

# COMMON CORE

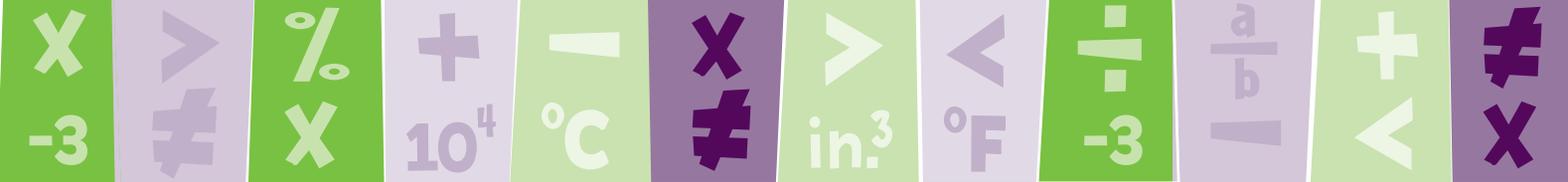
Grade 8

## Mathematics

# CLINICS

The Number System

 Options™



Module  
**1**

# The Number System

**Common Core State Standards**

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# Rational and Irrational Numbers

## Key Words

irrational number  
rational number

A **rational number** is a number that can be expressed as a ratio in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are both integers and  $b$  is not zero.  $\frac{1}{4}$ , 2.14, 45%, and  $4\frac{2}{5}$  are examples of rational numbers.

Numbers that cannot be expressed as a ratio of two integers are called **irrational numbers**.  $\pi$  and  $\sqrt{2}$  are examples of irrational numbers.

The decimal expansion of a rational number terminates in zeros or in a repeated pattern. When a decimal expansion repeats a pattern, draw a line over the repeating portion. For example,  $\frac{3}{22} = 0.1363636\dots = 0.13\overline{6}$ .

The decimal expansion of an irrational number does not terminate and does not repeat.

## Example

Find the decimal expansion of  $\frac{9}{8}$ .

Divide the numerator by the denominator.

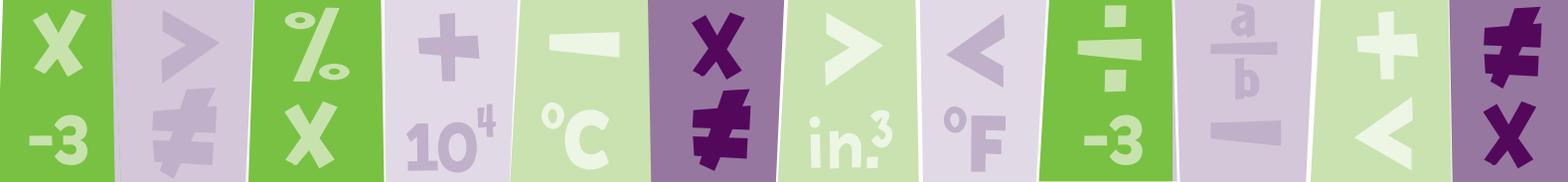
$$\begin{array}{r} 1.125 \\ 8 \overline{)9.000} \\ \underline{-8} \phantom{00} \\ 10 \phantom{0} \\ \underline{-8} \phantom{0} \\ 20 \\ \underline{-16} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

0 The decimal expansion terminates.

$$\frac{9}{8} = 1.125$$

## APPLY

Provide an example of a rational number in fraction form along with its decimal expansion.



## Guided Practice

- 1 Find the decimal expansion of  $\frac{1}{6}$ .

Divide the numerator by the denominator.

**Step 1** Divide 1 by 6 using long division.

$$\begin{array}{r}
 0.\underline{\quad} \\
 6 \overline{)1.0000} \\
 \underline{-6} \phantom{000} \\
 40 \phantom{00} \\
 \underline{-36} \phantom{0} \\
 40 \phantom{0} \\
 \underline{-36} \phantom{0} \\
 40 \phantom{0} \\
 \underline{-36} \phantom{0} \\
 40
 \end{array}$$

### REMEMBER

The decimal expansion of a rational number will terminate in zeros or in a repeating pattern.

**Step 2** Recognize a repeating pattern.  
Rewrite the decimal expansion.

$$\frac{1}{6} = 0.166666\dots = \underline{\quad}$$

$$\frac{1}{6} = \underline{\quad}$$

### REMEMBER

A repeating pattern is denoted with a line over the repeating portion of the decimal.

- 2 Is 3.491831... a rational number?

**Step 1** Decide if the decimal expansion terminates and if it repeats.

3.491831... does / does not (circle one) terminate.

3.491831... does / does not (circle one) have repeating patterns.

### THINK

The decimal has no repeating digits.

**Step 2** Determine if the number is rational or irrational.

3.491831... does not \_\_\_\_\_ and does not \_\_\_\_\_,

so it is a/an \_\_\_\_\_ number.

3.491831... is \_\_\_\_\_.

## Independent Practice

1. What is a rational number?

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2. What is an irrational number?

