

# Unit 9 – Linear Functions (chapter 9)

## Topics

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### Functions

Representing Linear Functions

Constant Rate of Change and Slope

Direct Variation

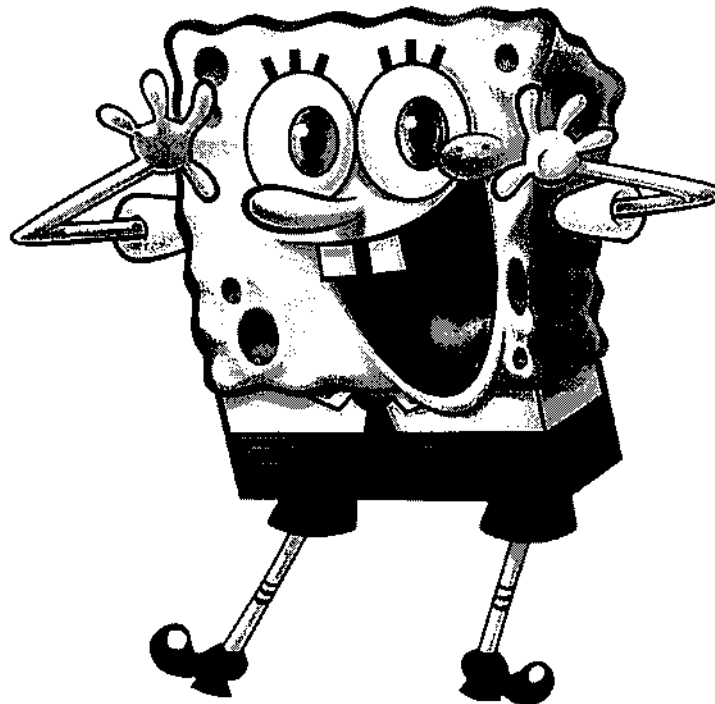
Slope-Intercept form

Solve Systems of equations by Graphing

Solve Systems of equations by Algebraically

Parallel and Perpendicular Lines

Graphing Inequalities



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Team: \_\_\_\_\_ Math Period: \_\_\_\_\_ Teacher: \_\_\_\_\_

## Notes Section:

## Notes Section:

# Lesson 1 Reteach

## Functions

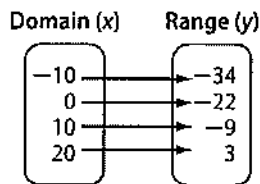
A **function** is a relation in which each element of the domain is paired with exactly one element of the range. To determine whether a relation is a function, make sure that each member of the domain pairs up with only one value in the range. Another method is to apply the **vertical line test** to the graph of the relation.

<b>Vertical Line Test</b>	Move a pencil or straightedge from left to right across the graph of a relation. • If it passes through no more than one point on the graph, the graph represents a function. • If it passes through more than one point on the graph, the graph does not represent a function.
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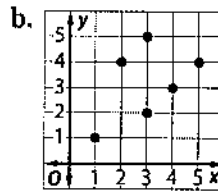
Since functions are relations, they can be represented using ordered pairs, tables, or graphs.

**Example 1** Determine whether each relation is a function. Explain.

a.  $\{(-10, -34), (0, -22), (10, -9), (20, 3)\}$



Because each element in the domain is paired with only one value in the range, this is a function.



Use a pencil or straightedge and move from left to right across the graph. It passes through more than one point of the graphed relation at  $x = 3$ . Therefore, this is not a function.

Functions that can be written as equations can be written in **function notation**, where the variable  $y$  and the term  $f(x)$  represent the dependent variable. The term  $f(x)$  is read "f of x."

**Example 2** If  $f(x) = 3x + 4$ , find the function value for  $f(-2)$ .

$$f(x) = 3x + 4$$

Write the function.

$$f(-2) = 3(-2) + 4 \text{ or } -2$$

Substitute  $-2$  for  $x$  into the function rule.

$$\text{So, } f(-2) = -2.$$

### Exercises

Determine whether each relation is a function. Explain.

1.  $\{(-5, 2), (3, -3), (1, 7), (3, 0)\}$

2.  $\{(2, 7), (-5, 20), (-10, 20), (-2, 10), (1, 20)\}$

If  $f(x) = -3x + 2$ , find each function value.

3.  $f(9)$

4.  $f(12)$

5.  $f(-2)$

6.  $f(-5)$

# Lesson 1 Homework Practice

## Functions

Determine whether each relation is a function. Explain.

1.  $\{(4, -5), (0, -9), (1, 0), (7, 0)\}$

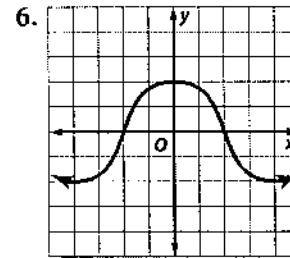
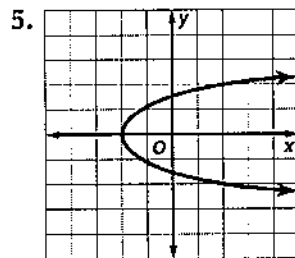
2.  $\{(5, 2), (-2, 15), (-7, 15), (1, 5), (4, 15), (-7, 2)\}$

3.

x	-3.0	3.5	4.1	-3.0	3.4
y	4.2	3.7	-3.8	3.7	4.0

4.

x	7	14	11	-10	-1
y	-3	-9	-4	-3	15



If  $f(x) = \frac{1}{2}x + 5$ , find each function value.

7.  $f(24)$

8.  $f(-30)$

9.  $f(11)$

10.  $f(-10)$

For Exercises 11–14, use the table, which shows the percent of employed men and women in the U.S. labor force every five years from 1985 to 2005.

Employed Members of Labor Force		
Year	Men (% of male population)	Women (% of female population)
1985	76.3	54.5
1990	76.4	57.5
1995	75.0	58.9
2000	78.9	67.3
2005	73.3	59.3

11. Is the relation (year, percent of men) a function? Explain.

12. Describe how the percent of employed men is related to the year.

13. Is the relation (year, percent of women) a function? Explain.

14. Describe how the percent of employed women is related to the year.

# Lesson 1 Problem-Solving Practice

## Functions

1. Below are shirt sizes found in a department store, listed as (neck size, arm length).  
 $\{(13 \frac{1}{2}, 33), (14 \frac{1}{2}, 35), (14 \frac{1}{2}, 36), (15, 34), (15, 35), (16, 34), (17, 35), (17, 36)\}$   
 Does the relation (neck size, arm length) represent a function? Explain.

2. The table below lists the average price of gasoline per gallon in the United States at the end of each month in a recent year.

Month	Price	Month	Price
January	\$3.11	July	\$3.84
February	\$3.33	August	\$3.75
March	\$3.54	September	\$3.81
April	\$3.92	October	\$3.85
May	\$4.19	November	\$4.07
June	\$3.95	December	\$4.02

Does the relation (month, price) represent a function? Explain.

3. The information listed in the table shows the cost of a cab ride across town.

Distance (miles)	Price (\$)
0.5	5.50
1.3	6.50
2.7	8.00
3.1	8.50
3.4	8.50
3.6	9.00

Does the relationship between the distance traveled and the cost represent a function? Explain.

4. The table at the right shows the price of a book and its page content.

Price (\$)	Pages
10.45	135
24.38	170
23.54	180
23.54	272
22.61	300

Does the relation (price, pages) represent a function? Explain.

5. The table below shows the typical air temperature at various altitudes.

Altitude (ft)	Air Temperature (°F)
0	59.0
10,000	23.3
20,000	-12.3
30,000	-48.0
40,000	-69.7
50,000	-69.7
60,000	-69.7
70,000	-69.7
80,000	-69.7
90,000	-56.6
100,000	-40.1

Explain whether or not this relationship represents a function.

6. Refer to the table in Exercise 5. Describe the relationship between altitude and air temperature.

**9-2**

**Study Guide and Intervention**  
**Functions**

Lesson 9-2

A function connects an input number,  $x$ , to an output number,  $f(x)$ , by a rule. To find the value of a function for a certain number, substitute the number into the function value in place of  $x$ , and simplify.

**Example 1** Find  $f(5)$  if  $f(x) = 2 + 3x$ .

$f(x) = 2 + 3x$  Write the function.  
 $f(5) = 2 + 3(5)$  or 17 Substitute 5 for  $x$  into the function rule and simplify.  
 So,  $f(5) = 17$ .

You can organize the input, rule, and output of a function using a function table.

**Example 2** Complete the function table for  $f(x) = 2x + 4$ .

Substitute each value of  $x$ , or input, into the function rule. Then simplify to find the output.

$f(x) = 2x + 4$   
 $f(-1) = 2(-1) + 4$  or 2  
 $f(0) = 2(0) + 4$  or 4  
 $f(1) = 2(1) + 4$  or 6  
 $f(2) = 2(2) + 4$  or 8

Input $x$	Rule $2x + 4$	Output $f(x)$
-1	$2(-1) + 4$	2
0	$2(0) + 4$	4
1	$2(1) + 4$	6
2	$2(2) + 4$	8

**Exercises**

Find each function value.

