

# Chapter 4

## Resource Masters



# Mathematics

Applications and Concepts

Course 2



New York, New York   Columbus, Ohio   Chicago, Illinois   Peoria, Illinois   Woodland Hills, California

**4-1****Study Guide and Intervention****Writing Expressions and Equations**

The table below shows phrases written as mathematical expressions.

Phrases	Expression	Phrases	Expression
9 more than a number the sum of 9 and a number a number plus 9 a number increased by 9 the total of $x$ and 9	$x + 9$	4 subtracted from a number a number minus 4 4 less than a number a number decreased by 4 the difference of $h$ and 4	$h - 4$
Phrases	Expression	Phrases	Expression
6 multiplied by $g$ 6 times a number the product of $g$ and 6	$6g$	a number divided by 5 the quotient of $t$ and 5 divide a number by 5	$\frac{t}{5}$

The table below shows sentences written as an equation.

Sentences	Equation
Sixty less than three times the amount is \$59. Three times the amount less 60 is equal to 59. 59 is equal to 60 subtracted from three times a number. A number times three minus 60 equals 59.	$3n - 60 = 59$

**EXERCISES**

**Write each phrase as an algebraic expression.**

- 7 less than  $m$
- the quotient of 3 and  $y$
- the total of 5 and  $c$
- the difference of 6 and  $r$
- $n$  divided by 2
- the product of  $k$  and 9

**Write each sentence as an algebraic equation.**

- A number increased by 7 is 11.
- The price decreased by \$4 is \$29.
- Twice as many points as Bob would be 18 points.
- After dividing the money 5 ways, each person got \$67.
- Three more than 8 times as many trees is 75 trees.
- Seven less than a number is 15.

**4-1****Practice: Skills*****Writing Expressions and Equations***

**Write each phrase as an algebraic expression.**

1.  $b$  plus 1
2. three more than  $x$
3. twelve minus  $y$
4. seven less than  $n$
5. five years younger than Jessica
6. a number less eleven
7. four increased by  $a$
8. eight dollars more than  $m$
9. the product of  $c$  and 10
10. twice as many days
11. three times as many soft drinks
12.  $t$  multiplied by 14
13. Emily's age divided by 3
14. 24 divided by some number
15. a number divided by 2
16. the quotient of  $-15$  and  $w$

**Write each sentence as an algebraic equation.**

17. A number plus three is 9.
18. The sum of  $x$  and 2 is 10.
19. Four cents more than the price is  $93¢$ .
20. Fifteen minus  $y$  is 7.
21. A number decreased by 5 is 12.
22. Five dollars less than Yumi's pay is \$124.
23. A number times four is 20.
24. Twice the number of cars is 40.
25. The product of  $z$  and 6 is 54.
26. A number divided by 6 is 12.
27. 72 divided by  $y$  is  $-9$ .
28. 175 students separated into  $n$  classes is 25.
29. One more than twice as many CDs is 17.
30. Four less than three times a number is 14.

**4-1****Practice: Word Problems****Writing Expressions and Equations**

**OLYMPICS** For Exercises 1–4, use the table that shows the number of medals won by each country in the 2002 Winter Olympics.

2002 Winter Olympic Medals					
Country	Medals	Country	Medals	Country	Medals
Germany	35	Austria	16	China	8
USA	34	Italy	12	Finland	7
Norway	24	France	11	Sweden	6
Canada	17	Switzerland	11	Croatia	4
Russia	16	Netherlands	8	South Korea	4

Let  $x$  represent the number of medals won by Italy.

1. Write an expression using $x$ to represent the number of medals won by Russia.	2. Write an expression using $x$ to represent the number of medals won by Croatia.
3. Which country's number of medals can be represented by $2x$ ?	4. Which country's number of medals can be represented by $2x + 10$ ?
5. <b>GEOGRAPHY</b> The Virgin Islands were acquired by the United States in 1927. This is 29 years after Puerto Rico was acquired. Write an equation to model this situation.	6. <b>POPULATION</b> According to the Census Bureau, the U.S. population grew from 281.4 million in April 2000 to 284.8 million in July 2001. Write an equation to model this situation.

**4-1****Reading to Learn Mathematics****Writing Expressions and Equations**

**Pre-Activity** Read the introduction at the top of page 150 in your textbook.  
Write your answers below.

1. Suppose the daughter is 12 years old. How old is the son?
2. What operation did you use to find the son's age? Explain.
3. Suppose the comic said that *the son is twice as old as the daughter*. If the daughter is 12 years old, how old is the son?
4. What operation did you use to find the son's age? Explain.

**Reading the Lesson**

5. Write the symbol that each word or phrase represents.

Symbol	Words
	more than
	is
	quotient

6. Give two examples of a word or phrase that can suggest each operation.

Operation	Words
+	
-	
×	
÷	

7. Write a verbal sentence for each equation.

Equation	Verbal Sentence
$2x - 5 = -3$	
$10 = a + 6$	
$r \div 9 = 7$	

**Helping You Remember**

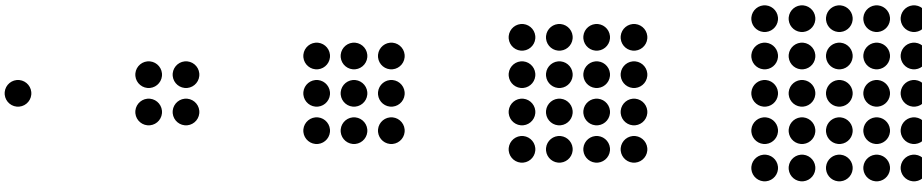
8. Work with a partner. Write down four or five real life math situations as sentences. Trade papers with your partner. Translate your partner's sentences into symbols.

**4-1**

**Enrichment**

***Expressions for Figurate Numbers***

Figurate numbers are numbers that can be shown with dots arranged in specific geometric patterns. Below are the first five square numbers.



The expression  $n^2$  will give you the number of dots in the  $n$ th square number. The variable  $n$  takes on the values 1, 2, 3, 4, and so on. So, to find the 10th square number, you would use 10 for  $n$ .

1. Match each set of dot patterns with its name and expression. Write exercise numbers in the boxes to show the matchings.

	Dot Patterns for Second and Third Numbers	Name of Figurate Number	Expression
a.		pentagonal <input type="checkbox"/>	$n(2n - 1)$ <input type="checkbox"/>
b.		hexagonal <input type="checkbox"/>	$\frac{n(n + 1)}{2}$ <input type="checkbox"/>
c.		triangular <input type="checkbox"/>	$\frac{n(3n - 1)}{2}$ <input type="checkbox"/>

Use the algebraic expressions on this page to compute each number. Then make a drawing of the number on a separate sheet of paper.

2. 6th square                      3. 4th triangular                      4. 4th pentagonal
5. 4th hexagonal                      6. 5th triangular                      7. 5th pentagonal

**4-2****Study Guide and Intervention****Solving Addition and Subtraction Equations**

Remember, equations must always remain balanced. If you subtract the same number from each side of an equation, the two sides remain equal. Also, if you add the same number to each side of an equation, the two sides remain equal.

**EXAMPLE 1** Solve  $x + 5 = 11$ . Check your solution.

$$\begin{array}{r} x + 5 = 11 \quad \text{Write the equation.} \\ - 5 = -5 \quad \text{Subtract 5 from each side.} \\ \hline x = 6 \quad \text{Simplify.} \end{array}$$

**Check**  $x + 5 = 11$  Write the equation.  
 $6 + 5 \stackrel{?}{=} 11$  Replace  $x$  with 6.  
 $11 = 11$  ✓ This sentence is true.

The solution is 6.