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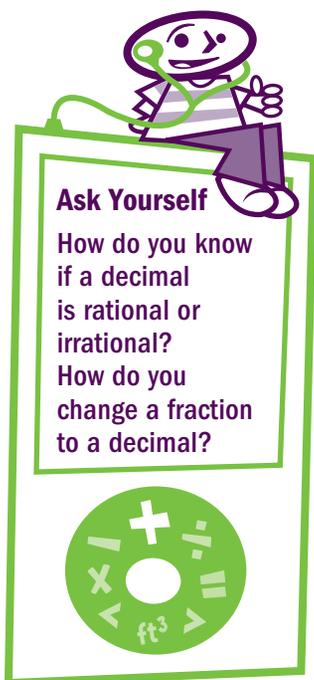
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3. What are the two possibilities for the decimal expansion of a rational number?

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**Ask Yourself**

How do you know if a decimal is rational or irrational?  
How do you change a fraction to a decimal?

Calculate the decimal expansion of each number. Indicate repeating decimals with the correct notation.

4.  $\frac{3}{4} =$  \_\_\_\_\_      5.  $\frac{2}{3} =$  \_\_\_\_\_      6.  $13\% =$  \_\_\_\_\_

7.  $\frac{6}{11} =$  \_\_\_\_\_      8.  $2\frac{4}{5} =$  \_\_\_\_\_      9.  $3\frac{5}{12} =$  \_\_\_\_\_

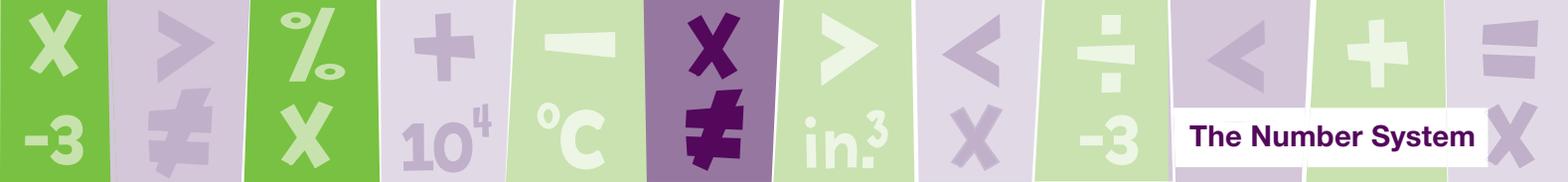
Classify each number as rational or irrational.

10. 0.00001 \_\_\_\_\_      11. 5.7161616... \_\_\_\_\_

12. 3.1232425... \_\_\_\_\_      13. 0.0220220... \_\_\_\_\_

Solve.

14. Ian and seven of his friends earn a total of \$95 shoveling snow from all of the driveways on their block. They split the money equally 8 ways. Express Ian's share,  $\frac{95}{8}$ , as a decimal and round to the nearest cent.



Express each rational number in decimal form.

15.  $\frac{2}{100} =$  \_\_\_\_\_

16.  $\frac{1}{9} =$  \_\_\_\_\_

17.  $495\% =$  \_\_\_\_\_

18.  $\frac{3}{11} =$  \_\_\_\_\_

19.  $\frac{18}{6} =$  \_\_\_\_\_

20.  $\frac{35}{8} =$  \_\_\_\_\_

Explain why each of the following is a rational number

21. 4.781 \_\_\_\_\_

22. 8 \_\_\_\_\_

23.  $14.\overline{61}$  \_\_\_\_\_

24.  $\frac{28}{59}$  \_\_\_\_\_

**Solve each problem.**

25. Lynnette earns a total of \$75 for 7 hours of work. Calculate the value of  $\frac{75}{7}$  to 2 decimal places to determine Lynnette's hourly wage.