- $f(1)$  if  $f(x) = x + 3$
- $f(6)$  if  $f(x) = 2x$
- $f(4)$  if  $f(x) = 5x - 4$
- $f(9)$  if  $f(x) = -3x + 10$
- $f(-2)$  if  $f(x) = 4x - 1$
- $f(-5)$  if  $f(x) = -2x + 8$

Complete each function table.

7.  $f(x) = x - 10$

$x$	$x - 10$	$f(x)$
-1		
0		
1		
2		

8.  $f(x) = 2x + 6$

$x$	$2x + 6$	$f(x)$
-3		
-1		
2		
4		

9.  $f(x) = 2 - 3x$

$x$	$2 - 3x$	$f(x)$
-2		
0		
3		
4		

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# 9-2 Practice Functions

Find each function value.

1.  $f(6)$  if  $f(x) = 4x$

2.  $f(8)$  if  $f(x) = x + 11$

3.  $f(3)$  if  $f(x) = 2x + 4$

4.  $f(5)$  if  $f(x) = 3x - 2$

5.  $f(-6)$  if  $f(x) = 4x + 7$

6.  $f(-14)$  if  $f(x) = 2x - 3$

7.  $f\left(\frac{2}{9}\right)$  if  $f(x) = 3x + \frac{1}{3}$

8.  $f\left(\frac{3}{4}\right)$  if  $f(x) = 2x - \frac{1}{4}$

9.  $f\left(\frac{4}{5}\right)$  if  $f(x) = 4x - \frac{1}{5}$

Complete each function table. Then state the domain and range of the function.

10.  $f(x) = 5x - 4$

$x$	$5x - 4$	$f(x)$
-4		
-1		
3		
6		

11.  $f(x) = 2 - 3x$

$x$	$2 - 3x$	$f(x)$
-3		
0		
2		
5		

12.  $f(x) = 6 + 2x$

$x$	$6 + 2x$	$f(x)$
-3		
-1		
1		
4		

13.  $f(x) = x - 7$

$x$	$x - 7$	$f(x)$
-3		
-2		
5		
10		

14.  $f(x) = 9x$

$x$	$9x$	$f(x)$
-6		
-4		
1		
3		

15.  $f(x) = 3x + 5$

$x$	$3x + 5$	$f(x)$
-5		
-1		
2		
6		

16. **JACKETS** The school baseball team wants to have each player's name imprinted on the player's jacket. The cost is \$75 plus \$8.50 for each name. Write a function to represent the cost  $c$  for  $n$  names. What is the cost to have names imprinted on 25 jackets?

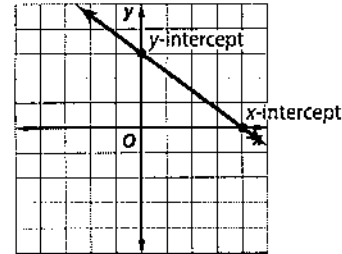
17. **LEMONADE** Gene sold 10 glasses of lemonade while setting up his lemonade stand. After opening, he sold an average of 20 glasses each hour. Write a function to represent the approximate number of glasses  $g$  sold after  $h$  hours. About when did he sell the 100th glass of lemonade?



# Lesson 2 Reteach

## Representing Linear Functions

An equation whose graph is a line is a **linear equation**. You can plot points on a coordinate plane to graph a linear equation. You can find ordered pairs using a table, or you can plot the  $x$ -intercept and the  $y$ -intercept and connect the two points. The  $x$ -intercept is the  $x$ -coordinate of the point at which the graph crosses the  $x$ -axis. The  $y$ -intercept is the  $y$ -coordinate of the point at which the graph crosses the  $y$ -axis.



**Example** Graph  $2x + y = 6$ .

You can graph an equation by using a table to find ordered pairs.

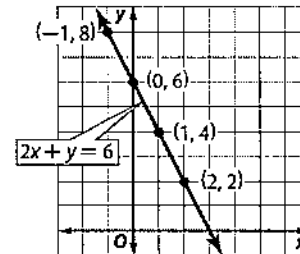
**Step 1** Rewrite the equation by solving for  $y$ .

$$\begin{aligned}
 2x + y &= 6 && \text{Write the equation.} \\
 2x - 2x + y &= 6 - 2x && \text{Subtract } 2x \text{ from each side.} \\
 \hline
 y &= 6 - 2x && \text{Simplify.}
 \end{aligned}$$

$x$	$y = 6 - 2x$	$y$	$(x, y)$
-1	$y = 6 - 2(-1)$	8	$(-1, 8)$
0	$y = 6 - 2(0)$	6	$(0, 6)$
1	$y = 6 - 2(1)$	4	$(1, 4)$
2	$y = 6 - 2(2)$	2	$(2, 2)$

**Step 2** Choose four values for  $x$  and find the corresponding values for  $y$ . Four solutions are  $(-1, 8)$ ,  $(0, 6)$ ,  $(1, 4)$  and  $(2, 2)$ .

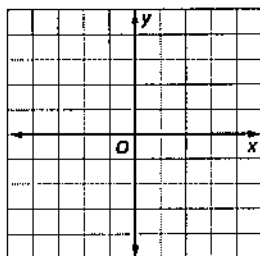
**Step 3** Graph the ordered pairs on a coordinate plane and draw a line through the points.



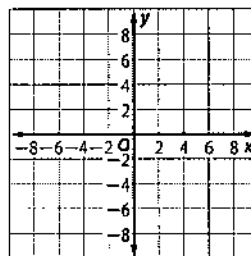
### Exercises

Graph each equation by plotting ordered pairs.

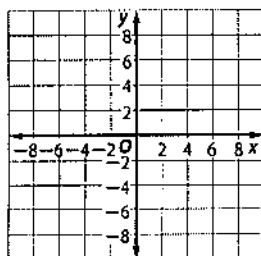
1.  $y = -4x$



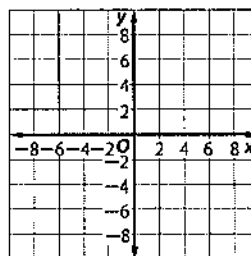
2.  $y = x + 6$



3.  $x + y = -4$



4.  $-4x + y = -3$



# Lesson 2 Homework Practice

## Representing Linear Functions

Find four solutions of each equation. Write the solutions as ordered pairs.

1.  $y = x - 5$

2.  $y = -7$

3.  $y = -3x + 1$

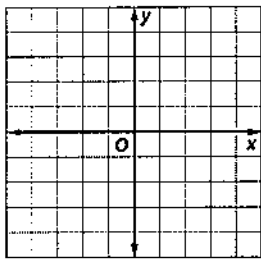
4.  $x - y = 6$

5.  $y = 2x + 4$

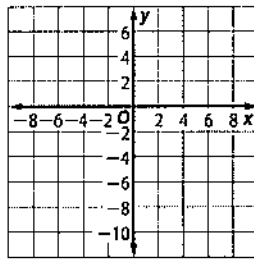
6.  $7x - y = 14$

Graph each equation by plotting ordered pairs.

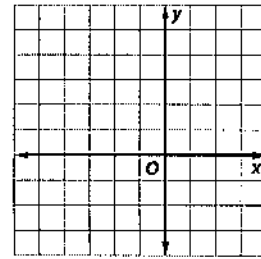
7.  $y = 2x - 1$



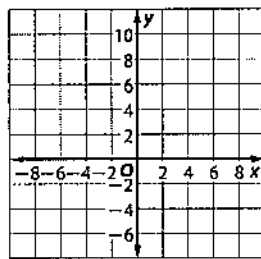
8.  $6x + y = 2$



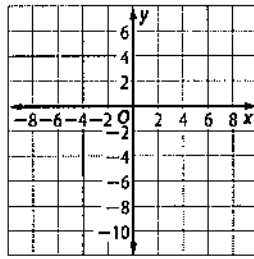
9.  $y = x + 4$



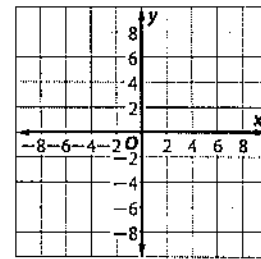
10.  $y = 7$



11.  $y = 3x - 9$

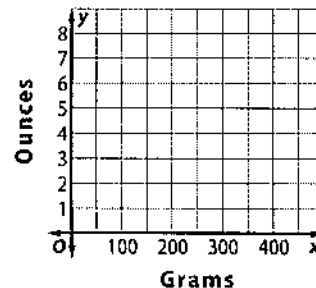


12.  $y = \frac{1}{2}x - 6$



13. Kirsten is making gingerbread cookies using her grandmother's recipe and needs to convert grams to ounces. The equation  $y = 0.04x$  describes the approximate number of ounces  $y$  in  $x$  grams.

