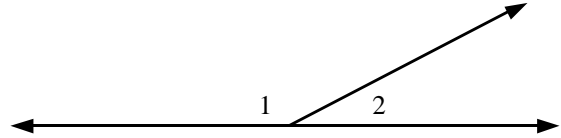
- A 30°
- B 60°
- * C 120°
- D 150°

5 What is the value of x ?



- A 40°
- B 60°
- C 80°
- * D 100°

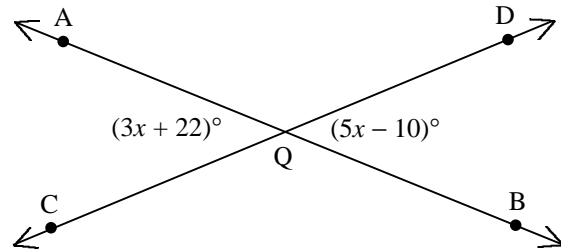
7 Given: $\angle 1$ and $\angle 2$ are a linear pair.



If $m\angle 1$ is eight times $m\angle 2$, what is $m\angle 1$?

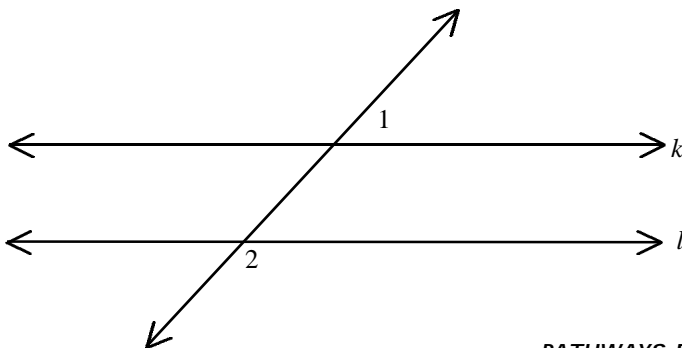
- A 20°
- B 22.5°
- C 157.5°
- * D 160°

8 Lines AB and CD intersect at point Q. What is the measure of $\angle AQC$?



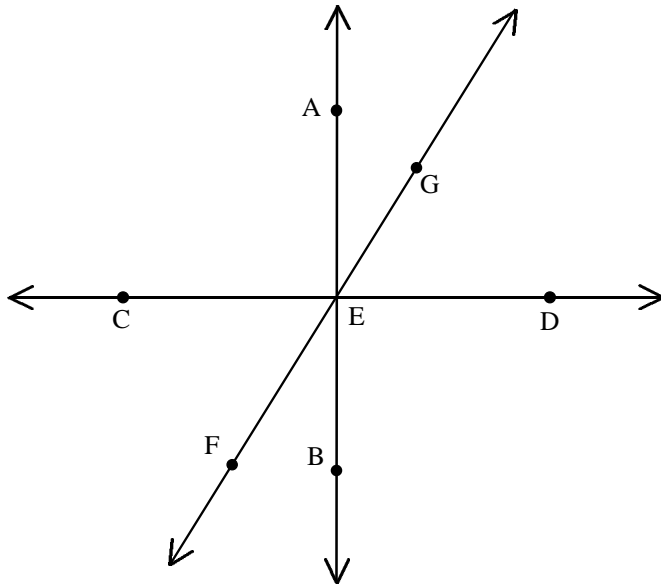
- A 16°
- B 21°
- * C 70°
- D 85°

9 Given: $k \parallel l$, $m\angle 1 = 55^\circ$
What is $m\angle 2$?



- A 25°
- B 55°
- * C 125°
- D 155°

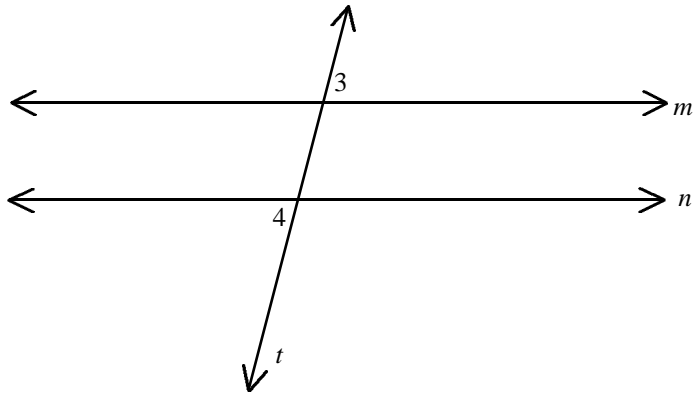
10 Given: $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$, $m\angle AED = (5x + 40)^\circ$, $m\angle FEB = (3x)^\circ$
 What is the value of $m\angle AEG$?



- A 28°
- * B 30°
- C 60°
- D 96°

11

Given: $m \parallel n$, $m\angle 3 = (2x + 5)^\circ$, $m\angle 4 = (3x - 20)^\circ$
What is the value of x ?



- A 21
- * B 25
- C 39
- D 55

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