\_\_\_\_\_ dollars

26. David divides a 125-mile drive into 3 equal-length segments. Express the length of each segment as a decimal.

\_\_\_\_\_ miles

# COMMON CORE

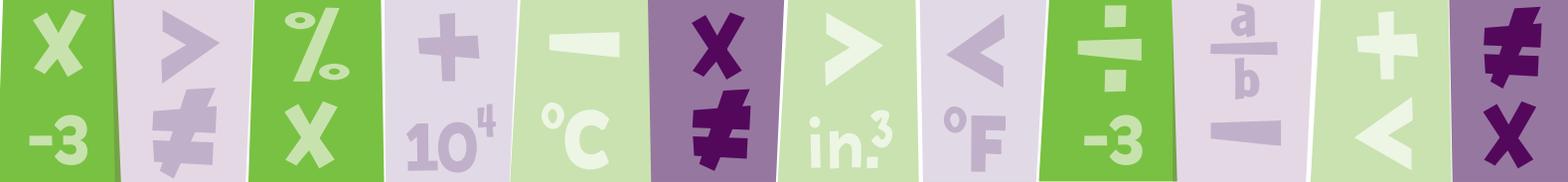
Grade 8

# CLINICS

## Mathematics

### Expressions and Equations

 Options™



**Module**  
**2**

# Expressions and Equations

**Common Core State Standards**

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# Slope

## Key Words

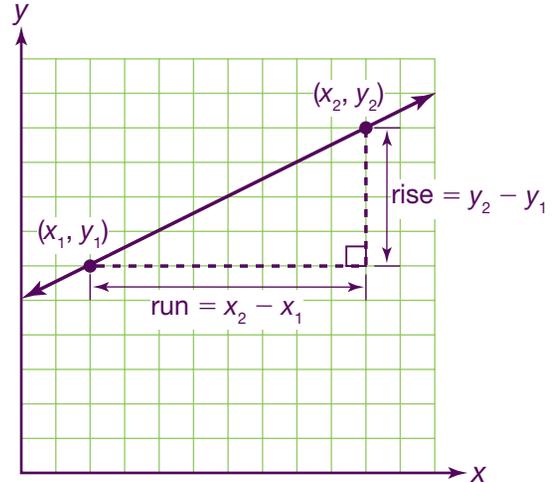
rise  
run  
slope

The **slope** of a line is a measure of its steepness. For any two points on a line, the **rise** is the vertical distance between the two points and the **run** is the horizontal distance.

The slope,  $m$ , between any two points on a line  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by the formula:

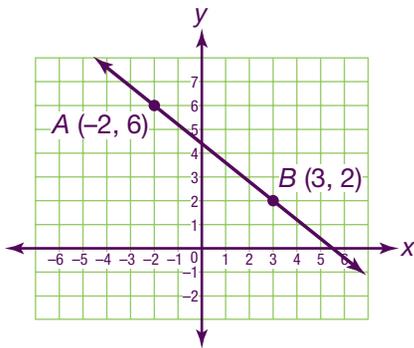
$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Lines with a positive slope slant upward as they move to the right. Lines with a negative slope slant downward. Horizontal lines have a slope of 0. The slope of vertical line is undefined.



## Example

Calculate the slope of the line through points A and B.



Determine the coordinates of the points. Point A has coordinates  $(-2, 6)$ . Point B has coordinates  $(3, 2)$ . Apply the slope formula.

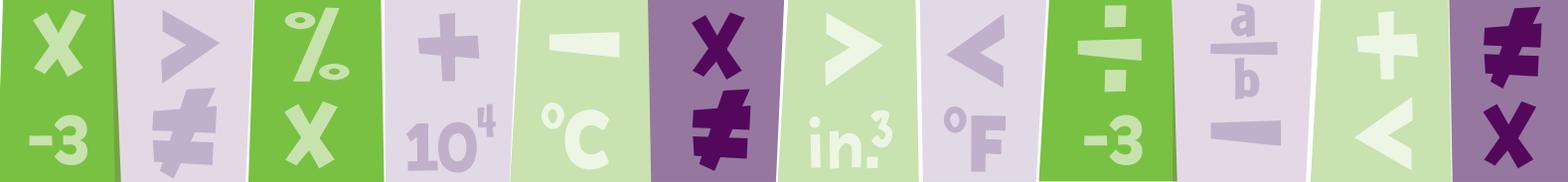
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 6}{3 - (-2)}$$

$$m = \frac{2 - 6}{3 + 2} = -\frac{4}{5}$$

The slope of the line is  $-\frac{4}{5}$ .

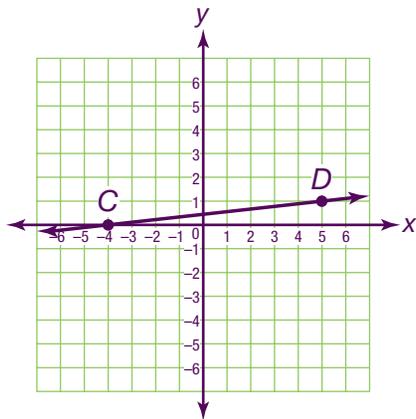
## DRAW

Sketch a line with a zero slope on a pair of coordinate axes.



## Guided Practice

What is the slope of the line shown below?



Determine the coordinates of two points on the line and calculate the slope.

**Step 1** Find the coordinates of points  $C$  and  $D$ .

The coordinates of point  $C$  are \_\_\_\_\_.

The coordinates of point  $D$  are \_\_\_\_\_.

**Step 2** Apply the formula for the slope of a line between two points.

The formula for the slope is  $m =$  \_\_\_\_\_.

For points  $C$  and  $D$ ,  $m =$  \_\_\_\_\_.

$=$  \_\_\_\_\_

The slope of the line is \_\_\_\_\_.

### THINK

Point  $C$  is 4 units to the left of the origin. Point  $D$  is 5 units to the right of the origin and 1 unit up.

### REMEMBER

The slope is given by  $\frac{\text{rise}}{\text{run}}$ .