- Find three solutions of this equation.
- Draw the graph that contains these points.
- Do negative values of  $x$  make sense in this case? Explain.



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## Lesson 2 Problem-Solving Practice

### Representing Linear Functions

<p>1. On January 31, 2008, the equation <math>1.99p = d</math> represented the relationship between the U.S. dollar <math>d</math> and the British pound sterling <math>p</math>. Complete the following table.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">UK Pounds</th> <th style="padding: 2px;">US Dollars</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;">1</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"></td> <td style="text-align: center; padding: 2px;">1</td> </tr> <tr> <td style="text-align: center; padding: 2px;">3.4</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"></td> <td style="text-align: center; padding: 2px;">140</td> </tr> </tbody> </table>	UK Pounds	US Dollars	1			1	3.4			140	<p>2. The equation <math>c = 2.54i</math> can be used to convert between inches <math>i</math> and centimeters <math>c</math>. Complete the three ordered pairs <math>(i, c)</math> below. Round your answers to the nearest hundredth. <math>(19.2, \underline{\quad})</math>, <math>(\underline{\quad}, 84.2)</math>, <math>(68.5, \underline{\quad})</math>.</p>
UK Pounds	US Dollars										
1											
	1										
3.4											
	140										
<p>3. Jerry bought material for a fence to put around the garden shown in the drawing.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>The equation <math>2x + y = 80</math> describes the relationship between <math>x</math> the width and <math>y</math> the length of his garden in feet. Find one ordered pair solution that makes sense in the situation and one that does not. Explain your choices.</p>	<p>4. The cost of renting a car from the Frugal Car Rental Company includes a \$20 non-refundable deposit and a travel cost of 4¢ per mile. Find an equation to represent the total cost, <math>C</math>, if a car is rented and driven <math>n</math> miles. Then, find two ordered pairs that satisfy this condition.</p>										
<p>5. Melissa is buying prizes for a school carnival. At the store, she finds colorful note paper sold in packs containing 4 sheets and stickers sold individually. She needs 50 prizes altogether. Melissa uses the equation <math>4p + s = 50</math> to help plan her purchase. Find three ordered pairs <math>(p, s)</math> that satisfy this condition, and use them to graph the relationship.</p> <div style="text-align: center; margin: 20px 0;"> </div>	<p>6. Refer to the equation and graph in Exercise 5. Complete the following ordered pair: <math>(\underline{\quad}, 40)</math>. Does this make sense for Melissa's purchase? Explain.</p>										

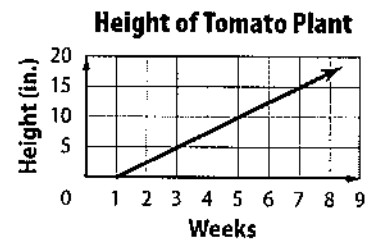
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# Lesson 3 Reteach

## Constant Rate of Change and Slope

A **rate of change** is a rate that describes how one quantity changes in relation to another quantity. A **linear relationship** has a constant rate of change, which means that the rates of change between any two data points is the same.

**Example** Gina recorded the height of a tomato plant in her garden. Find the constant rate of change for the plant's growth in the graph shown. Then interpret its meaning.



**Step 1** Choose any two points on the line, such as (3, 5) and (7, 15).

**Step 2** Find the rate of change between the points.

$$\text{rate of change} = \frac{\text{change in height}}{\text{change in time}} = \frac{15 \text{ in.} - 5 \text{ in.}}{7 \text{ wk} - 3 \text{ wk}} = \frac{10 \text{ in.}}{4 \text{ wk}} = 2.5 \text{ in./wk}$$

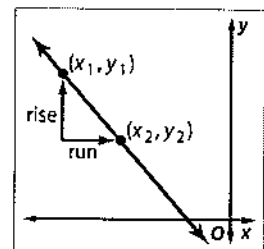
The rate of change 2.5 in./wk means the plant is growing at a rate of 2.5 inches per week.

Note that the **slope** is the same for any two points on a straight line. It represents a constant rate of change.

**Words** The slope  $m$  of a line passing through points  $(x_1, y_1)$  and  $(x_2, y_2)$  is the ratio of the difference in the  $y$ -coordinates to the corresponding difference in  $x$ -coordinates.

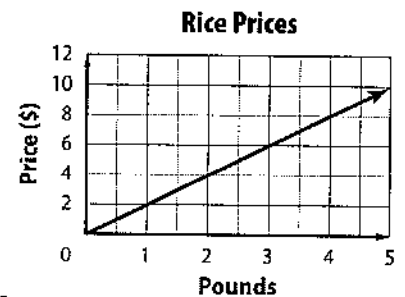
**Symbols**  $m = \frac{y_2 - y_1}{x_2 - x_1}$ , where  $x_2 \neq x_1$

**Model**



### Exercises

1. Find the constant rate of change for the linear function at the right and interpret its meaning.



Find the slope of the line that passes through each pair of points.

2.  $A(2, 2), B(-5, 4)$

3.  $L(5, 5), M(4, 2)$

4.  $R(7, -4), S(7, 3)$

5.  $Q(3, 9), R(-5, 3)$

6.  $G(5, 7), H(2, 7)$

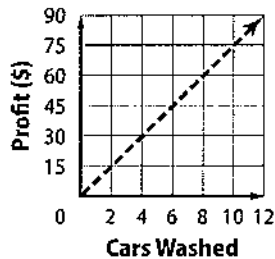
7.  $S(-8, -2), T(1, 4)$

# Lesson 3 Homework Practice

## Constant Rate of Change and Slope

Find the constant rate of change for each linear function and interpret its meaning.

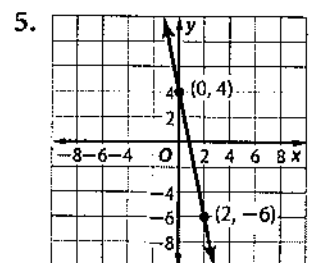
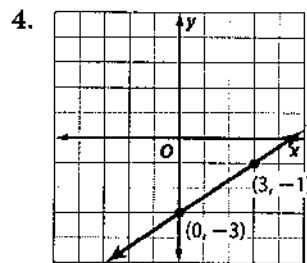
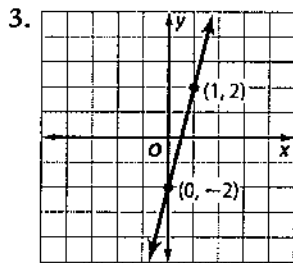
1. **Fundraiser Profits**



2.

Time (seconds)	Distance (yards)
$x$	$y$
1.2	6
2.4	8
3.6	10
4.8	12

Find the slope of each line.



Find the slope of the line that passes through each pair of points.

6.  $A(-10, 6), B(-5, 8)$

7.  $C(7, -3), D(11, -4)$

8.  $E(5, 2), F(12, -3)$

9.  $P(12, 2), Q(18, -2)$

10.  $R(-2, -3), S(-2, -5)$

11.  $T(-13, 8), U(21, 8)$

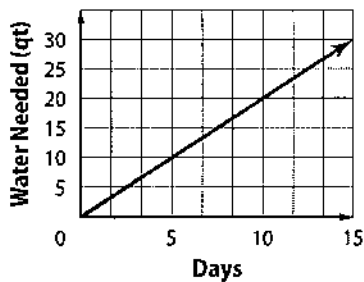
12. One particularly large ant hill found in 1997 measured 40 inches wide at the base and 18 inches high. What was the slope of the ant hill?

13. Today, the Great Pyramid at Giza near Cairo, Egypt, stands 137 meters tall, coming to a point. Its base is a square with each side measuring 230 meters wide. What is the slope of the pyramid?

# Lesson 3 Problem-Solving Practice

## Constant Rate of Change and Slope

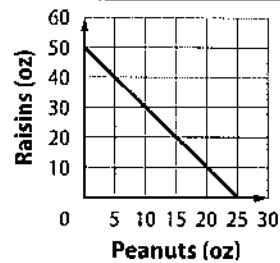
1. The graph shows the number of quarts of water the typical person needs in a certain number of days. Find the constant rate of change for the relationship and interpret its meaning.



2. Lewis County, Washington, has a guideline that new roads should not exceed a 15% grade, or a 15 foot rise over a horizontal distance of 100 feet. A proposed roadway rises 41 feet over 254 feet horizontally. Find the grade of the proposed roadway to the nearest percent. Does it meet the county's guideline?

3. A party of trekkers left a staging hut, at an elevation of 465 feet, and arrived at their destination at an elevation of 2347 feet. According to the map, the camps were 3000 feet apart. What was the average slope between the two camps?

4. Jennifer and a group of her friends are planning a hiking trip. Jennifer is in charge of making trail mix that will provide the group a total of 4000 Calories.



- The graph shows the amount of peanuts and raisins she would have to buy in order to make the trail mix as planned. Find the constant rate of change for this linear function and interpret its meaning.