2. Apply Pythagorean Theorem.

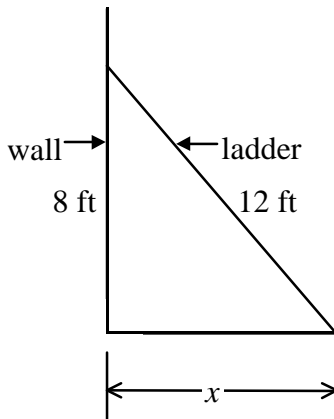
ELIGIBLE CONTENT

- The Pythagorean Theorem will be given on the reference page.
- Diagrams will be included.
- Word problems will be used.
- Radicals may be included in options.
- All radicals will be simplified.
- Drawings will be to scale.

SAMPLE ITEMS

1

Peter uses a 12-foot ladder to wash windows at his house.

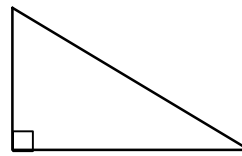


What is the distance (x) from the base of the wall to the bottom of the ladder?

- * A $4\sqrt{5}$ feet
- B $4\sqrt{13}$ feet
- C $16\sqrt{5}$ feet
- D $16\sqrt{13}$ feet

2

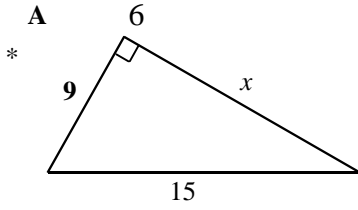
Which of these sets of numbers could be the lengths of the sides of a right triangle?



- A {2, 3, 4}
- B {3, 4, 6}
- * C {5, 12, 13}
- D {6, 10, 11}

3

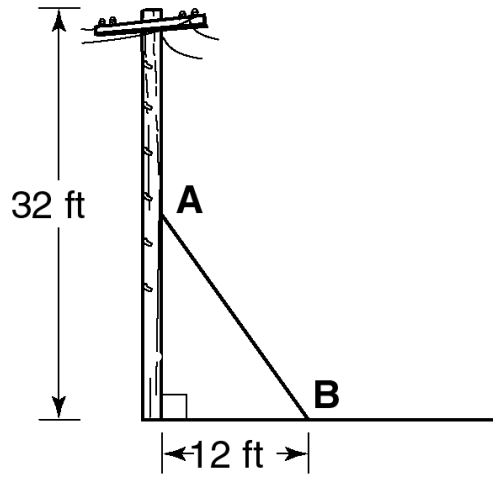
What is the value of x in the right triangle below?



- B 12
- C $\sqrt{6}$
- D $3\sqrt{34}$

4

The diagram below shows a 32-foot telephone pole. An electrician wants to connect a support wire from point A, halfway up the pole, to point B.



What is the length of the wire?