**EXAMPLE 2** Solve  $15 = t - 12$ . Check your solution.

$$\begin{array}{r} 15 = t - 12 \quad \text{Write the equation.} \\ + 12 = +12 \quad \text{Add 12 to each side.} \\ \hline 27 = t \quad \text{Simplify.} \end{array}$$

**Check**  $15 = t - 12$  Write the equation.  
 $15 \stackrel{?}{=} 27 - 12$  Replace  $t$  with 27.  
 $15 = 15$  ✓ This sentence is true.

The solution is 27.

**EXERCISES**

Solve each equation. Check your solution.

1.  $h + 3 = 14$

2.  $m + 8 = 22$

3.  $p + 5 = 15$

4.  $17 = y + 8$

5.  $w + 4 = -1$

6.  $k + 5 = -3$

7.  $25 = 14 + r$

8.  $57 + z = 97$

9.  $b - 3 = 6$

10.  $7 = c - 5$

11.  $j - 12 = 18$

12.  $v - 4 = 18$

13.  $-9 = w - 12$

14.  $y - 8 = -12$

15.  $14 = f - 2$

16.  $23 = n - 12$

**4-2****Practice: Skills*****Solving Addition and Subtraction Equations*****Solve each equation. Check your solution.**

1.  $x + 2 = 8$

2.  $y + 7 = 9$

3.  $a + 5 = 12$

4.  $16 = n + 6$

5.  $q + 10 = 22$

6.  $m + 9 = 17$

7.  $b - 4 = 9$

8.  $8 = c - 4$

9.  $11 = t - 7$

10.  $d - 10 = 8$

11.  $x - 11 = 9$

12.  $2 = z - 14$

13.  $72 = 24 + w$

14.  $86 + y = 99$

15.  $6 + y = -8$

16.  $-5 = m + 11$

17.  $n + 3.5 = 6.7$

18.  $x + 1.6 = 0.8$

19.  $98 = t - 18$

20.  $12 = g - 56$

21.  $x - 18 = -2$

22.  $p - 11 = -5$

23.  $a - 1.5 = 4.2$

24.  $7.4 = n - 2.6$

**4-2****Practice: Word Problems****Solving Addition and Subtraction Equations**

**ANIMALS** For Exercises 1–4, use the table.

The average lifespans of several different types of animals are shown in the table.

Average Lifespans of Animals			
Animal	Lifespan (yr)	Animal	Lifespan (yr)
Black Bear	18	Guinea Pig	4
Dog	12	Puma	?
Giraffe	10	Tiger	16
Gray Squirrel	10	Zebra	?

<p><b>1.</b> The lifespan of a black bear is 3 years longer than the lifespan of a zebra. Write an addition equation that you could use to find the lifespan of a zebra.</p>	<p><b>2.</b> Solve the equation you wrote in Exercise 1. What is the lifespan of a zebra?</p>
<p><b>3.</b> The lifespan of a guinea pig is 8 years shorter than the lifespan of a puma. Write a subtraction equation that you could use to find the lifespan of a puma.</p>	<p><b>4.</b> Solve the equation you wrote in Exercise 3. What is the lifespan of a puma?</p>
<p><b>5. TECHNOLOGY</b> A survey of teens showed that teens in Pittsburgh aged 12-17 spend 15.8 hours per week online. Teens in Miami/Ft. Lauderdale spend 14.2 hours per week online. Write and solve an addition equation to find the difference in time spent online by teens in these cities.</p>	<p><b>6. SPORTS</b> Annika Sorenstam won the 2002 LPGA Takefuji Classic with a final score of 14 under par, or <math>-14</math>. Her scores for the first two of the three rounds were <math>-6</math> and <math>-4</math>. What was Ms. Sorenstam's score for the third round?</p>

**4-2****Reading to Learn Mathematics****Solving Addition and Subtraction Equations**

**Pre-Activity** *Read the introduction at the top of page 156 in your textbook. Write your answers below.*

1. What does  $x$  represent in the figure?
2. Write an expression to represent *4 meters longer than a dolphin*.
3. Write an addition equation you could use to find the length of a dolphin.

**Reading the Lesson**

4. Match the method of solving with the appropriate equation.

- |                    |                                     |
|--------------------|-------------------------------------|
| $x + 5 = 9$ _____  | <b>a.</b> add 2 to each side        |
| $-2 + y = 1$ _____ | <b>b.</b> add 5 to each side        |
| $5 = m - 1$ _____  | <b>c.</b> subtract 5 from each side |
| $r + 9 = -7$ _____ | <b>d.</b> add 1 to each side        |
| $k - 5 = -2$ _____ | <b>e.</b> subtract 9 from each side |

5. Explain in words how to solve each equation.

$a - 10 = 3$  \_\_\_\_\_

$4 + t = -12$  \_\_\_\_\_

$18 = n - 7$  \_\_\_\_\_

6. Solve each equation.

**a.**  $w + 23 = -11$

**b.**  $35 = z - 15$

**c.**  $42 + c = -9$

**Helping You Remember**

7. Take turns with a partner explaining the Addition and Subtraction Properties of Equality in your own words. Then each of you write two addition and two subtraction equations. Trade equations and solve. Check your work by explaining to each other the method you used to solve the equations.

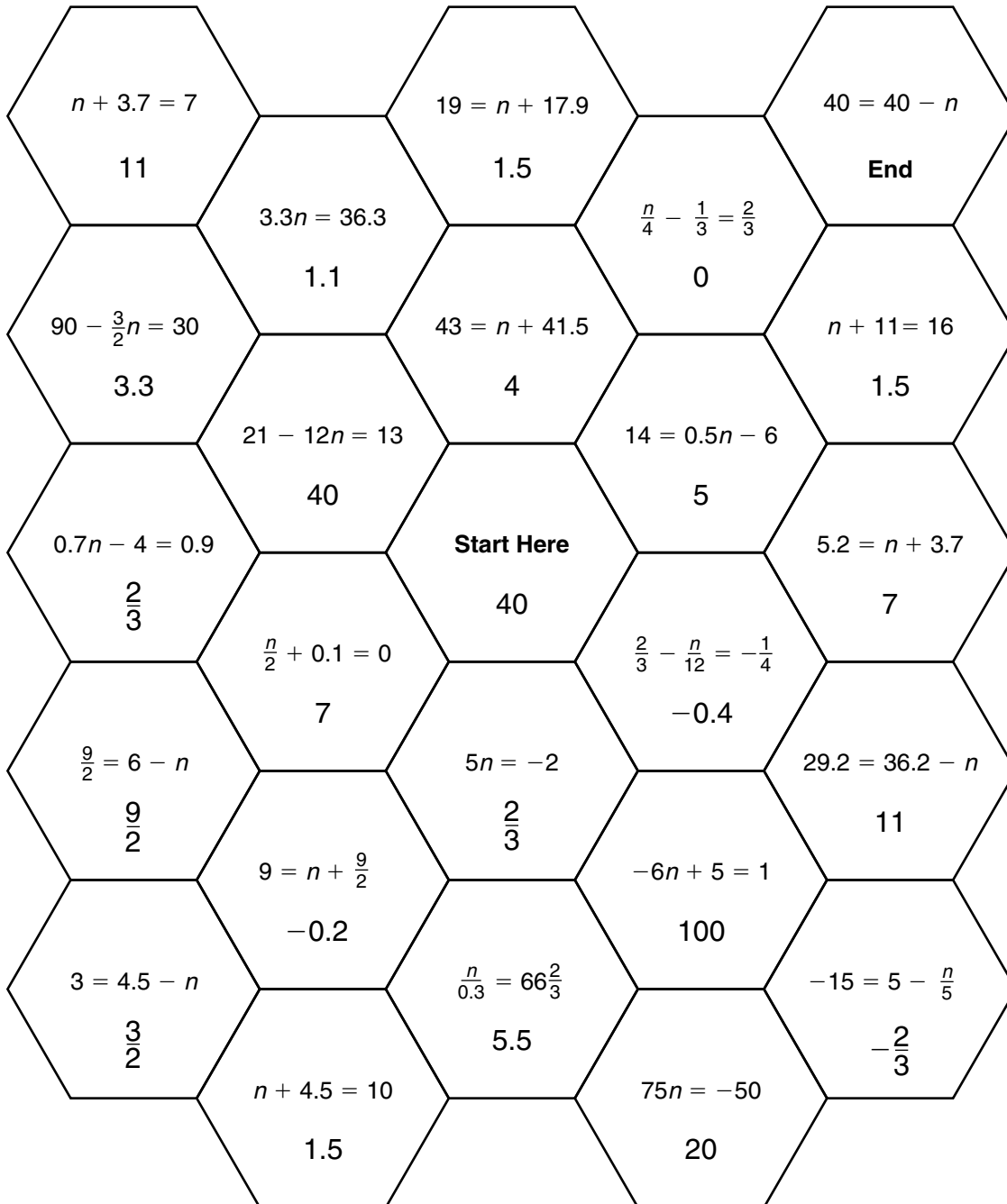
# 4-2

## Enrichment

### Equation Hexa-maze

This figure is called a *hexa-maze* because each cell has the shape of a hexagon, or six-sided figure.