5. To function properly, a water outflow pipe must drop 1 inch for every 22 inches of horizontal distance. Calculate the slope for this drain pipe.

6. Refer to the information in Exercise 5. A design calls for a drainage pipe to cross a building 45 feet wide as it drops 25 inches. Is this pipe steep enough to function properly? Explain.

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# Lesson 4 Reteach

## Direct Variation

When the ratio of two variable quantities is constant, their relationship is a **direct variation**. The graph of a direct variation always passes through the origin and can be expressed as  $y = kx$ , where  $k$  is the **constant of variation**, or **constant of proportionality**.

**Example** As scuba divers descend below the surface of the ocean, the pressure that they feel from the water varies directly with the depth.

Depth (ft)	Water Pressure (lb/in <sup>2</sup> )
$x$	$y$
20	8.9
30	13.35
40	17.8
50	22.25

a. Write an equation that relates the depth and the amount of water pressure.

**Step 1** Find the value of  $k$  using the equation  $y = kx$ . Choose any point in the table. Then solve for  $k$ .

$$y = kx \quad \text{Direct variation equation}$$

$$17.8 = k(40) \quad \text{Replace } y \text{ with } 17.8 \text{ and } x \text{ with } 40.$$

$$0.445 = k \quad \text{Simplify.}$$

**Step 2** Use  $k$  to write an equation.

$$y = kx \quad \text{Direct variation equation}$$

$$y = 0.445x \quad \text{Replace } k \text{ with } 0.445.$$

b. Predict what the pressure will be at 28 feet.

$$y = 0.445x \quad \text{Write the direct variation equation.}$$

$$y = 0.445(28) \quad \text{Replace } x \text{ with } 28.$$

$$y = 12.46 \quad \text{Simplify.}$$

The water pressure at a depth of 28 feet will be 12.46 lb/in<sup>2</sup>.

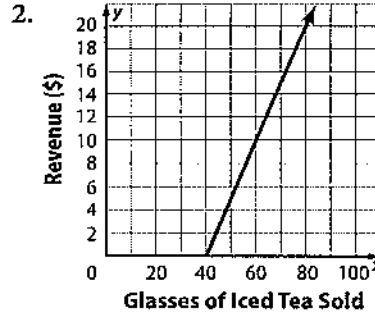
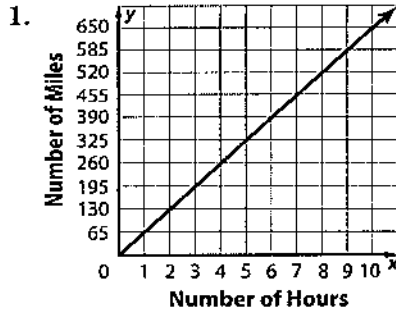
### Exercises

- The amount that Jared earns every week varies directly with the number of hours that he works. Suppose that last week he earned \$75 for 6 hours of work. Write an equation that could be used to find how much Jared earns per hour. Then find out how much Jared would earn if he worked 25 hours.
- The cost of buying gas varies directly with the number of gallons purchased. Suppose that Lena bought 12.2 gallons of gas for \$35.99. Write an equation that could be used to find the unit cost per gallon of gas. Then find out how much 9.5 gallons of gas would cost. Round to the nearest cent.
- The circumference of a circle is in direct variation with the diameter of the circle. Kwan drew a circle with a circumference of 47.1 inches and a diameter of 15 inches. Write an equation that relates the circumference to the diameter. Use the equation to find the circumference of a circle with a 12-inch diameter.

# Lesson 4 Homework Practice

## Direct Variation

Determine if the relationship between the two quantities is a direct variation.



Determine whether the linear relationship is a direct variation. If so, state the constant of variation.

3.

<b>x</b>	3	6	9	12
<b>y</b>	120	90	60	30

4.

<b>x</b>	2	4	6	8
<b>y</b>	-5	-10	-15	-20

5. The cost of paper varies directly with the number of reams bought. Suppose 2 reams cost \$5.10.

- Write an equation that could be used to find the cost of  $x$  reams of paper.
- Find the cost of 15 reams of paper.

6. Recall that the length a spring stretches varies directly with the amount of weight attached to it. A certain spring stretches 5 cm when a 10-gram weight is attached.

- Write a direct variation equation relating the weight  $x$  and the amount of stretch  $y$ .
- Estimate the stretch of the spring when it has a 42-gram weight attached.



## Lesson 4 Problem-Solving Practice

### Direct Variation

<p>1. The equation <math>y = 40x</math> represents the number of hours <math>y</math> Jennifer works in <math>x</math> weeks. Determine if there is a constant of variation. If so, explain what it means.</p>	<p>2. The amount of flour needed for a recipe varies directly with the number of servings planned. Three servings require <math>4\frac{1}{2}</math> cups of flour. Write a direct variation equation relating the number of servings <math>s</math> and the required number of cups of flour <math>f</math>.</p>										
<p>3. Fresh Air Scuba Company leases scuba diving equipment. The following table shows the cost of renting equipment for different lengths of time. Determine whether the relationship is a direct variation. Explain.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Days</th> <th style="padding: 5px;">Cost (\$)</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">3</td> <td style="padding: 5px;">30</td> </tr> <tr> <td style="padding: 5px;">6</td> <td style="padding: 5px;">50</td> </tr> <tr> <td style="padding: 5px;">9</td> <td style="padding: 5px;">70</td> </tr> <tr> <td style="padding: 5px;">12</td> <td style="padding: 5px;">90</td> </tr> </tbody> </table>	Days	Cost (\$)	3	30	6	50	9	70	12	90	<p>4. The distance a bus travels varies directly with time. A Red Lines bus has been traveling for 4.5 hours and has traveled a distance of 281.25 miles. The total distance it must cover on a particular route is 520 miles. How long will the bus take to cover this distance?</p>
Days	Cost (\$)										
3	30										
6	50										
9	70										
12	90										
<p>5. The table represents the number of feet Marco has left to climb down a mountain <math>y</math> for <math>x</math> hours.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;"><math>x</math></th> <th style="padding: 5px;">1</th> <th style="padding: 5px;">2</th> <th style="padding: 5px;">3</th> <th style="padding: 5px;">4</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"><math>y</math></td> <td style="padding: 5px;">5500</td> <td style="padding: 5px;">4425</td> <td style="padding: 5px;">3350</td> <td style="padding: 5px;">2275</td> </tr> </tbody> </table> <p>Determine if the relationship between the two quantities is a direct variation. Explain.</p>	$x$	1	2	3	4	$y$	5500	4425	3350	2275	<p>6. The equation <math>y = 175x + 250</math> represents the number of dollars <math>y</math> in McKenzie's saving account after <math>x</math> months. Determine if there is a constant of variation. If so, explain what it means.</p>
$x$	1	2	3	4							
$y$	5500	4425	3350	2275							

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# Lesson 5 Reteach

## Slope-Intercept Form

An equation of the form  $y = mx + b$ , where  $m$  is the slope and  $b$  is the  $y$ -intercept, is in **slope-intercept form**.

**Example 1** State the slope and the  $y$ -intercept of the graph of  $6x - y = 7$ .

Write the equation in slope-intercept form.

$6x - y = 7$	Write the original equation.
$\underline{-6x} \quad \underline{-6x}$	Subtract $6x$ from each side.
$-y = 7 - 6x$	Simplify.
$-y = -6x + 7$	Write in slope-intercept form.
$y = 6x - 7$	Divide both sides by $-1$ to remove the negative coefficient from $y$ .
$\begin{array}{c} \uparrow \quad \uparrow \\ y = mx + b \end{array}$	$m = 6, b = -7$

The slope of the graph is 6 and the  $y$ -intercept is  $-7$ .

**Example 2** Graph  $y = -4x - 3$  using the slope and  $y$ -intercept.

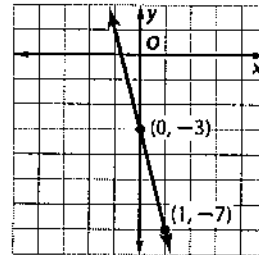
**Step 1** Find the slope and  $y$ -intercept.

slope =  $-4$        $y$ -intercept =  $-3$

**Step 2** Graph the  $y$ -intercept point at  $(0, -3)$ .

**Step 3** Write the slope as  $\frac{-4}{1}$ . Use it to locate a second point on the line.

$m = \frac{-4}{1}$  ← change in  $y$ : down 4 units  
 ← change in  $x$ : right 1 unit



**Step 4** Draw a line through the two points and extend the line.

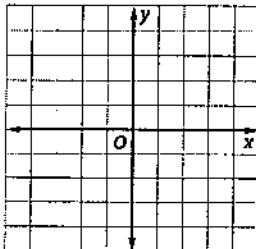
### Exercises

State the slope and the  $y$ -intercept of the graph of each equation.