# Independent Practice

1. What does the slope of a line measure?

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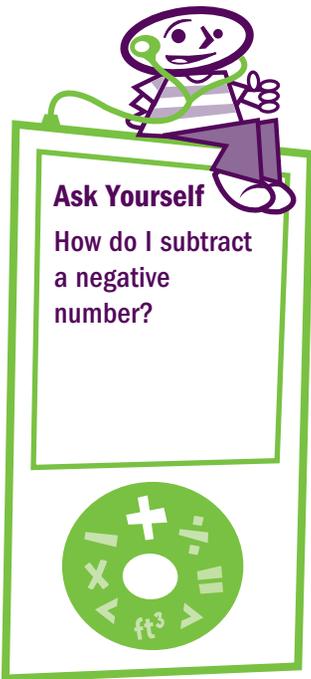
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2. Describe how to calculate the slope of a line when the coordinates of two points are given.

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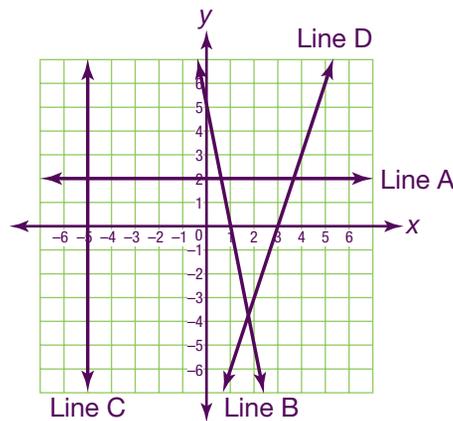


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**Ask Yourself**  
How do I subtract a negative number?

Classify the slope of each line shown below as positive, negative, zero, or undefined.



3. Line A: \_\_\_\_\_ 4. Line B: \_\_\_\_\_

5. Line C: \_\_\_\_\_ 6. Line D: \_\_\_\_\_

Calculate the slope of the line through each pair of points.

7. (0, 0), (9, 1)  
slope = \_\_\_\_\_

8. (1, 6), (4, 10)  
slope = \_\_\_\_\_

9. (5, 2), (1, 8)  
slope = \_\_\_\_\_

10. (-7, -12), (6, -1)  
slope = \_\_\_\_\_



Calculate the slope of each line.

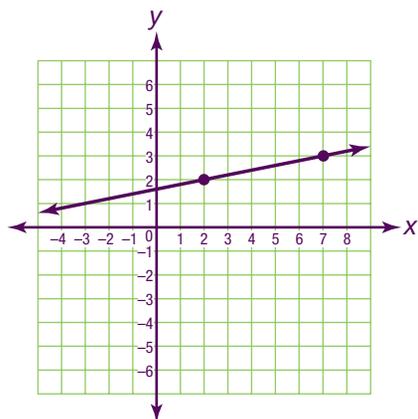
11. Line through (4, 9) and (4, 0)

slope = \_\_\_\_\_

12. Line through (-5, 8) and (6, 8)

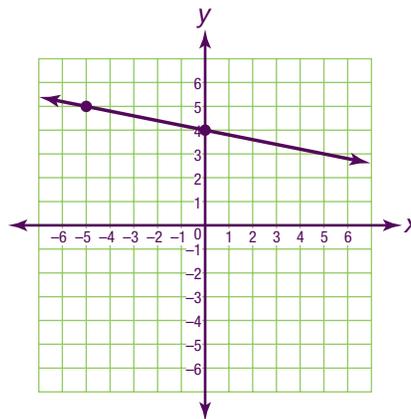
slope = \_\_\_\_\_

13.



slope = \_\_\_\_\_

14.



slope = \_\_\_\_\_

**Solve each problem.**

15. A line with slope  $\frac{3}{8}$  passes through the point (-4, 0). Use the definition of slope to find another point on the same line.

\_\_\_\_\_

16. A line with slope -4.5 passes through the point (6, -4). Use the definition of slope to find another point on the same line.

\_\_\_\_\_

17. Julia plots the points (4, 1), (-2, 3), and (8, 0) on a coordinate grid. Do all three points lie on the same line? Explain your reasoning.

\_\_\_\_\_  
\_\_\_\_\_

# COMMON CORE

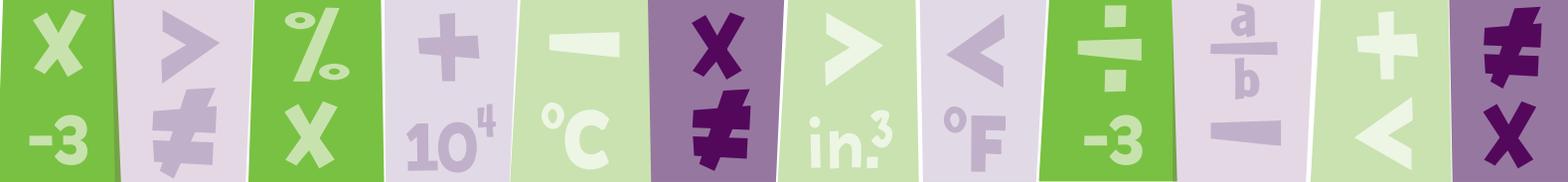
Grade 8

# CLINICS

## Mathematics

Functions, Statistics,  
and Probability

 Options™



**Module**  
**3**

# Functions, Statistics, and Probability

**Common Core State Standards**

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# Introduction to Functions

## Key Words

function  
linear function  
nonlinear  
function

A **function** is a rule that assigns to each input exactly one output. In a function, the value of the input determines the value of the output. A rule that assigns more than one output to any input value is not a function.