- A 12 feet
- B 16 feet
- * C 20 feet
- D 34 feet

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE

3. Apply properties of similar polygons.

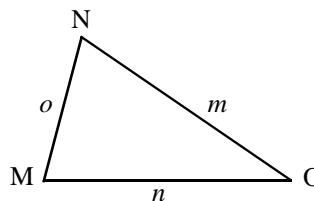
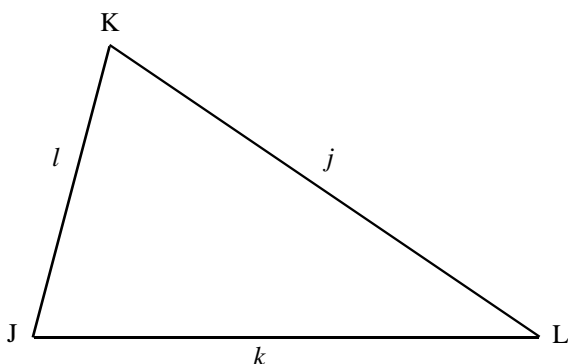
ELIGIBLE CONTENT

- Diagrams may be included.
- Drawings will be to scale.
- The word *similar* or the symbol “~” may be used.
- Use of the scale factor will be required.

SAMPLE ITEMS

1

If $\triangle JKL \sim \triangle MNO$, which of these proportions is true?



A $\frac{m}{n} = \frac{j}{l}$

B $y = 3x - 5$

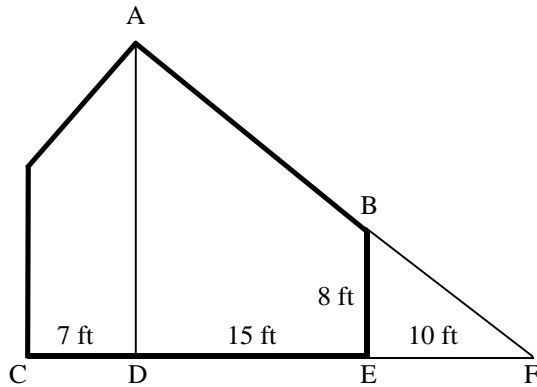
C $\frac{m}{n} = \frac{l}{j}$

* D $\frac{m}{n} = \frac{j}{k}$

2 Which of these dimensions form a rectangle similar to a rectangle with a width of 2 inches and a length of 5 inches?

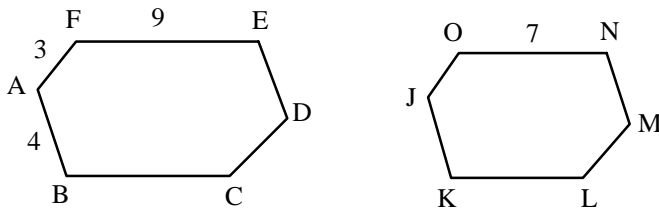
- A 2 inches by 10 inches
- B 4 inches by 25 inches
- C 6 inches by 9 inches
- * D 6 inches by 15 inches

3 In the house plan shown below, figure FEB is similar to figure FDA. What is the length of segment AD?



- A 12 feet
- * B 20 feet
- C 30 feet
- D 35 feet

4 If $ABCDEF \sim JKLMNO$, what is the length of segment JK?



- A 2
- B $2\frac{1}{3}$
- * C $3\frac{1}{9}$
- D 6

5 The bases for a major league baseball field form a square that is 90 feet long on each side. The bases for a little league field form a square that is 60 feet long on each side. What is the ratio of the area of the major league baseball field to the area of the little league field?

- A $\frac{3}{2}$
- B $\frac{2}{3}$
- * C $\frac{9}{4}$
- D $\frac{4}{9}$

6

Which of these dimensions would form a rectangle that is similar to a rectangle with sides measuring 49×14 ?