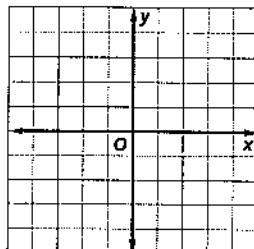
1.  $y = 4x + 12$       2.  $y = x - 9$       3.  $12x = y - 9$       4.  $y - 8x = 21$

Graph each equation using the slope and  $y$ -intercept.

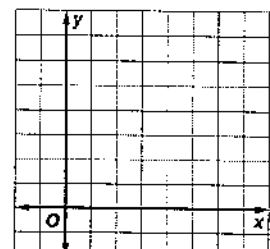
5.  $y = 4x - 1$



6.  $y = 6x + 4$



7.  $y = -\frac{1}{4}x + 5$



# Lesson 5 Homework Practice

## Slope-Intercept Form

State the slope and the  $y$ -intercept of the graph of each line.

1.  $4x - y = 6$

2.  $3x + 2y = 8$

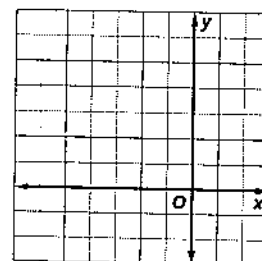
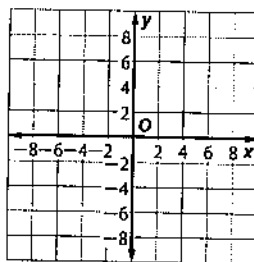
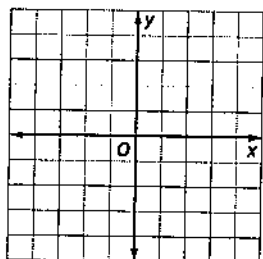
3.  $y - \frac{1}{2}x = \frac{3}{4}$

Graph each equation using the slope and  $y$ -intercept.

4.  $y = \frac{3}{4}x - 3$

5.  $y = \frac{5}{6}x + 1$

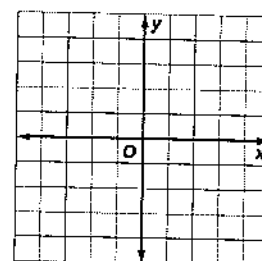
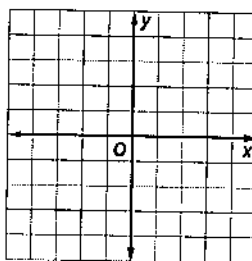
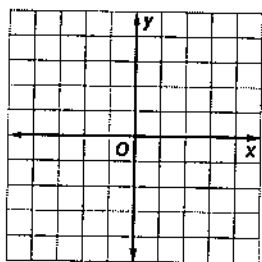
6.  $y = x + 5$



7.  $y = -\frac{1}{2}x - 4$

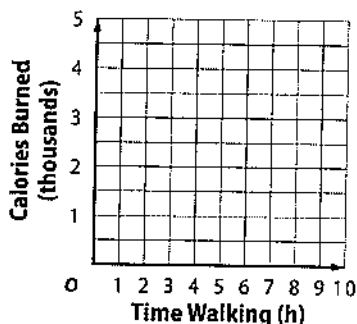
8.  $y = x - 4$

9.  $y = -6x + 3$



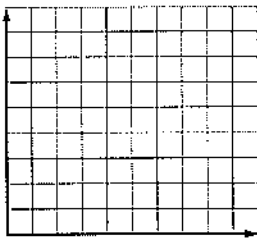
10. A person weighing 150 pounds burns about 320 Calories per hour walking at a moderate pace. Suppose that the same person burns an average of 1500 Calories per day through basic activities. The total Calories  $y$  burned by that person can be represented by the equation  $y = 320x + 1500$ , where  $x$  represents the number of hours spent walking.

- a. Graph the equation using the slope and  $y$ -intercept.      b. State the slope and  $y$ -intercept of the graph of the equation and describe what they represent.



## Lesson 5 Problem-Solving Practice

### Slope-Intercept Form

<p>1. Rod is paid an overtime rate of \$25 per hour after he earns his basic wage of \$600 per week. Write an equation in slope-intercept form for the total pay <math>p</math> if he works <math>h</math> hours of over-time.</p>	<p>2. The monthly cost <math>C</math> of Marge's phone plan is given by <math>C = 40 + m</math>, where <math>m</math> is the number of extra minutes she uses in that month. Name the slope and <math>y</math>-intercept in this situation, and explain what each represents.</p>
<p>3. An elevator travels vertically in a building that has 32 floors, each 11 feet tall. The height <math>h</math> above the first floor after <math>t</math> seconds is given by <math>h = 297 - 4.4t</math>. How long will it take for the elevator to reach the second floor?</p>	<p>4. Pete's bank account showed a balance at the beginning of the month of \$180. He spent \$2.50 each day on bus tokens. The amount <math>A</math> left in his bank account after <math>d</math> days can be given by <math>A = 180 - 2.5d</math>. Graph the equation using the slope and <math>y</math>-intercept.</p> <div style="text-align: center;">  </div>
<p>5. Refer to the graph in Exercise 4. State the slope and <math>y</math>-intercept of the graph, and describe what each represents.</p>	<p>6. Refer to the equation in Exercise 4. Find the <math>x</math>-intercept and describe what it represents.</p>

# Lesson 6 Reteach

## Solve Systems of Equations by Graphing

A collection of two or more equations with the same set of variables is a **system of equations**. The solution to a system of equations with two variables,  $x$  and  $y$ , are the coordinate pair  $(x, y)$ . If you graph both equations on the same coordinate plane, the coordinates of the point of intersection are the solution.

### Example 1 Solve the system of equations by graphing.

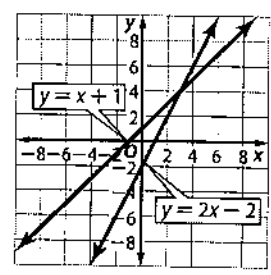
$$y = x + 1$$

$$y = 2x - 2$$

The graphs appear to intersect at  $(3, 4)$ . Check this estimate by substituting the coordinates into each equation.

**Check**

$y \stackrel{?}{=} x + 1$	$y = 2x - 2$
$4 \stackrel{?}{=} 3 + 1$	$4 \stackrel{?}{=} 2(3) - 2$
$4 = 4 \checkmark$	$4 = 4 \checkmark$



The solution of the system of equations is  $(3, 4)$ .

Systems of equations can have one solution, no solution, or infinitely many solutions. When the graphs of a system of equation are

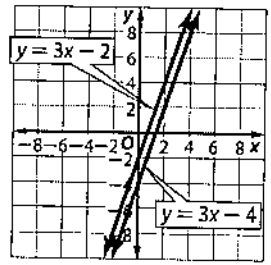
- parallel lines, there are no solutions.
- the same graph, there are infinitely many solutions.

### Example 2 Solve the system of equations by graphing.

$$y = 3x - 2$$

$$y = 3x - 4$$

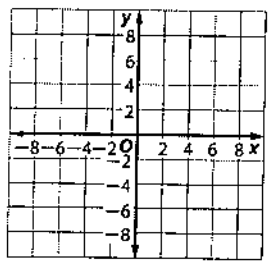
The graphs appear to be parallel lines. Because there is no coordinate pair that is a solution to both equations, there is no solution to this system of equations.



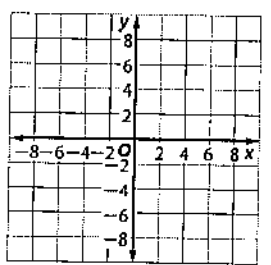
### Exercises

Solve each system of equations by graphing.

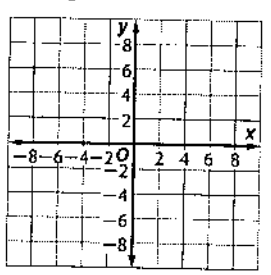
1.  $y = 2x$   
 $y = x + 3$



2.  $y = -3x$   
 $y = -2x - 2$



3.  $y = \frac{1}{4}x + 2$   
 $y = \frac{1}{4}x - 3$



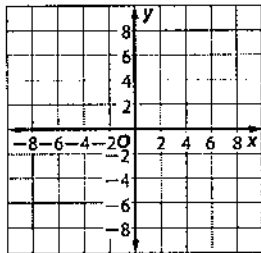
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# Lesson 6 Homework Practice

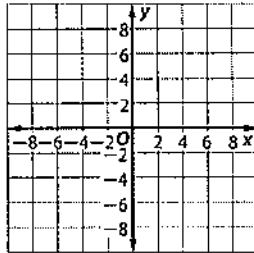
## Solve Systems of Equations by Graphing

Solve each system of equations by graphing.