Functions can be represented as a set of ordered pairs, as a table of values, as an equation, as a verbal description, or as a graph. Since every input value can have only one output value, the graph of a function cannot intersect any  $x$ -coordinate at more than one point.

An equation of the form  $y = mx + b$  represents a **linear function**. The graph of a linear function is a straight line. The slope of the line, given by  $m$  in the equation, represents the rate of change of the function.

A **nonlinear function** has an equation that cannot be put in  $y = mx + b$  form. The graph of a non-linear function is not a straight line.

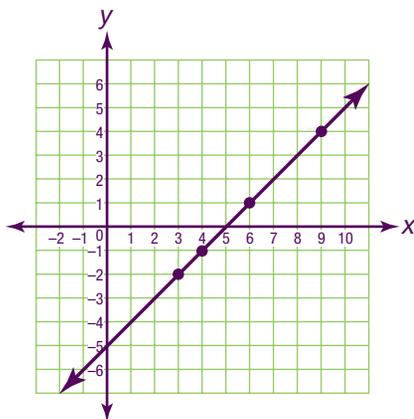
## Example

Does the table of values represent a function? Is it linear?

$x$	3	4	6	9
$y$	-2	-1	1	4

Each  $x$ -value corresponds to only one  $y$ -value, so the relation is a function. Graph the relationship.

The table gives four points  $(3, -2)$ ,  $(4, -1)$ ,  $(6, 1)$ ,  $(9, 4)$ .

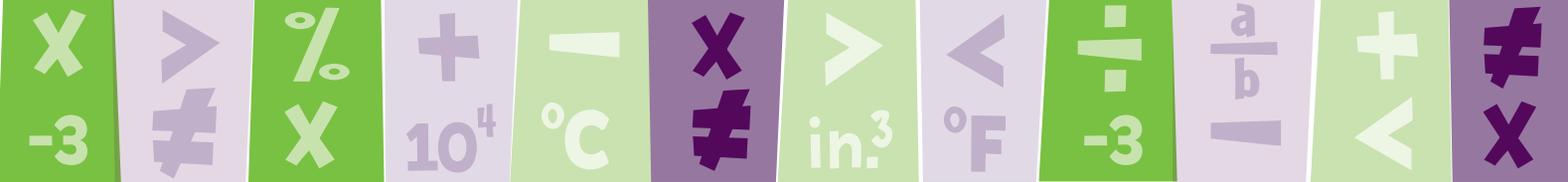


The graph is a straight line.

The table represents a linear function.

## CLASSIFY

Is  $y = x^2 + 2$  a linear function? Why or why not?



## Guided Practice

- 1 Does the set of ordered pairs below represent a function? Is it linear?

$\{(0, 0), (1, 1), (2, 4), (3, 9)\}$

**Step 1** Compare the inputs and outputs.

Every input value has \_\_\_\_\_ output.

The set of ordered pairs is a \_\_\_\_\_.

**Step 2** Plot the coordinate pairs.

The points \_\_\_\_\_ be joined by a straight line.

The relationship is not a \_\_\_\_\_ function.

The set of ordered pairs represents a \_\_\_\_\_ function.

- 2 Does the equation represent a linear or nonlinear function?

$$4x + 3y = 8$$

**Step 1** Solve the equation for  $y$ .

Subtract \_\_\_\_\_ from both sides.

$$3y = \_\_\_\_ + 8$$

Divide both sides by \_\_\_\_\_.

$$y = \_\_\_\_ x + \_\_\_\_$$

**Step 2** Decide if the function is linear.

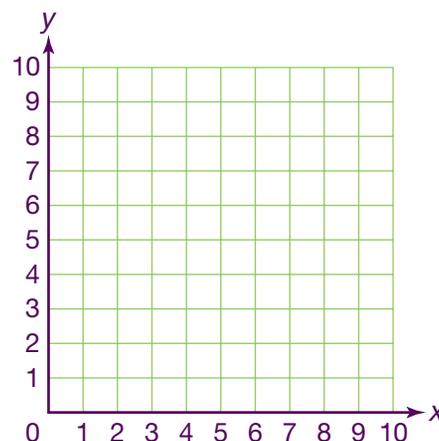
$$y = -\frac{4}{3}x + \frac{8}{3} \text{ is in } y = mx + b \text{ form.}$$

The equation is a \_\_\_\_\_ function.

The equation represents a \_\_\_\_\_ function.

**THINK**

No input values are repeated.



**REMEMBER**

A linear function can be written in  $y = mx + b$  form.

# Independent Practice

1. What is a function?

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2. Describe two characteristics of a linear function.