- A 9×4
- B 8×3
- * C 7×2
- D 6×2

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

4. Apply properties of plane and solid geometric figures.

ELIGIBLE CONTENT

- Diagrams may be included.
- **Word problems may be used.**
- The following content may be included:
 - area and perimeter of triangles, rectangles, and squares
 - area and circumference of a circle, given radius or diameter
 - perimeter of a regular polygon, given one side
 - volume of rectangular prism or cylinder
 - sum of the measures of the angles in a triangle
 - sum of the measures of the angles in a rectangle
- Determining any dimension of a figure may be required.
- Determining any dimension of a figure when the dimension is expressed as an algebraic expression may be required.

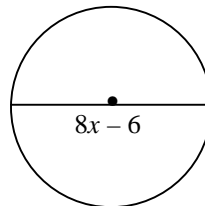
SAMPLE ITEMS

2

1

A box has a volume of 2880 cubic inches, a height of 20 inches, and a square base. What is the length of a side of the base?

- * **A** 12 inches
- B** 24 inches
- C** 48 inches
- D** 144 inches

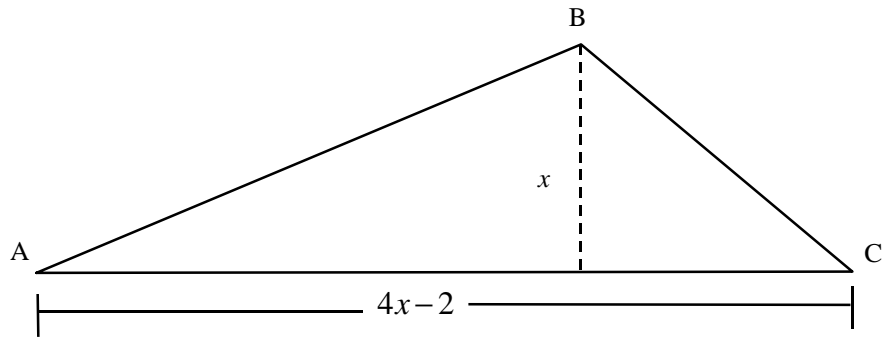


What is the area of a circle with $d = 8x - 6$?

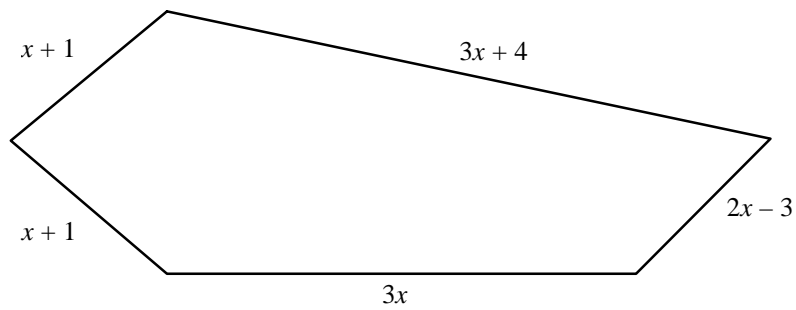
- A** $(16x - 12) \pi$
- B** $(28x + 9) \pi$
- C** $(16x^2 + 12x + 9) \pi$
- * **D** $(16x^2 - 24x + 9) \pi$

3

What is the area of the triangle ABC?



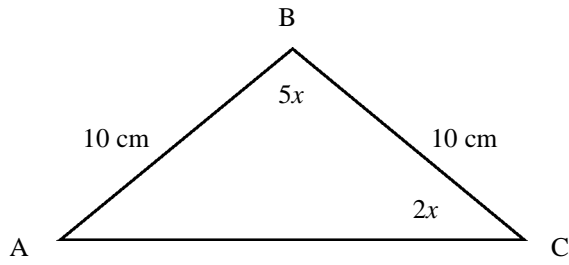
- * **A** $2x^2 - x$
- B** $2x^2 - 1$
- C** $2x^2 - 2x$
- D** $2x^2 - 2$

4If the perimeter of the figure shown below is 33 centimeters, what is the value of x ?