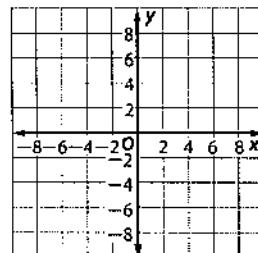
1.  $y = x + 3$   
 $y = 4x$



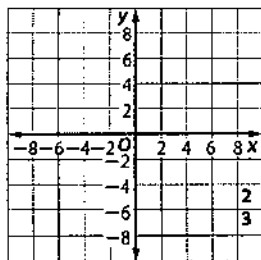
2.  $y = x - 3$   
 $y = x + 3$



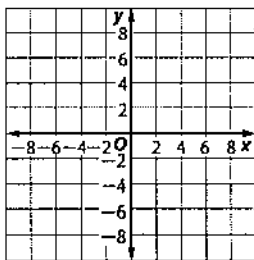
3.  $4x + y = 18$   
 $y = -x$



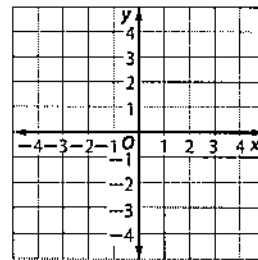
4.  $y = -4x + 9$   
 $y = \frac{2}{3}x - 5$



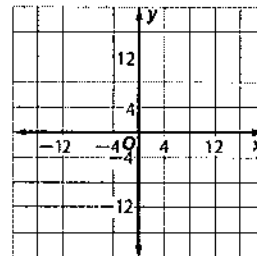
5.  $y - x = 7$   
 $y = 2x + 8$



6.  $y + 1 = 3x$   
 $2y = 6x - 2$



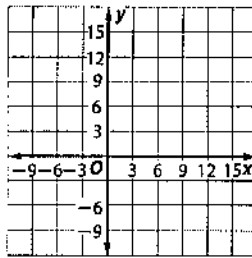
7. There are twice as many girls as boys in the school chorus. There are 8 fewer boys than girls in the chorus. Write a system of equations to represent this situation. Then solve the system by graphing. Explain what the solution means.



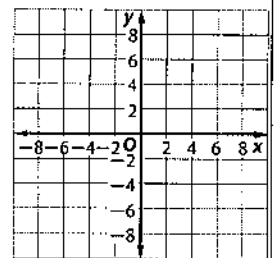
## Lesson 6 Problem-Solving Practice

### Solve Systems of Equations by Graphing

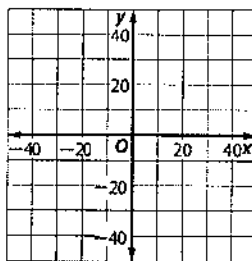
1. Rachel and Kyle both collect geodes. Rachel has 3 less than twice the number of geodes that Kyle has. Kyle has 6 fewer geodes than Rachel. Write a system of equations to represent this situation. Then solve the system of equations by graphing. Explain what the solution means.



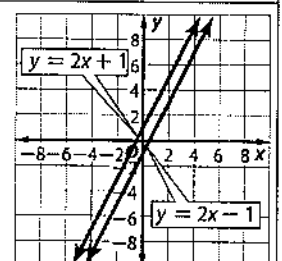
2. Michael has 9 five dollar bills and ten dollar bills in his wallet. The total amount in his wallet is \$60. Write a system of equations to represent this situation. Then solve the system of equations by graphing. Explain what the solution means.



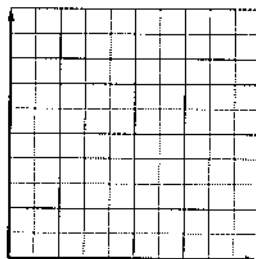
3. Zayn and Cleo both have sticker collections. Zayn has 5 more than three times the number of stickers that Cleo has. Cleo has 25 fewer stickers than Zayn. Write a system of equations to represent this situation. Then solve the system of equations by graphing. Explain what the solution means.



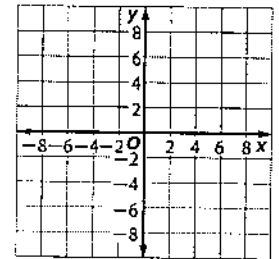
4. How many solutions does the system of equations graphed at the right have? Explain how you know.



5. Tanner has 24 more songs on his mp3 player than Amelia. Together they have 144 songs. Write a system of equations to represent this situation. Then solve the system of equations by graphing. Explain what the solution means.



6. In one basketball game, Ryan made 7 two point and three point baskets to score 17 points. Write a system of equations to represent this situation. Then solve the system of equations by graphing. Explain what the solution means.



# Lesson 7 Reteach

## Solve Systems of Equations Algebraically

Systems of equations can also be solved algebraically by **substitution**.

**Example** Solve the system of equations by substitution.

$$y = x + 5$$

$$y = 8$$

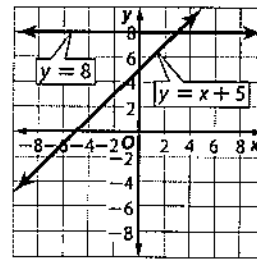
Replace  $y$  with 8 in the first equation.

$$y = x + 5 \quad \text{Write the first equation.}$$

$$8 = x + 5 \quad \text{Replace } y \text{ with } 8.$$

$$3 = x \quad \text{Solve for } x.$$

The solution of this system of equations is  $(3, 8)$ . You can check the solution by graphing. The graphs appear to intersect at  $(3, 8)$ , so the solution is correct.



### Exercises

Solve each system of equations by substitution.

- |                                |                                |                                |
|--------------------------------|--------------------------------|--------------------------------|
| 1. $y = 6 + x$<br>$y = 1$      | 2. $y = 7 - x$<br>$y = 12$     | 3. $y = 3x$<br>$y = 21$        |
| 4. $y = 2x$<br>$y = -4$        | 5. $y = 2x - 6$<br>$y = -2$    | 6. $y = 4x + 11$<br>$y = 3$    |
| 7. $y = 6x - 21$<br>$y = -3$   | 8. $y = 3x + 14$<br>$y = 2$    | 9. $y = -2x - 8$<br>$y = 6$    |
| 10. $x + y = 17$<br>$y = 5$    | 11. $y + 2x = 12$<br>$y = x$   | 12. $3y - 2x = 20$<br>$y = 2x$ |
| 13. $5x - 2y = 22$<br>$y = 3x$ | 14. $6x - 3y = 27$<br>$y = -x$ | 15. $-y + 6x = 30$<br>$y = 4x$ |

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## Lesson 7 Homework Practice

### Solve Systems of Equations Algebraically

Solve each system of equations by substitution.

$$\begin{aligned} 1. \quad y &= -2x \\ y &= 3x + 25 \end{aligned}$$

$$\begin{aligned} 2. \quad y &= x + 2 \\ y - 2 &= 12x \end{aligned}$$

$$\begin{aligned} 3. \quad y &= 6x - 8 \\ y &= x - 3 \end{aligned}$$

$$\begin{aligned} 4. \quad y &= x - 2 \\ y &= 4 \end{aligned}$$

$$\begin{aligned} 5. \quad y &= 13 - x \\ y &= -5 \end{aligned}$$

$$\begin{aligned} 6. \quad y &= 10x + 24 \\ y &= -6 \end{aligned}$$

$$\begin{aligned} 7. \quad y &= 5x + 12 \\ y &= -x \end{aligned}$$

$$\begin{aligned} 8. \quad y &= -2x \\ x &= 0 \end{aligned}$$

$$\begin{aligned} 9. \quad y &= 4x + 45 \\ x &= 4y \end{aligned}$$

$$\begin{aligned} 10. \quad y + x &= 4 \\ y &= 2x - 8 \end{aligned}$$

$$\begin{aligned} 11. \quad y &= 9 - x \\ y &= -x - 2 \end{aligned}$$

$$\begin{aligned} 12. \quad y &= 3x - 1 \\ y &= 4x - 3 \end{aligned}$$

$$\begin{aligned} 13. \quad y &= 5x - 7 \\ y &= -2x + 7 \end{aligned}$$

$$\begin{aligned} 14. \quad y - 2 &= x \\ y &= 3x - 12 \end{aligned}$$

$$\begin{aligned} 15. \quad y + 11 &= 2x \\ 3y - 6x &= -33 \end{aligned}$$

16. The admission fee at a carnival is \$5 for children and \$8 for adults. On Friday, 1250 people attended the carnival and \$7300 was collected. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.
17. Darci placed two orders for flowers and bushes. The first order was for 24 flowers and 6 bushes. The total of the first order was \$144. The second order was for 18 flowers and 3 bushes. The total of the second order was \$90. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.
18. The cost of 8 muffins and 2 quarts of milk is \$18. The cost of 3 muffins and 1 quart of milk is \$7.50. Write a system of equations to represent this situation. Solve the system of equations by substitution. Explain what the solution means.