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Determine if each set of ordered pairs represents a function.

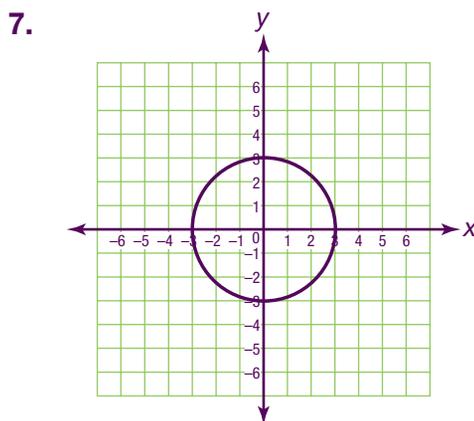
3.  $(-7, 1), (2, 3), (-1, 5), (5, 8)$  \_\_\_\_\_

4.  $(1, 4), (1, -2), (2, 0), (3, 1)$  \_\_\_\_\_

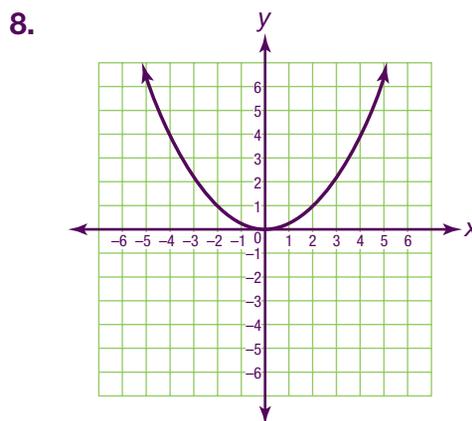
5.  $(-3, 0), (-1, 0), (0, 0), (2, 0)$  \_\_\_\_\_

6.  $(-2, -2), (-1, -1), (0, 0), (3, 3)$  \_\_\_\_\_

Determine if each graph represents a function.

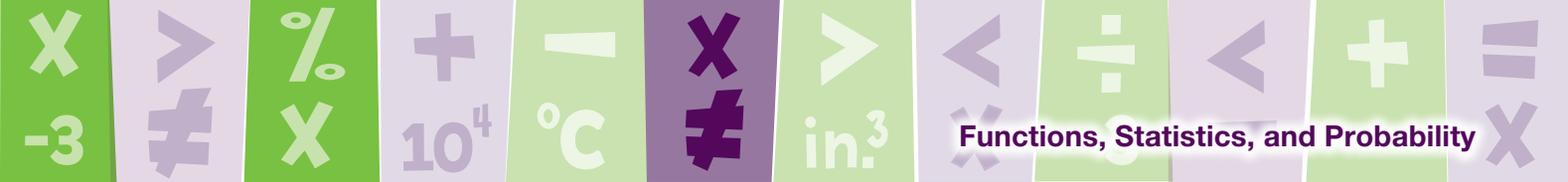


Function? \_\_\_\_\_



Function? \_\_\_\_\_

**Ask Yourself**  
How can I tell if a relation is a function from its graph?



Determine if each equation represents a linear function.

9.  $y = -\frac{7}{15}x + 3$  Linear function? \_\_\_\_\_

10.  $y = \frac{1}{x}$  Linear function? \_\_\_\_\_

11.  $2x + 6y = x - y + 9$  Linear function? \_\_\_\_\_

12.  $y = x^2 + 3x + 2$  Linear function? \_\_\_\_\_

Graph the table or set of ordered pairs. Determine if the relationship is a linear function. (You can use the grid below for both graphs.)

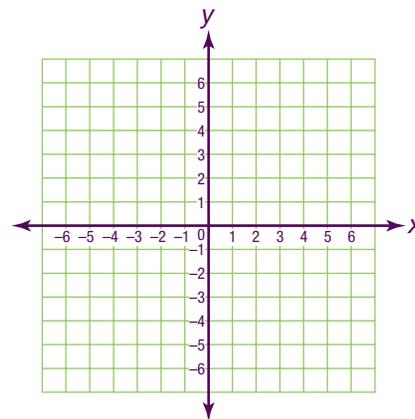
13.

<b>x</b>	-4	0	2	4
<b>y</b>	0	-2	-3	-4

Linear function? \_\_\_\_\_

14.  $(-5, 5), (-2, 0), (0, -5), (2, -6)$

Linear function? \_\_\_\_\_



**Solve.**

15. A relation between two variables consists of 4 ordered pairs.

$(0, 8) (3, 7) (6, 6) (a, b)$

a. Choose values of  $a$  and  $b$  that make the relation a linear function.

$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_

b. Choose values of  $a$  and  $b$  that make the relation a nonlinear function.

$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_

c. Choose values of  $a$  and  $b$  that make the relation not a function.