- A** $\frac{12}{5}$
- * **B** 3
- C** $\frac{18}{5}$
- D** 33

5

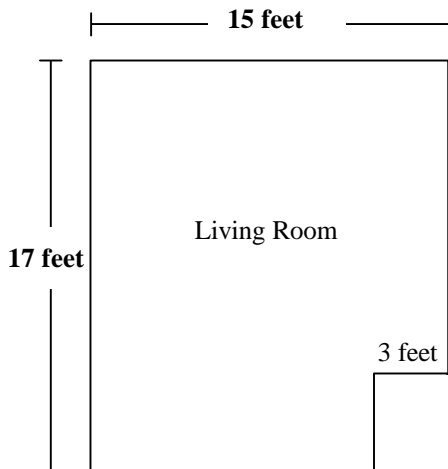
What is the measure of angle A in the figure below?



- A 20°
- B 30°
- * C 40°
- D 50°

6

How many square feet of carpet are needed to cover the living room shown in the diagram below?



- A 210 square feet
- B 222 square feet
- * C 243 square feet
- D 255 square feet

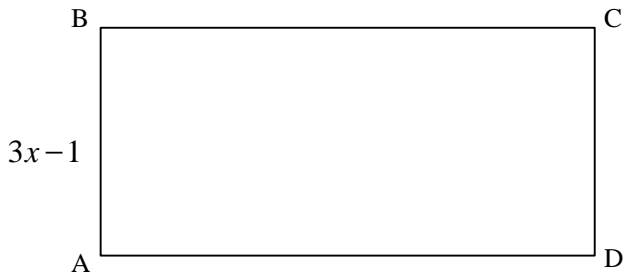
7 A circular manhole has a lid that has a circumference of 26π inches. What is the area of the lid?

- * A 169π square inches
- B 676π square inches
- C 169 square inches
- D 676 square inches

8 A pool was built in the shape of a circle with diameter $d = 10$ feet. What is the approximate distance around the pool?

- A 18 feet
- * B 31 feet
- C 63 feet
- D 78 feet

9 The perimeter of the rectangle shown below is $16x + 8$. The length of side AB is $3x - 1$. What is the length of side AD?



- A $5x + 3$
- * B $5x + 5$
- C $10x + 10$
- D $13x + 9$

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

5. Determine measures of central tendency.

ELIGIBLE CONTENT

- The word “mean” will be used for the arithmetic average.
- The set of numbers used to assess the range will not be in numerical order.
- Decimals up to hundredths may be used.
- Decimals with different numbers of decimal digits may be used in the same item.
- Frequency diagrams may be used.

SAMPLE ITEMS

1 Seven students in gym class shot 20 free throws each. The number of free throws made successfully is shown in the table below.

FREE THROW RESULTS

Student	1	2	3	4	5	6	7
Successful Free Throws	5	15	13	15	8	10	18

What is the median number of free throws made successfully?

- A** 12
- * **B** 13
- C** 14
- D** 15

2

The average high temperatures for a city during the month of October are shown in the table below.

**AVERAGE HIGH
TEMPERATURES**

Year	Temperature
1990	83°
1991	76°
1992	86°
1993	88°
1994	62°
1995	76°
1996	82°

What is the mean of the average high temperatures?

- A 76°
- * B 79°
- C 82°
- D 88°

3

What is the mode of this set of data?

5, 6, 10, 8, 5, 10, 5

- * A 5
- B 6
- C 7
- D 10

4

The frequency table shows the average number of hours students in a class spend each day on math homework. What is the mode of the average hours?

DAILY AVERAGE HOURS OF MATH HOMEWORK

Average Hours	Frequency
1	5
2	7
3	8
4	2
5	1
6	1

- A $2\frac{1}{2}$ hours
- * B 3 hours
- C $3\frac{1}{2}$ hours
- D 8 hours

5

What is the median of this set of data?