To solve the maze, start with the number in the center. This number is the solution to the equation in one of the adjacent cells. Move to that cell. The number in the new cell will then be the solution to the equation in the next cell. At each move, you may only move to an adjacent cell. Each cell is used only once.



**4-3****Study Guide and Intervention****Solving Multiplication Equations**

If each side of an equation is multiplied by the same number, the resulting equation is equivalent to the given one. You can use this property to solve equations involving multiplication and division.

**EXAMPLE 1** Solve  $45 = 5x$ . Check your solution.

$$45 = 5x \quad \text{Write the equation.}$$

$$\frac{45}{5} = \frac{5x}{5} \quad \text{Divide each side of the equation by 5.}$$

$$9 = x \quad 45 \div 5 = 9$$

**Check**  $45 = 5x$  Write the original equation.

$$45 \stackrel{?}{=} 5(9) \quad \text{Replace } x \text{ with } 9. \text{ Is this sentence true?}$$

$$45 = 45 \quad \checkmark$$

The solution is 9.

**EXAMPLE 2** Solve  $-21 = -3y$ . Check your solution.

$$-21 = -3y \quad \text{Write the equation.}$$

$$\frac{-21}{-3} = \frac{-3y}{-3} \quad \text{Divide each side by } -3.$$

$$7 = y \quad -21 \div (-3) = 7$$

**Check**  $-21 = -3y$  Write the original equation.

$$-21 \stackrel{?}{=} -3(7) \quad \text{Replace } y \text{ with } 7. \text{ Is this sentence true?}$$

$$-21 = -21 \quad \checkmark$$

The solution is 7.

**EXERCISES**

Solve each equation. Then check your solution.

1.  $8q = 56$

2.  $4p = 32$

3.  $42 = 6m$

4.  $104 = 13h$

5.  $-6n = 30$

6.  $-18x = 36$

7.  $48 = -8y$

8.  $72 = -3b$

9.  $-9a = -45$

10.  $-12m = -120$

11.  $-66 = -11t$

12.  $-144 = -9r$

13.  $3a = 4.5$

14.  $2h = 3.8$

15.  $4.9 = 0.7k$

16.  $9.75 = 2.5z$

**4-3****Practice: Skills*****Solving Multiplication Equations***

Solve each equation. Check your solution.

1.  $4c = 16$

2.  $10x = 50$

3.  $42 = 6s$

4.  $9c = 45$

5.  $49 = 7y$

6.  $11t = 44$

7.  $15a = 60$

8.  $72 = 12c$

9.  $18x = 162$

10.  $14d = 154$

11.  $24z = 288$

12.  $16v = 256$

13.  $-5b = 40$

14.  $32 = -2f$

15.  $-9x = -63$

16.  $4g = -52$

17.  $-5x = -85$

18.  $-63 = 7a$

19.  $0.6m = 1.8$

20.  $1.5z = 6$

21.  $0.6q = 3.6$

22.  $1.8a = 0.9$

23.  $1.2r = 4.8$

24.  $2.4 = 0.2t$

**4-3****Practice: Word Problems*****Solving Multiplication Equations***

<p><b>1. TRAVEL</b> The speed limit on an Arizona highway is 75 miles per hour. Suppose a truck traveling at the speed limit drives 225 miles before the driver stops for a break. Write a multiplication equation to find the length of time the truck has traveled.</p>	<p><b>2. TRAVEL</b> Solve the equation you wrote in Exercise 1. How long did the truck travel?</p>
<p><b>3. FLOWERS</b> A gardening expert recommends that flower bulbs be planted to a depth of three times their height. Suppose Jenna determines that a certain bulb should be planted at a depth of 4.5 inches. Write a multiplication equation to find the height of the bulb.</p>	<p><b>4. FLOWERS</b> Solve the equation you wrote in Exercise 3. What is the height of the bulb?</p>
<p><b>5. EXERCISE</b> A 125-pound person uses 4.4 Calories per minute when walking. Write a multiplication equation to find the number of minutes of walking it will take for a 125-pound person to use 198 Calories.</p>	<p><b>6. EXERCISE</b> Solve the equation you wrote in Exercise 5. How many minutes of walking it will take for a 125-pound person to use 198 Calories?</p>
<p><b>7. ELECTRICITY</b> The electric company charges \$0.06 per kilowatt hour of electricity used. Write a multiplication equation to find the number of kilowatt hours of electricity for which the Estevez family was charged if their electric bill was \$45.84.</p>	<p><b>8. ELECTRICITY</b> Solve the equation you wrote in Exercise 7. For how many kilowatt hours of electricity was the Estevez family charged?</p>

**4-3****Reading to Learn Mathematics*****Solving Multiplication Equations***

**Pre-Activity** *Complete the Mini Lab at the top of page 160 in your textbook.  
Write your answers below.*

**Solve each equation using models.**

1.  $4x = 8$

2.  $-8 = 2x$

3.  $3x = 3$

4. What operation did you use to find each solution?

5. How can you use the coefficient of  $x$  to solve the equation  $4x = 12$ ?

6. How can you use the coefficient of  $x$  to solve  $-5x = 10$  without using cups and counters?

**Reading the Lesson**

7. Complete each sentence.

a. To solve  $4x = 36$ , divide each side by \_\_\_\_\_.

b. To solve  $-27 = -3d$ , divide each side by \_\_\_\_\_.

c. To solve  $15h = -75$ , divide each side by \_\_\_\_\_.

d. To solve  $-8a = 96$ , divide each side by \_\_\_\_\_.

8. Write and solve two different equations that both require you to divide each side by  $-2$  in order to solve.

**Helping You Remember**

9. In your own words, define the Division Property of Equality. Describe a real-life situation in which you may need to use the Division Property of Equality.

**4-3****Enrichment**

Equations of the form  $y = ax$  and  $y = x \div a$  can be used to show how one quantity varies with another. Here are two examples.

Driving at a speed of 50 miles per hour, the distance you travel  $d$  varies directly with the time you are on the road  $t$ . The longer you drive, the farther you get.

$$d = 50t$$

It is also the case that the time  $t$  varies directly with the distance  $d$ . The farther you drive, the more time it takes.

$$t = \frac{d}{50}$$

**Complete the equation for each situation. Then describe the relationship in words.**

1. If you go on a diet and lose 2 pounds a month, after a certain number of months  $m$ , you will have lost  $p$  pounds.
2. You and your family are deciding between two different places for your summer vacation. You plan to travel by car and estimate you will average 55 miles per hour. The distance traveled  $d$  will result in a travel time of  $t$  hours.
3. You find that you are spending more than you had planned on renting video movies. It costs \$2.00 to rent each movie. You can use the total amount spent  $a$  to find the number of movies you have rented  $m$ .
4. You spend \$30 a month to take the bus to school. After a certain number of months  $m$ , you will have spent a total of dollars  $d$  on transportation to school.
5. You are saving money for some new athletic equipment and have 12 weeks before the season starts. The amount you need to save each week  $s$  will depend on the cost  $c$  of the equipment you want to buy.