$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_

# COMMON CORE

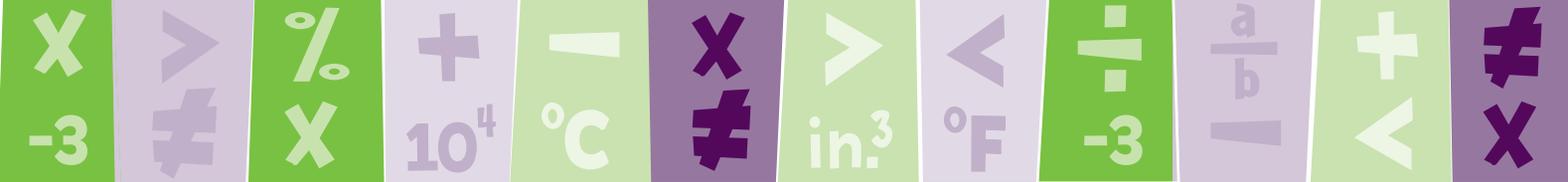
Grade 8

# CLINICS

## Mathematics

## Geometry

 Options™



**Module**  
**4**

**Geometry**

**Common Core State Standards**

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# Congruence Transformations

## Key Words

congruence  
transformation  
congruent  
reflection  
rotation  
translation

A **congruence transformation** moves a figure in the coordinate plane to create another figure with the same size and shape. Angles are taken to angles of the same measure. Line segments are taken to line segments of the same length. The congruence transformations are **translations** (slides), **reflections** (flips), and **rotations** (spins).

Two figures are **congruent** if the second can be obtained from the first by a sequence of rotations, reflections, and translations. Congruent figures have the same size and shape.

## Example

Translate the line segment 7 units down and 2 units to the left.

The endpoints of the line segment are  $(1, 9)$  and  $(5, 6)$ .

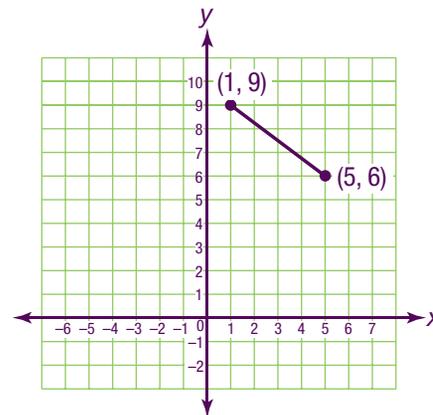
To shift down, subtract 7 from the  $y$ -coordinate.

To shift left, subtract 2 from the  $x$ -coordinate.

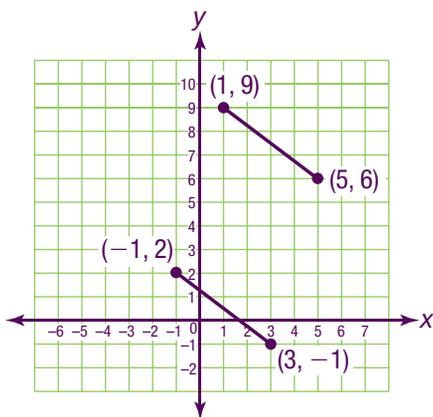
$$(1, 9) \longrightarrow (1 - 2, 9 - 7) \longrightarrow (-1, 2)$$

$$(5, 6) \longrightarrow (5 - 2, 6 - 7) \longrightarrow (3, -1)$$

The endpoints of the segment after translation are  $(-1, 2)$  and  $(3, -1)$ .

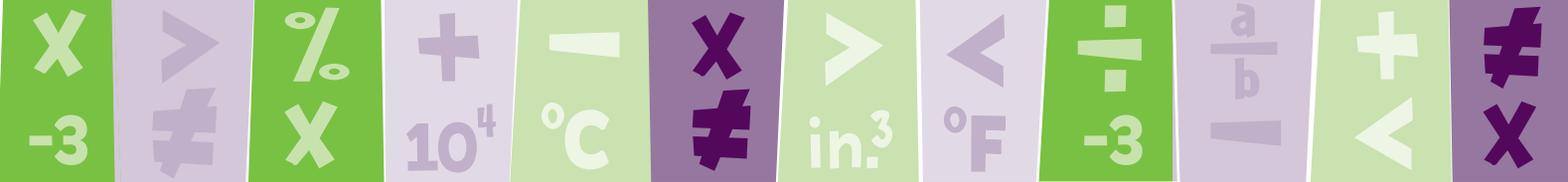


Translate the endpoints and draw the new line segment.



## DESCRIBE

What happens to the coordinates of a point that is reflected across the  $y$ -axis?



## Guided Practice

Triangle  $ABC$  has vertices  $(4, 9)$ ,  $(9, 7)$ , and  $(6, 3)$ . Rotate  $\triangle ABC$   $180^\circ$  around the origin. Then reflect it across the  $x$ -axis. What are the coordinates of the final image?

**Step 1** Rotate the figure  $180^\circ$  to create  $\triangle A'B'C'$ .

The vertices of the triangle are  $(4, 9)$ ,  $(9, 7)$ , and  $(6, 3)$ .

After rotating  $180^\circ$ , the new vertices of the triangle are: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

Plot the rotated triangle on the grid below and label the vertices  $A'$ ,  $B'$ , and  $C'$ .