## Lesson 7 Problem-Solving Practice

### *Solve Systems of Equations Algebraically*

<p>1. A concession stand sells hot dogs and hamburgers. At a football game, 84 hot dogs and 36 hamburgers were sold for \$276. At another football game, 60 hot dogs and 18 hamburgers were sold for \$174. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.</p>	<p>2. The sum of two numbers is 32. The difference between the numbers is 8. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.</p>
<p>3. Jose and Caroline went shopping for school supplies. Caroline spent \$15.50 on 5 notebooks and 3 folders. Jose bought 4 notebooks and 4 folders and spent \$14. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.</p>	<p>4. Gabe charges \$30 to mow a lawn. Nate charges \$25 to mow a lawn. Their total combined revenue one summer was \$2020. Nate mowed 6 more lawns than Gabe. Write a system of equations to represent this situation. Then solve the system of equations by substitution. Explain what the solution means.</p>
<p>5. Ms. Brockman wants to take her class on a trip to either the nature center or the zoo. The nature center charges \$4 per student, plus \$95 for a 1-hour naturalist program. The zoo charges \$9 per student plus \$75 for a 1-hour guided tour. Write a system of equations to represent this situation. Then solve the system of equations by substitution.</p>	<p>6. Refer to the system of equations in Exercise 5. What does the solution mean?</p>

# Practice 6-6

## Parallel and Perpendicular Lines

Find the slope of a line parallel to the graph of each equation.

1.  $y = 4x + 2$

2.  $y = \frac{2}{7}x + 1$

3.  $y = -9x - 13$

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

5.  $6x + 2y = 4$

6.  $y - 3 = 0$

7.  $-5x + 5y = 4$

8.  $9x - 5y = 4$

9.  $-x + 3y = 6$

10.  $6x - 7y = 10$

11.  $x = -4$

12.  $-3x - 5y = 6$

Write an equation for the line that is perpendicular to the given line and that passes through the given point.

13.  $(6, 4); y = 3x - 2$

14.  $(-5, 5); y = -5x + 9$

15.  $(-1, -4); y = \frac{1}{6}x + 1$

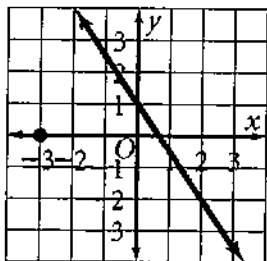
16.  $(1, 1); y = -\frac{1}{4}x + 7$

17.  $(12, -6); y = 4x + 1$

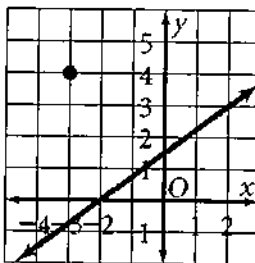
18.  $(0, -3); y = -\frac{4}{3}x - 7$

19.

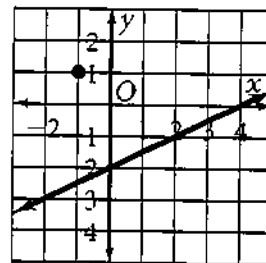
A)



B)



C)



# Graphing Linear Inequalities

1.
2.
3.
4.
***

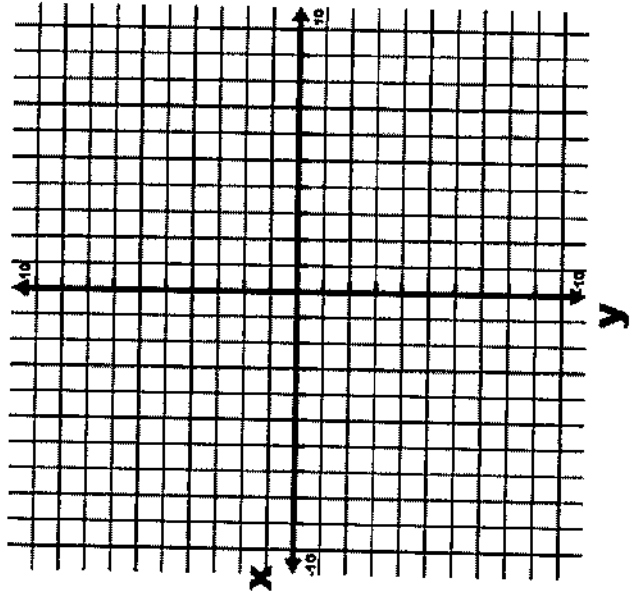
Example: Graph  $y < 2x - 1$

SOLID LINE

DASHED LINE

SHADE ABOVE

SHADE BELOW



# Graphing Linear Inequalities

1.
2.
3.
4.
***

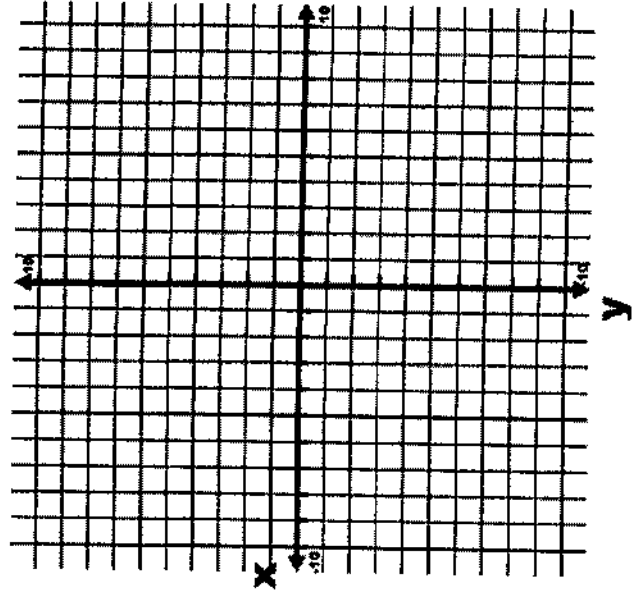
Example: Graph  $3y \geq -6x + 12$

SOLID LINE

DASHED LINE

SHADE ABOVE

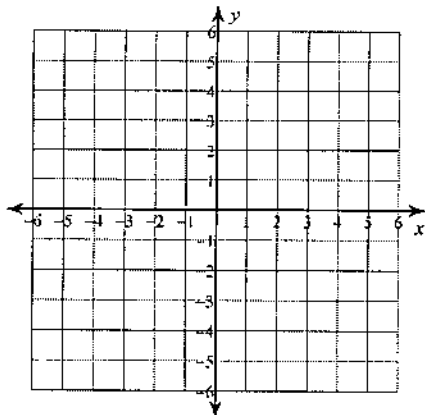
SHADE BELOW



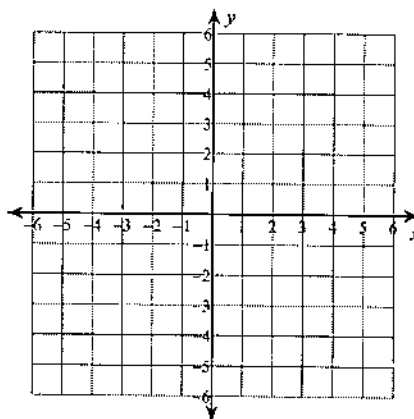
### Graphing Linear Inequalities

Sketch the graph of each linear inequality.