**4-4****Study Guide and Intervention****Solving Two-Step Equations**

To solve two-step equations, you need to add or subtract first. Then divide to solve the equation.

**EXAMPLE 1** Solve  $7v - 3 = 25$ . Check your solution.

$$\begin{array}{l} 7v - 3 = 25 \quad \text{Write the equation.} \\ \underline{+3 = +3} \quad \text{Add 3 to each side.} \\ 7v = 28 \quad \text{Simplify.} \\ \frac{7v}{7} = \frac{28}{7} \quad \text{Divide each side by 7.} \\ v = 4 \quad \text{Simplify.} \end{array}$$

**Check**  $7v - 3 = 25$  Write the original equation.  
 $7(4) - 3 \stackrel{?}{=} 25$  Replace  $v$  with 4.  
 $28 - 3 \stackrel{?}{=} 25$  Multiply.  
 $25 = 25 \checkmark$  The solution checks.

The solution is 4.

**EXAMPLE 2** Solve  $-10 = 8 + 3x$ . Check your solution.

$$\begin{array}{l} -10 = 8 + 3x \quad \text{Write the equation.} \\ \underline{-8 = -8} \quad \text{Subtract 8 from each side.} \\ -18 = 3x \quad \text{Simplify.} \\ \frac{-18}{3} = \frac{3x}{3} \quad \text{Divide each side by 3.} \\ -6 = x \quad \text{Simplify.} \end{array}$$

**Check**  $-10 = 8 + 3x$  Write the original equation.  
 $-10 \stackrel{?}{=} 8 + 3(-6)$  Replace  $x$  with  $-6$ .  
 $-10 \stackrel{?}{=} 8 + (-18)$  Multiply.  
 $-10 = -10 \checkmark$  The solution checks.

The solution is  $-6$ .

**EXERCISES**

Solve each equation. Check your solution.

1.  $4y + 1 = 13$

2.  $6x + 2 = 26$

3.  $-3 = 5k + 7$

4.  $6n + 4 = -26$

5.  $7 = -3c - 2$

6.  $-8p + 3 = -29$

7.  $-5 = -5t - 5$

8.  $-9r + 12 = -24$

9.  $11 + 7n = 4$

10.  $35 = 7 + 4b$

11.  $15 + 2p = 9$

12.  $49 = 16 + 3y$

13.  $2 = 4t - 14$

14.  $-9x - 10 = 62$

15.  $30 = 12z - 18$

16.  $7 + 4g = 7$

17.  $24 + 9x = -3$

18.  $50 = 16q + 2$

19.  $3c - 2.5 = 4.1$

20.  $9y + 4.8 = 17.4$

**4-4****Practice: Skills*****Solving Two-Step Equations*****Solve each equation. Check your solution.**

1.  $2x + 1 = 9$

2.  $5b + 2 = 17$

3.  $3w + 5 = 23$

4.  $8n + 1 = 25$

5.  $4t - 2 = 14$

6.  $7k - 3 = 32$

7.  $8x - 1 = 63$

8.  $2x - 5 = 15$

9.  $3 + 6v = 45$

10.  $9 + 4b = 17$

11.  $2p + 14 = 0$

12.  $3y + 10 = -2$

13.  $3w + 5 = 2$

14.  $8x + 7 = -9$

15.  $5d - 1 = -11$

16.  $4d - 35 = -3$

17.  $11x - 24 = -2$

18.  $15a - 54 = -9$

19.  $3g - 49 = -7$

20.  $-2x - 4 = 8$

21.  $-9d - 1 = 17$

22.  $-4f + 1 = 13$

23.  $-5b + 24 = -1$

24.  $-6x + 4 = -2$

**4-4****Practice: Word Problems*****Solving Two-Step Equations***

**1. GOLF** It costs \$12 to attend a golf clinic with a local pro. Buckets of balls for practice during the clinic cost \$3 each. How many buckets can you buy at the clinic if you have \$30 to spend?

**2. MONEY** Paulo has \$145 in his savings account. He earns \$36 a week mowing lawns. If Paulo saves all of his earnings, after how many weeks will he have \$433 saved?

**3. RETAIL** An online retailer charges \$6.99 plus \$0.55 per pound to ship electronics purchases. How many pounds is a DVD player for which the shipping charge is \$11.94?

**4. MONEY** Caitlin has a \$10 gift certificate to the music store. She has chosen a number of CDs from the \$7 bargain bin. If the cost of the CDs is \$32 after the gift certificate is credited, how many CDs did Caitlin buy?

**5. EMPLOYMENT** Mrs. Jackson earned a \$500 bonus for signing a one-year contract to work as a nurse. Her salary is \$22 per hour. If her first week's check including the bonus is \$1,204, how many hours did Mrs. Jackson work?

**6. PHOTOGRAPHY** Morgan subscribes to a website for processing her digital pictures. The subscription is \$5.95 per month and 4 by 6 inch prints are \$0.19 each. How many prints did Morgan purchase if the charge for January was \$15.83?

**4-4****Reading to Learn Mathematics*****Solving Two-Step Equations***

**Pre-Activity** Complete the Mini Lab at the top of page 166 in your textbook.  
Write your answers below.

Solve each equation using models.

1.  $3x + 1 = 7$

2.  $2x - 4 = 2$

3.  $2x + 3 = -3$

**Reading the Lesson**

4. Describe in words each step shown for solving the equation.

$12 + 7s = -9$

$12 + 7s = -9$  \_\_\_\_\_

$-12$  =  $-12$  \_\_\_\_\_

$7s = -21$  \_\_\_\_\_

$\frac{7s}{7} = \frac{-21}{7}$  \_\_\_\_\_

$s = -3$  \_\_\_\_\_

5. Number the steps in the correct order for solving the equation

$-4v + 11 = -5$ .

\_\_\_\_\_ Simplify.

\_\_\_\_\_ Write the equation.

\_\_\_\_\_ Divide each side by  $-4$ .

\_\_\_\_\_ Simplify.

\_\_\_\_\_ Subtract 11 from each side.

\_\_\_\_\_ Check the solution.

6. Check the solution given for each equation. If it is correct, write *correct*.  
If it is incorrect, solve to show the correct solution.

a.  $9a + 2 = -25$ ;  $a = -4$     b.  $-6f - 10 = 32$ ;  $f = -7$     c.  $-18 + 3n = 21$ ;  $n = 9$

**Helping You Remember**

7. In your own words, describe the steps necessary to solve a two-step equation. Will these steps work for all two-step equations?



# 4-5

## Study Guide and Intervention

### Inequalities

An **inequality** is a mathematical sentence that contains the symbols  $<$ ,  $>$ ,  $\leq$ , or  $\geq$ .

Words	Symbols
$m$ is greater than 7.	$m > 7$
$r$ is less than $-4$ .	$r < -4$
$t$ is greater than or equal to 6.	$t \geq 6$
$y$ is less than or equal to 1.	$y \leq 1$

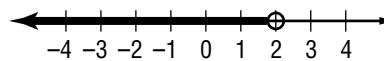
#### EXAMPLE 1 Solve $v + 3 < 5$ . Then graph the solution.

$$\begin{array}{r} v + 3 < 5 \\ -3 = -3 \\ \hline v < 2 \end{array}$$

Write the inequality.  
Subtract 3 from each side.  
Simplify.

**Check** Try 1, a number less than 2.  
 $v + 3 < 5$  Write the inequality.  
 $1 + 3 < 5$  Replace  $v$  with 1.  
 $4 < 5$  ✓ The solution checks.

The solution is all numbers less than 2.