### REMEMBER

To rotate  $180^\circ$  around the origin, switch the sign of the  $x$  and  $y$  coordinates.

**Step 2** Reflect the figure across the  $x$ -axis to create  $\triangle A''B''C''$ .

After rotation, the triangle has vertices  $(-4, -9)$ ,  $(-9, -7)$ , and  $(-6, -3)$ .

After reflecting the object across the  $x$ -axis, the new vertices of the triangle are: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

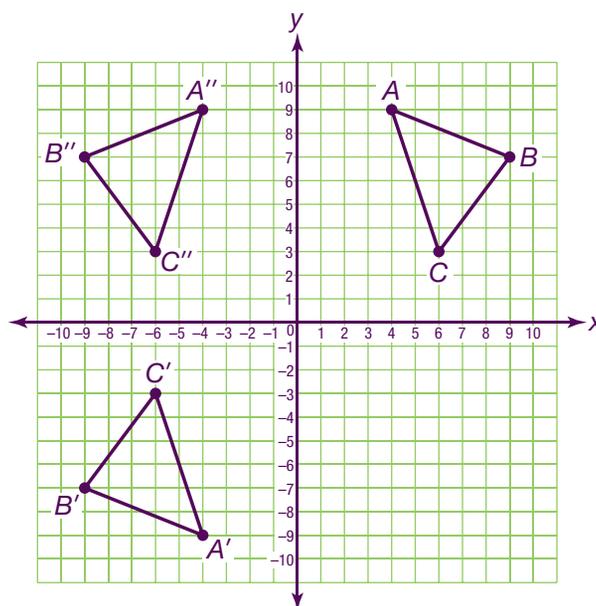
Plot the reflected triangle on the grid and label the vertices  $A''$ ,  $B''$ , and  $C''$ .

### REMEMBER

To reflect an object across the  $x$ -axis, change the sign of the  $y$ -coordinate.

The resulting triangle is shown in Step 2.

Its coordinates are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.



# Independent Practice

1. What does it mean for two figures to be congruent?

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2. What is a translation?

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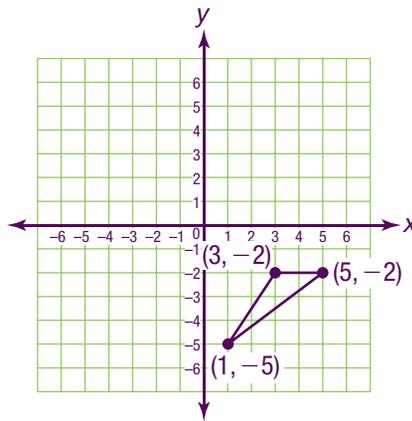


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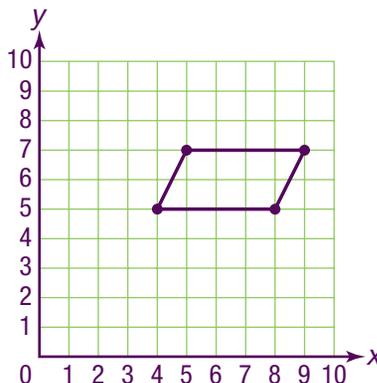
**Ask Yourself**  
Should a figure that has been translated, rotated, or reflected be congruent to the original figure?

Perform the given transformation on each figure. Sketch the result on the provided axes.

3. Rotate the figure  $180^\circ$  around the origin.

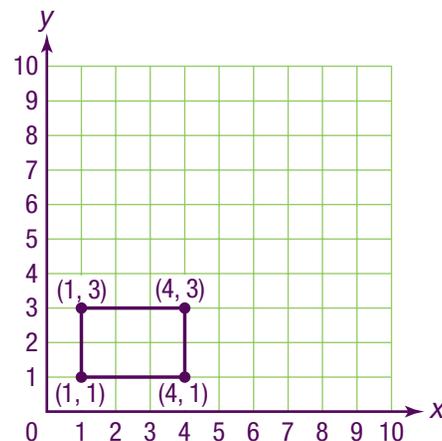


4. Translate the figure 4 units down and 3 units to the left.





5. An interior decorator uses a coordinate grid to design the layout of a room. Each unit on the grid represents 1 foot. The rectangle to the right represents the location of a desk in the room. Sketch the result on the grid if the desk is moved 3 feet to the right and 6 feet up.



**Solve each problem.**

6. A line segment has endpoints  $(-8, 0)$  and  $(-1, 10)$ . What are the coordinates of the endpoints after the line segment is reflected across the  $y$ -axis and translated 7 units down in that order?

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7. The point  $(-4, 5)$  is a vertex of a triangle. What are the new coordinates of the vertex if the triangle is rotated  $180^\circ$  around the origin, then translated 6 units up and 4 units to the left, in that order?

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8. Rectangles 1 and 2 show the location of a car before and after it is moved. Each unit on the grid represents two meters.

Describe the translation that moves the car.

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