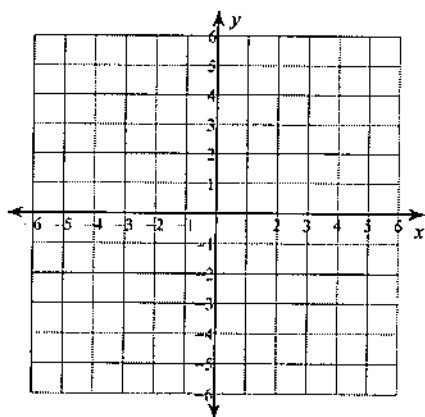
1)  $y \geq -3x + 4$



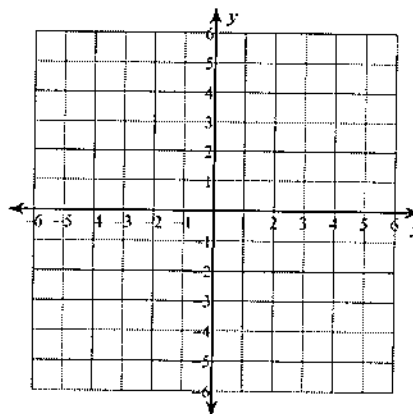
2)  $y \leq \frac{3}{5}x - 5$



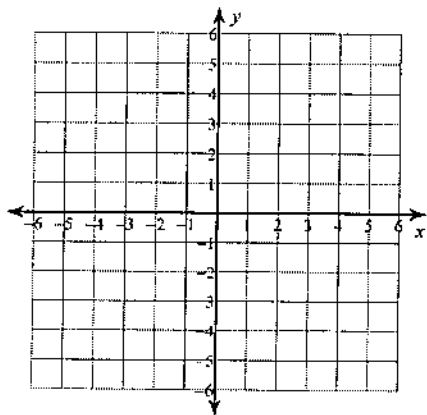
3)  $y > -x - 5$



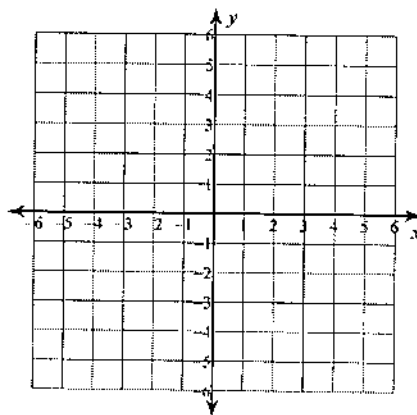
4)  $y > -4$



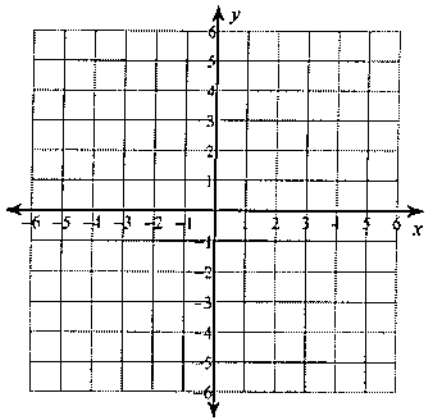
5)  $y > 2x - 5$



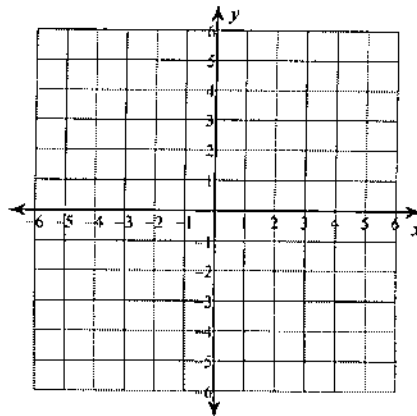
6)  $y \geq \frac{7}{4}x + 2$



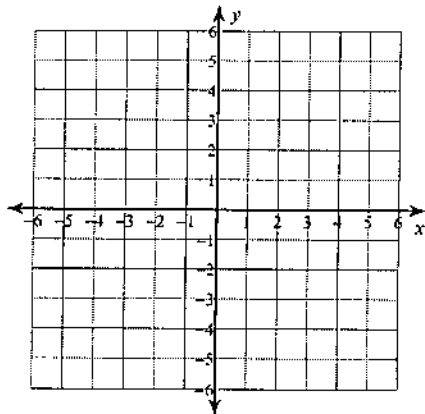
7)  $x < -5$



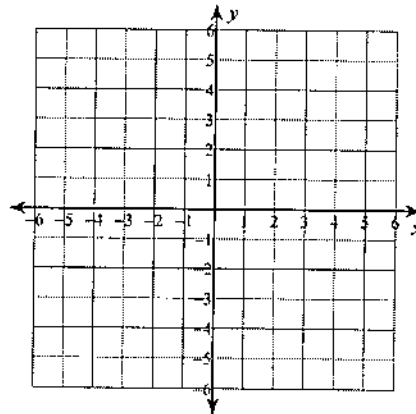
8)  $y \leq \frac{4}{3}x - 4$



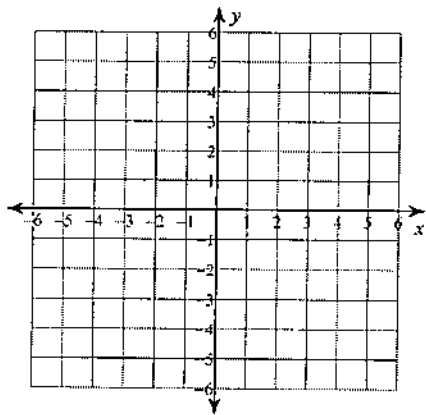
9)  $3x - 2y < 10$



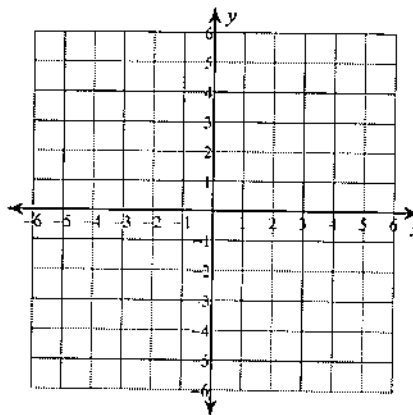
10)  $5x - 3y \leq -15$



11)  $y \geq 4$

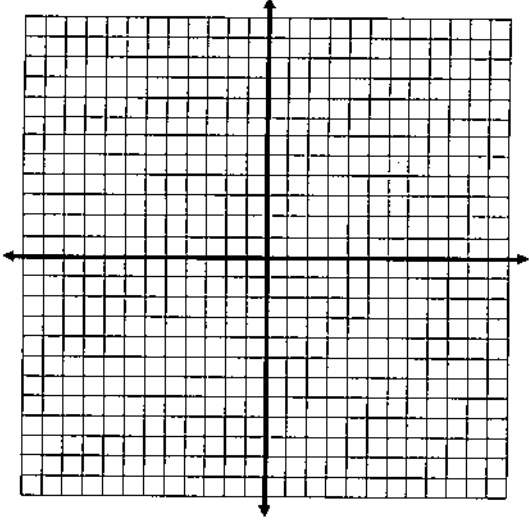


12)  $x - y > 2$

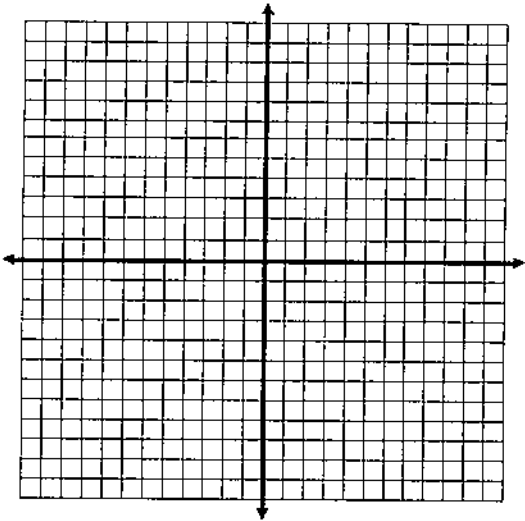


Coordinate Planes.

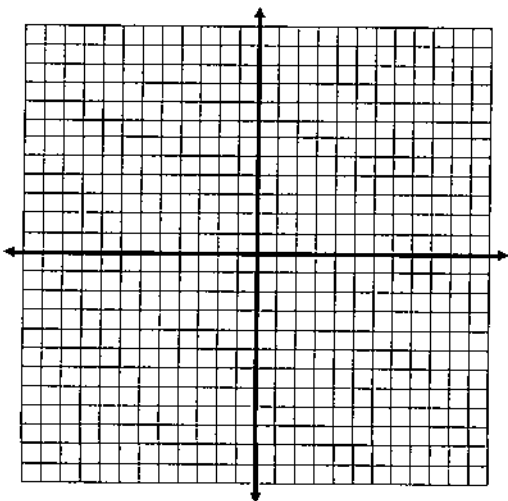
1.



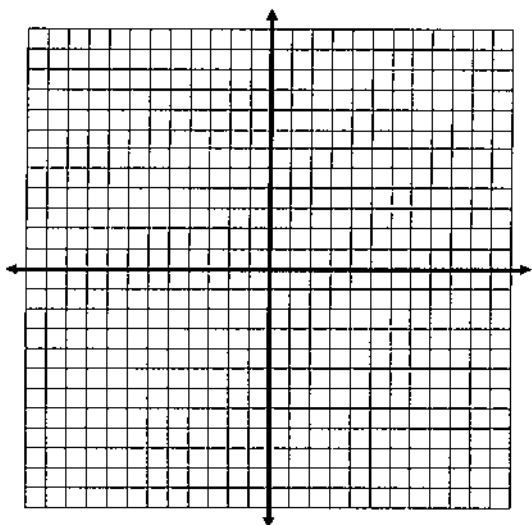
2.



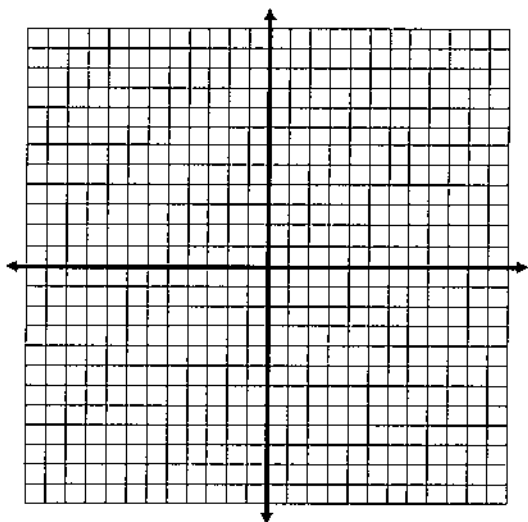
3.



4.



5.



6.