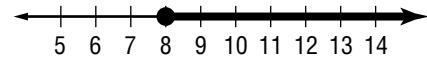


#### EXAMPLE 2 Solve $3y + 2 \geq 26$ . Then graph the solution.

$$\begin{array}{r} 3y + 2 \geq 26 \\ -2 \geq -2 \\ \hline 3y \geq 24 \\ \frac{3y}{3} \geq \frac{24}{3} \\ y \geq 8 \end{array}$$

Write the inequality.  
Subtract 2 from each side.  
Simplify.  
Divide each side by 3.  
 $24 \div 3 = 8$

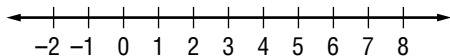
The solution is all numbers greater than or equal to 8.



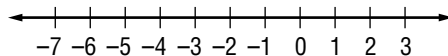
### EXERCISES

Graph each inequality on the number line.

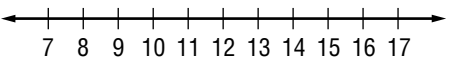
1.  $c < 5$



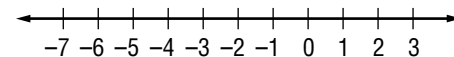
2.  $y > -5$



3.  $x \geq 10$

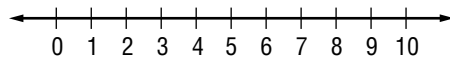


4.  $n \leq -1$

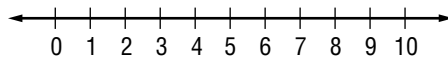


Solve each inequality. Graph the solution.

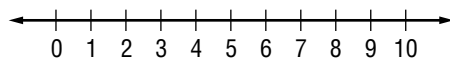
5.  $y + 6 < 11$



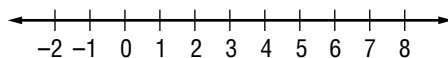
6.  $a - 6 > 0$



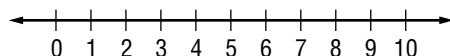
7.  $4q \leq 32$



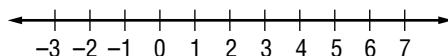
8.  $9w > 45$



9.  $2r + 5 \leq 19$

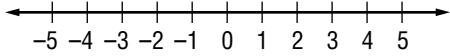


10.  $5x - 7 \geq -2$

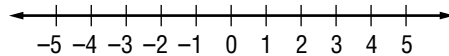


**4-5****Practice: Skills*****Inequalities*****Graph each inequality on a number line.**

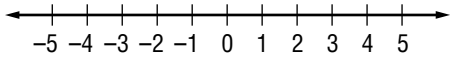
**1.**  $x > 2$



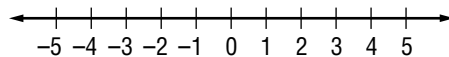
**2.**  $y > -3$



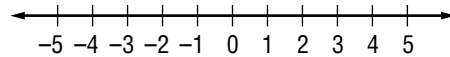
**3.**  $b \geq 1$



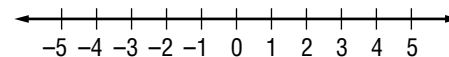
**4.**  $c \geq -5$



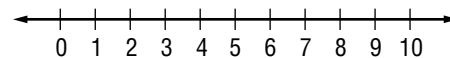
**5.**  $z < 3$



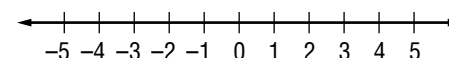
**6.**  $q < -2$



**7.**  $a \leq 6$



**8.**  $r \leq 0$

**Solve each inequality.**

**9.**  $a + 4 < 10$

**10.**  $c + 5 < 9$

**11.**  $d - 1 \geq 8$

**12.**  $g - 11 > 2$

**13.**  $t + 4 \geq -6$

**14.**  $a + 12 < 8$

**15.**  $x - 7 \leq -8$

**16.**  $3t \leq 15$

**17.**  $3w \geq 30$

**18.**  $4n + 8 < 24$

**19.**  $6y + 1 \leq 19$

**20.**  $2r - 8 > 6$

**21.**  $b - 5 > -2$

**22.**  $2y + 1 \leq -5$

**23.**  $4x - 6 > -10$

**4-5****Practice: Word Problems*****Inequalities***

<p><b>1. HURRICANES</b> The National Hurricane Center issues a hurricane warning if sustained winds of 74 miles per hour or higher associated with a hurricane are expected in a coastal area. Write an inequality showing the wind speeds for which a hurricane warning is issued.</p>	<p><b>2. BUSINESS</b> An Internet company reported that its earnings will be less than the 24 cents per share that was predicted. Write an inequality showing the possible earnings per share.</p>
<p><b>3. EXERCISE</b> Jumping rope can burn 600 Calories per hour. Write and solve an inequality to find the number of hours of jumping rope that it would take for you to burn at least 450 Calories.</p>	<p><b>4. TRAVEL</b> The speed limit on highways in Florida is 70 miles per hour. Write and solve an inequality to find how long will it take you to travel the 105 miles from Orlando to St. Augustine if you travel at or below the speed limit.</p>
<p><b>5. SHOPPING</b> Suppose a DVD costs \$19 and a CD costs \$14. Write an inequality to find how many CDs you can buy along with one DVD if you have \$65 to spend. Solve the inequality.</p>	<p><b>6. TRAVEL</b> Jeanine has driven 35 miles of a 230-mile trip. If she is traveling at or below the 65-mile-per-hour speed limit, much longer can Jeanine expect to spend completing the trip?</p>

**4-5**

**Reading to Learn Mathematics**

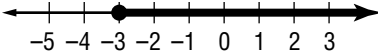
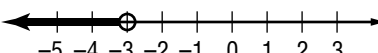
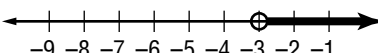
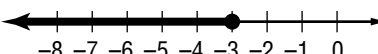
***Inequalities***

**Pre-Activity** *Read the introduction at the top of page 172 in your textbook. Write your answers below.*

1. Suppose your favorite cereal has 2 grams of fat, 7 grams of protein, 4 grams of fiber, and 3 grams of sugar. Is it a healthy cereal? Explain.
  
2. Is a cereal with 3 grams of fiber considered healthy? Explain.
  
3. Is a cereal with 5 grams of sugar considered healthy? Explain.

**Reading the Lesson**

4. Match each equation with its graph.

$x \leq -3$ _____	<b>a.</b>	
$x > -3$ _____	<b>b.</b>	
$x \geq -3$ _____	<b>c.</b>	
$x < -3$ _____	<b>d.</b>	

5. Complete the table. You may repeat symbols, but not words.

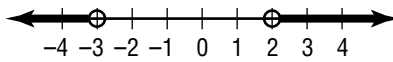
Symbol	Words
<	
	is at least
≤	
	is fewer than
>	
	is no more than

**Helping You Remember**

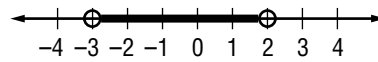
6. Use the Internet, a local newspaper, or your favorite magazine. Find examples of inequalities. Translate each inequality you find into symbols and, if you can, graph each inequality on a number line.

**4-5****Enrichment**

Statements that consist of two or more inequalities are called **compound inequalities**. When you graph a compound inequality, you need to pay special attention to the words that connect the inequalities.



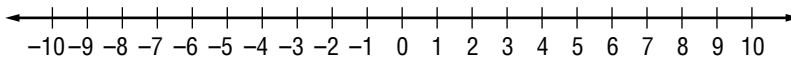
The graph includes all numbers that are *either* less than  $-3$  *or* greater than  $2$ .



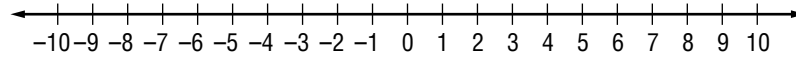
The graph includes all numbers that are *both* greater than  $-3$  *and* less than  $2$ .