51.2, 19.5, 39.3, 31.9, 45.3, 37.9, 32.3

- A 31.9
- B 36.8
- * C 37.9
- D 39.3

6

In the first four years of his career, a baseball player had batting averages of .460, .490, .540, and .520. If he wants his mean batting average to be .550 at the end of five years, what batting average must he get in his fifth year?

- A .190
- B .512
- C .550
- * D .740

7

The table below shows Alex's scores during a golf tournament.

Golf Tournament	
Round	Score
1	74
2	67
3	
4	72
5	69

If Alex's mean of the five scores was 70, what was his score in the third round?

- A 67
- * B 68
- C 69
- D 70

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

6. Determine probabilities.

ELIGIBLE CONTENT

- Both AND and OR situations may be included.

SAMPLE ITEMS

1 A committee consists of 6 students and 4 teachers. If two committee members are selected at random, what is the probability that the first member selected is a student and the second member is a teacher?

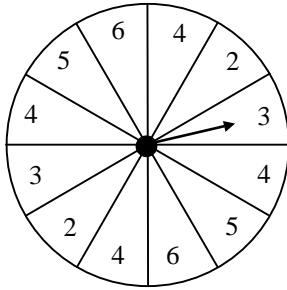
- A** $\frac{1}{5}$
*** B** $\frac{4}{15}$
C $\frac{1}{24}$
D $\frac{6}{25}$

2 In a group of 10 students, 2 were born in April, 3 in May, 3 in July, and 2 in October. If a student is chosen at random, what is the probability that the student was born in April or October?

- A** $\frac{1}{5}$
*** B** $\frac{2}{5}$
C $\frac{3}{5}$
D $\frac{4}{5}$

3

What is the probability of spinning a 4 on the spinner below?



A $\frac{1}{12}$

B $\frac{1}{4}$

* C $\frac{1}{3}$

D $\frac{1}{2}$

4

A bag contains 30 balls—8 white, 7 red, 9 green, and 6 blue. If one ball is drawn at random, what is the probability that it is white?

A $\frac{1}{30}$

* B $\frac{4}{15}$

C $\frac{18}{5}$

D $\frac{2}{15}$

5

Ten colored marbles are placed in a box—4 red, 2 yellow, and 4 green. In a random drawing, two marbles are chosen without replacement. What is the probability that the first marble selected will be red and the second marble will be green?

A $\frac{2}{15}$

B $\frac{3}{25}$

C $\frac{4}{25}$

* D $\frac{8}{45}$

6

The table shows the distribution of positions on a soccer team. To select the game captain, each player's name is written on a ball.

SOCCER TEAM POSITIONS	
Position	Number of Players
Goalie	1
Center forward	1
Wing	2
Halfback	3
Fullback	4
Total Players	11

If one ball is drawn at random, what is the probability of selecting a goalie or a wing?

- A $\frac{2}{11}$
- * B $\frac{3}{11}$
- C $\frac{5}{11}$
- D $\frac{6}{11}$

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

7. Solve problems involving direct variation.

ELIGIBLE CONTENT

- Diagrams may be used.
- Verbal descriptions of proportions may be used.

SAMPLE ITEMS

1 Lou would like to exchange 354 British pounds for U.S. dollars. If 1 U.S. dollar is equal to 0.59 British pounds, how many U.S. dollars will Lou receive?

- A \$145.14
- B \$208.86
- * C \$600.00
- D \$863.41

2 The scale of a map is $\frac{1}{4}$ inch = 40 miles. **If two cities are located 6 inches apart on the map, what is the actual distance between them?**

- A 60 miles
- B 160 miles
- C 240 miles
- * D 960 miles

3 A model airplane is built to a scale of 1:36. If the length of the model is 12 inches, what is the length of the actual airplane?