**Graph each compound inequality.**

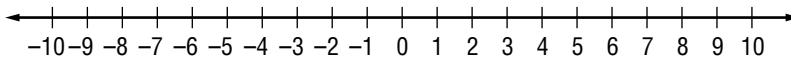
1.  $h > -5$  and  $h < 4$



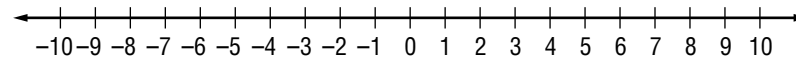
2.  $q < -7$  or  $q > 6$



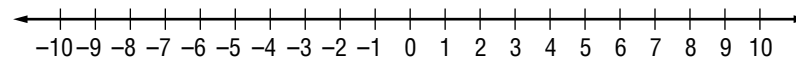
3.  $x \geq 0$  and  $x \leq 8$



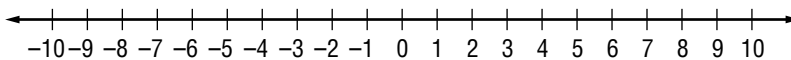
4.  $k \geq 4$  or  $k \leq -2$



5.  $r \leq -3$  or  $r > 0$



6.  $a < 8$  and  $a \geq -4$



7. **CHALLENGE** Describe the graph of each inequality.

a.  $m < -4$  and  $m > 4$

b.  $m > -4$  or  $m < 4$

# 4-6

## Study Guide and Intervention

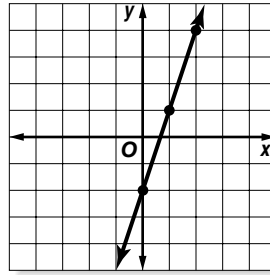
### Functions and Linear Equations

The solution of an equation with two variables consists of two numbers, one for each variable, that make the equation true. The solution is usually written as an ordered pair  $(x, y)$ , which can be graphed. If the graph for an equation is a straight line, then the equation is a linear equation.

#### EXAMPLE 1 Graph $y = 3x - 2$ .

Select any four values for the input  $x$ . We chose 3, 2, 0, and  $-1$ . Substitute these values for  $x$  to find the output  $y$ .

$x$	$3x - 2$	$y$	$(x, y)$
2	$3(2) - 2$	4	$(2, 4)$
1	$3(1) - 2$	1	$(1, 1)$
0	$3(0) - 2$	$-2$	$(0, -2)$
$-1$	$3(-1) - 2$	$-5$	$(-1, -5)$

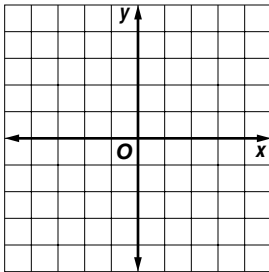


Four solutions are  $(2, 4)$ ,  $(1, 1)$ ,  $(0, -2)$ , and  $(-1, -5)$ . The graph is shown at the right.

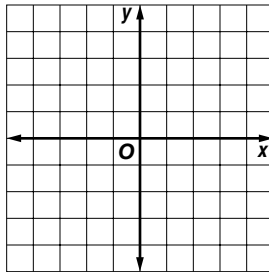
#### EXERCISES

Graph each equation.

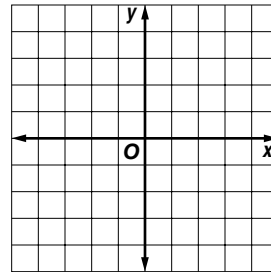
1.  $y = x - 1$



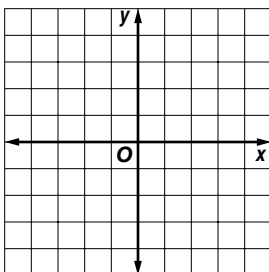
2.  $y = x + 2$



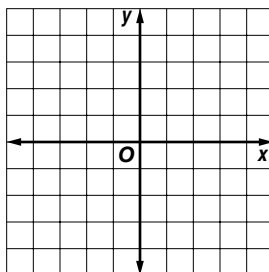
3.  $y = -x$



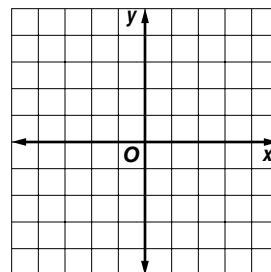
4.  $y = 4x$



5.  $y = 2x + 4$



6.  $y = 3x - 1$



# 4-6

## Practice: Skills

### Functions and Linear Equations

Copy and complete each function table. Identify the domain and range.

1.  $y = x - 1$

x	$x - 1$	y
1		
2		
3		
4		

2.  $y = x + 7$

x	$x + 7$	y
1		
2		
3		
4		

3.  $y = 3x$

x	$3x$	y
1		
2		
3		
4		

4.  $y = -4x$

x	$-4x$	y
-1		
0		
1		
2		

5.  $y = 3x + 1$

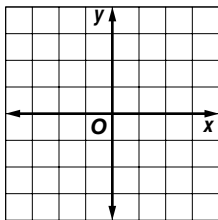
x	$3x + 1$	y
-1		
0		
1		
2		

6.  $y = -2x + 3$

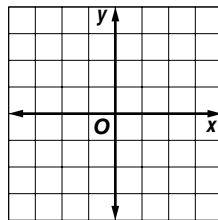
x	$-2x + 3$	y
-1		
0		
1		
2		

Graph each equation.

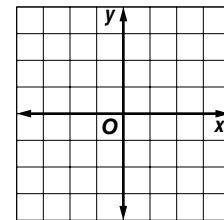
7.  $y = x - 2$



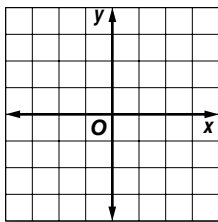
8.  $y = x + 4$



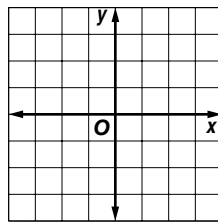
9.  $y = -3x$



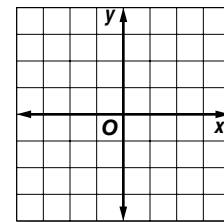
10.  $y = 2x$



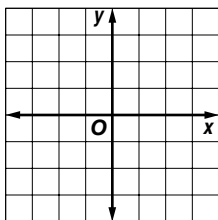
11.  $y = 2x + 2$



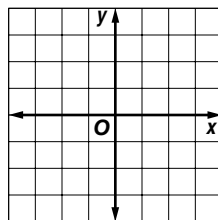
12.  $y = 3x - 2$



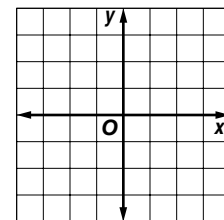
13.  $y = 0.75x$



14.  $y = 0.5x + 1$



15.  $y = 2x - 0.5$



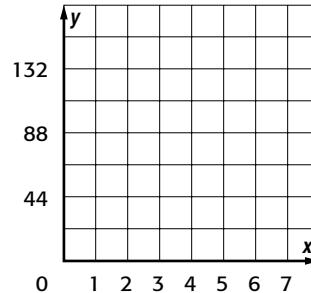
**4-6**

**Practice: Word Problems**

**Functions and Linear Equations**

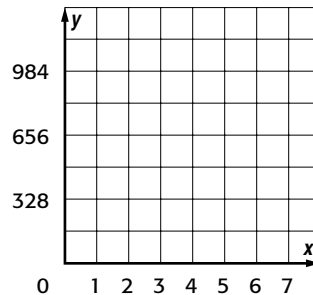
**1. TECHNOLOGY** The fee for your pager service is \$22 per month. Make a function table that shows your total charge for 1, 2, 3, and 4 months of service.

**2. TECHNOLOGY** Use the information in Exercise 1 to write an equation in which  $x$  represents the number of months and  $y$  represents the total charge. Then graph the equation.



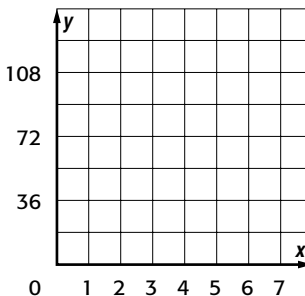
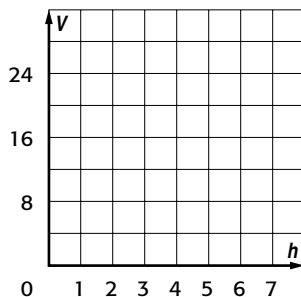
**3. TRAINS** Between Hiroshima and Kokura, Japan, the bullet train averages a speed of 164 miles per hour, which is the fastest scheduled train service in the world. Make a function table that shows the distance traveled at that speed in 1, 2, 3, and 4 hours.

**4. TRAINS** Use the information in Exercise 3 to write an equation in which  $x$  represents the number of hours and  $y$  represents the distance. Then graph the equation.



**5. GEOMETRY** The formula for the volume of a rectangular prism whose base has an area of 8 square units is  $V = 8h$ , where  $V$  is the volume and  $h$  is the height. Graph the function.

**6. ANIMALS** The fastest insect in the world is the dragonfly with a top speed of 36 miles per hour. Write an equation using  $x$  to represent hours and  $y$  to represent distance. Then graph the equation.



**4-6**

**Reading to Learn Mathematics**

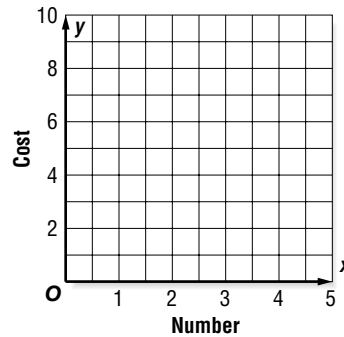
*Functions and Linear Equations*

**Pre-Activity** *Read the introduction at the top of page 177 in your textbook. Write your answers below.*

1. Complete the table to find the cost of 2, 3, and 4 hamburgers.

Hamburgers		
Number	Multiply by 2	Cost
1	$2 \times 1$	2
2		
3		
4		

2. Graph the ordered pairs (number, cost). Describe how the points appear on the grid.



3. What happens to the cost as the number of hamburgers increases?

**Reading the Lesson**

4. Complete each function table. Then identify the domain and range.

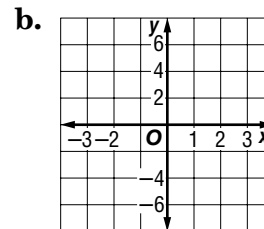
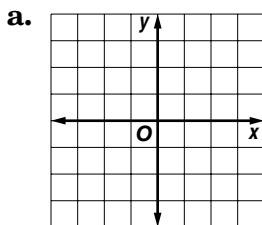
a.

$x$	$2x - 1$	$y$
-1		
0		
1		

b.

$x$	$4x$	$y$
-1		
0		
1		

5. Graph the functions in Exercise 4 above.



**Helping You Remember**

6. Draw a picture of a “machine” that shows how a function works. Your picture should illustrate input, a function rule, and output.

**4-6****Enrichment**

To solve equations containing two variables, find ordered pair solutions for the equation by selecting values for  $x$  and completing a table. Although any value can be selected for  $x$ , values usually selected include  $-2$ ,  $-1$ ,  $0$ ,  $1$ , and  $2$ .

For example, to solve the equation  $y = 2x$  given below in Exercise 1, first select values for  $x$ , then complete a table.

Ordered pair solutions for the equation  $y = 2x$  include  $(-2, -4)$ ,  $(-1, -2)$ ,  $(0, 0)$ ,  $(1, 2)$ , and  $(2, 4)$ .

Match each equation with the point whose coordinates are a solution of the equation. Then, at the bottom of the page, write the letter of the point on the line directly above the number of the equation *each time it appears*. (The first one has been done as an example.) If you have matched the equations and solutions correctly, the letters below will reveal a message.

- |                       |           |           |
|-----------------------|-----------|-----------|
| 1. $y = 2x$           | A(-3, 8)  | N(-1, 0)  |
| 2. $y = x - 3$        | B(0, 2)   | O(3, 0)   |
| 3. $y = -x + 1$       | C(-2, 1)  | P(1, 5)   |
| 4. $y = 3x - 2$       | D(0, -5)  | Q(0, 6)   |
| 5. $y = -2x - 4$      | E(-1, -5) | R(1, 6)   |
| 6. $y = x + (-2)$     | F(1, 3)   | S(2, 1)   |
| 7. $y = -4x - 1$      | G(0, -4)  | T(-2, 3)  |
| 8. $y = \frac{1}{2}x$ | H(-1, 3)  | U(1, 2)   |
| 9. $y = x + 3$        | I(2, 0)   | V(-3, 5)  |
| 10. $y = 7x + 7$      | J(0, 4)   | W(0, -7)  |
| 11. $y = -2x - 6$     | K(-3, 1)  | X(-3, -3) |
| 12. $y = -x + 5$      | L(-4, 2)  | Y(1, 8)   |
| 13. $y = -5x + 8$     | M(-2, 2)  | Z(0, -8)  |
| 14. $y = -x$          |           |           |

14 12 3 7 4 14 12 3 6 9 8      6 8      3 7 4

**U**

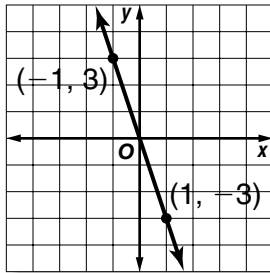
11 12 10 5 1 12 5 4      2 13      8 9 6 4 10 9 4

**4-7****Study Guide and Intervention****Lines and Slope**

**Slope** is a number that tells how steep the line is.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} \quad \leftarrow \begin{array}{l} \text{vertical change} \\ \text{horizontal change} \end{array}$$

**EXAMPLE 1** Find the slope of the line.

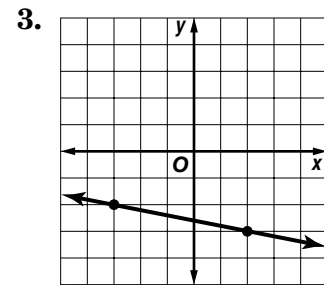
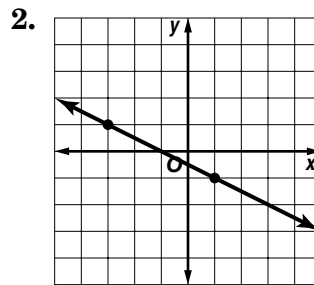
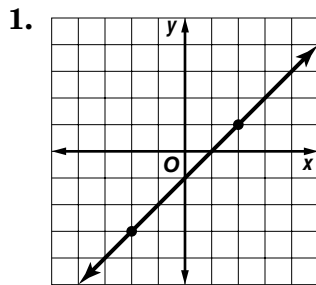


$$\begin{aligned} \text{slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{-6}{2} \text{ or } -3 \end{aligned}$$

The slope of the line is  $-3$ .