- A 30 feet
- * B 36 feet
- C 360 feet
- D 432 feet

4 The speed of sound in dry air at a temperature of 0° C (32° F) is 331.6 m/sec. How far would sound travel in 3 minutes?

- A 994.8 meters
- B 19,896 meters
- * C 59,688 meters
- D 71,625,600 meters

5

In an equation, y varies directly with x . If $x = 6$ when $y = 16$, what is the value of x when $y = 64$?

A $1\frac{1}{2}$

* B 24

C 16

D $170\frac{2}{3}$

6

A roofer can install 100 square feet of shingles in 60 minutes. At this rate, how long will it take to install 240 square feet of shingles?

A 40 minutes

B 50 minutes

* C 144 minutes

D 400 minutes

7

In an equation, x and y vary directly. If $x = 3$ when $y = -\frac{3}{2}$, which of these equations shows the relationship of x and y ?

* A $y = -\frac{1}{2}x$

B ~~$(4x+1)(x+1)$~~

C $y = -2x$

D $(5, 5)$

8

The ratios required for a certain orange paint mix are 1 part white to 2 parts red to 3 parts yellow. If 6 pints of red are used, how much yellow is needed?

A $1\frac{2}{3}$ pints

B $2\frac{1}{3}$ pints

* C 9 pints

D $7x^2 - 3x + 3$

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE

8. Solve problems involving algebraic concepts.

ELIGIBLE CONTENT

- Word problems will be used.
- Interpretation of figures may be required.
- The following content may be included:
 - distance-rate-time problems
 - money problems, which may require a system of equations
 - numbers (sum, difference, product, quotient)
 - simple age problems referring only to the present
 - consecutive integers
 - area, volume, dimension problems
 - quantity problems
 - cost problems
 - wage problems

SAMPLE ITEMS

1 Mr. Ward drove from his office to a business meeting at an average speed of **60 miles per hour. When he drove the same route on the return trip, his average speed** was 55 mph, and the trip took $\frac{1}{4}$ hour longer. What was Mr. Ward's total travel time?

- A $\sqrt{3}$ hours
- B 3 hours
- C $\sqrt{3}$ hours
- * D $5\frac{3}{4}$ hours

2 Pants cost \$5.00 more than shirts. If John buys 3 shirts and 3 pairs of pants for a total of \$135, how much does one pair of pants cost?

- A \$18.33
- B \$20.00
- C \$23.33
- * D \$25.00

3 A new savings account was opened with a deposit of \$5000. Part of the money earned 4% interest and the remainder earned 9%. The account earned a total of \$385 in simple interest during one year. How much money was invested to earn 9% interest?

- A \$1300
- B \$2500
- * C \$3700
- D \$4500

4 The sum of 3 consecutive integers is 81. What is the value of the middle integer?

- A 26
- * B 27
- C 28
- D 29

5 Ryan makes \$3.00 per hour more than Scott. If 3 times Ryan's rate plus 4 times Scott's rate is \$65.00, what is Ryan's hourly wage?

- A \$7.57
- B \$8.00
- C \$9.71
- * D \$11.00

6 The volume of a telephone book is 198 cubic inches. The book is 2 inches thick and the pages are 2 inches longer than the width. What is the width of the telephone book?

- A $8\frac{1}{2}$ inches
- * B 9 inches
- C $10\frac{1}{2}$ inches
- D 11 inches

7 The area of a rectangular lot is 112 square feet. The width is 6 feet less than the length. What is the length of the lot?

- A 7 feet
- B 8 feet
- * C 14 feet
- D 24 feet

8 John is 3 times as old as Beth. The sum of their ages is 36. How old is John?

- A 9
- B 12

- C 18
- D 27

*

9 The sum of two numbers is 58. The difference between three times the small number and the larger number is 38. What is the value of the smallest number?

- A 5
- B 10
- C 12
- * D 24