**EXERCISES**

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



4.  $(5, 3), (3, 1)$

5.  $(5, 3), (6, 5)$

6.  $(3, 4), (-1, -4)$

7.  $(2, -6), (3, -3)$

8.  $(4, 6), (5, 2)$

9.  $(4, 4), (5, 2)$

10.  $(0, 3), (1, -4)$

11.  $(-3, 2), (-1, -4)$

12.  $(2, 0), (6, 1)$

13.  $(11, 4), (7, 1)$

14.  $(2, 7), (-3, 4)$

15.  $(-1, -3), (7, 3)$

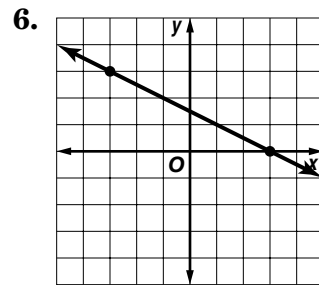
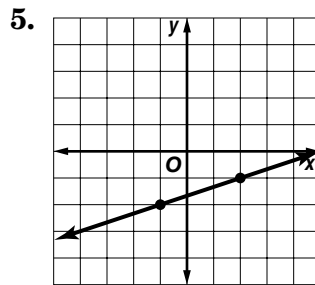
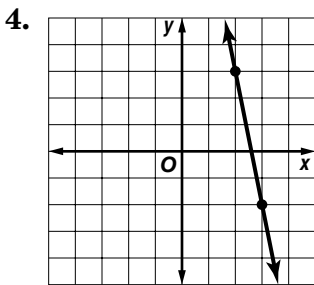
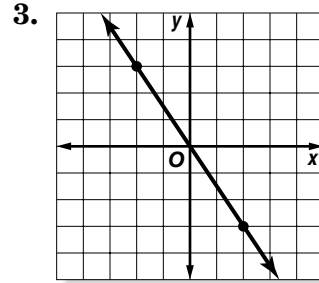
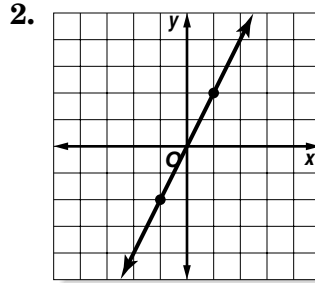
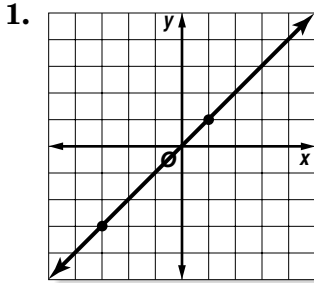
16.  $(7, -4), (1, 0)$

17.  $(5, -2), (7, -3)$

18.  $(0, 0), (6, -1)$

**4-7****Practice: Skills*****Lines and Slope***

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



7.  $(3, 4), (2, 2)$

8.  $(3, 6), (2, 1)$

9.  $(8, 4), (12, 6)$

10.  $(1, 6), (15, 8)$

11.  $(2, -4), (1, -5)$

12.  $(3, -3), (2, -5)$

13.  $(9, 5), (8, 10)$

14.  $(5, 0), (6, 1)$

15.  $(2, 7), (5, 6)$

16.  $(2, 0), (-10, 2)$

17.  $(12, -4), (7, 1)$

18.  $(1, -2), (2, -5)$

19.  $(7, -5), (1, 7)$

20.  $(4, 6), (8, 4)$

21.  $(0, 2), (6, 0)$

22.  $(-8, -1), (-4, 2)$

23.  $(9, 0), (-3, -3)$

24.  $(13, -4), (7, 1)$

**4-7**

**Practice: Word Problems**

*Lines and Slope*

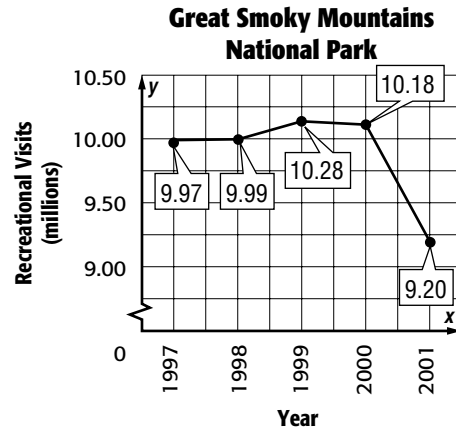
**1. TRAVEL** Suppose each of these functions was graphed on a coordinate plane. Which line is steeper? Explain.

Hours Traveled	Distance (mi)	
	Scott	Amparo
1	55	60
2	110	120
3	165	180
4	220	240

**2. TRAVEL** Use the data in Exercise 1. Find the slope of each line.

**3. TRAVEL** What does the slope of each line that you found in Exercise 2 represent?

**4. NATIONAL PARKS** Which section of the graph shows the least increase in recreational visits? Describe the slope of this part of the graph.



**5. NATIONAL PARKS** Use the graph in Exercise 4. What happened to recreational visits between 1998 and 1999? Describe the slope of this part of the graph.

**6. NATIONAL PARKS** Use the graph in Exercise 4. What happened to the sales between 2000 and 2001? Describe the slope of this part of the graph.

**4-7****Reading to Learn Mathematics*****Lines and Slope***

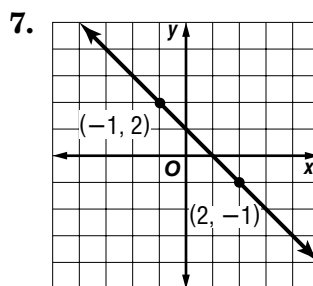
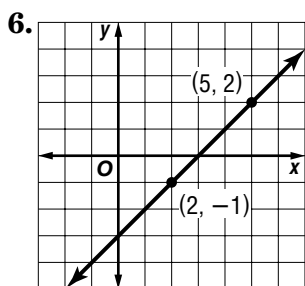
**Pre-Activity** *Read the introduction at the top of page 182 in your textbook. Write your answers below.*

- Which line is steeper?
- What causes one line to be steeper?
- Make a conjecture** about where the line showing a cost of \$2 per gallon would be graphed. Explain.

**Reading the Lesson**

- Define slope in your own words.
- Complete each sentence.
  - Change in  $y$  is \_\_\_\_\_ change, and change in  $x$  is \_\_\_\_\_ change.
  - A line with a positive slope \_\_\_\_\_ to the right, whereas a line with a negative slope \_\_\_\_\_ to the right.

**Find the slope of each line.**

**Helping You Remember**

- To help distinguish between positive and negative slope, think of the words *up* and *down*. Notice the last letter of each word is the same as the first letter of the words *positive* and *negative*. Moving left to right, a line that goes up has a positive slope, and a line that goes down has a negative slope. Create and explain your own unique method for remembering positive and negative slope.

**4-7**

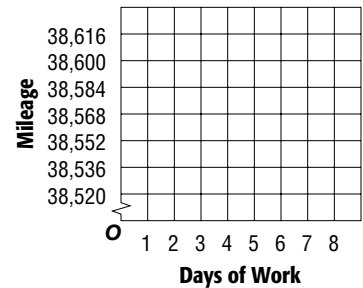
**Enrichment**

**Rate of Change**

The graph of any given relationship is a straight line when the rate of change is constant for equal time intervals. The rate of change is sometimes called the slope of the line. If the rate of change is negative, the  $y$ -values decrease as the  $x$ -values increase. If the rate of change is positive, the  $y$ -values increase as the  $x$ -values increase. You can find the rate of change by reading a graph, by looking at the data in a table, or by finding the slope.

**For Exercises 1 and 2, use the following sets of data to find and interpret the rate of change.**

1. Ingrid's family purchased a used car that Ingrid was allowed to drive only to work. The car originally had 38,520 miles on it, and no one else in the family used it during the school year.
  - a. Ingrid worked at a movie theatre 8 miles from home. Plot on graph paper the point that represents the number of miles on the odometer after the first day Ingrid used the car.
  - b. Then plot the point that represents the mileage after Ingrid has used the car for 4 days. What is the rate of change in miles per day?
  - c. Continue to plot points that represent the mileage after any given number of days. Describe the pattern you see.
  - d. Calculate the rate of change in miles per day, first using the number of miles after 5 days of work and then again after 10 days of work. What can you conclude?



2. Find the slope, or rate of change in price, for each pair of points plotted on the following two graphs. What real-world situations could the points represent? Describe what each rate of change tells you.

