CHAPTER 4

Chapter Summary

WHAT did you learn?	*WHY did you learn it?*
Plot points and draw scatter plots. (4.1)	See relationships between two real-life quantities and make predictions. (p. 205)
Graph a linear equation in two variables	
• using a table of values. (4.2)	Model earnings from a business. (p. 216)
• using intercepts. (4.3)	Make a quick graph to help plan a fundraiser. (p. 220)
• using slope-intercept form. (4.6)	Make a quick graph of a river's heights. (p. 243)
Find the slope of a line passing through two points. (4.4)	Represent the steepness of a road. (p. 231)
Interpret slope as a rate of change. (4.4)	Describe the rate of change of a parachutist's height above the ground. (p. 229)
Write and graph direct variation equations. (4.5)	Model the relationship between lengths of stringed instruments. (p. 238)
Use a graph to check or approximate the solution of a linear equation. (4.7)	Model production costs for a business. (p. 254)
Identify, evaluate, and graph functions. (4.8)	Model projected school enrollments. (p. 260)

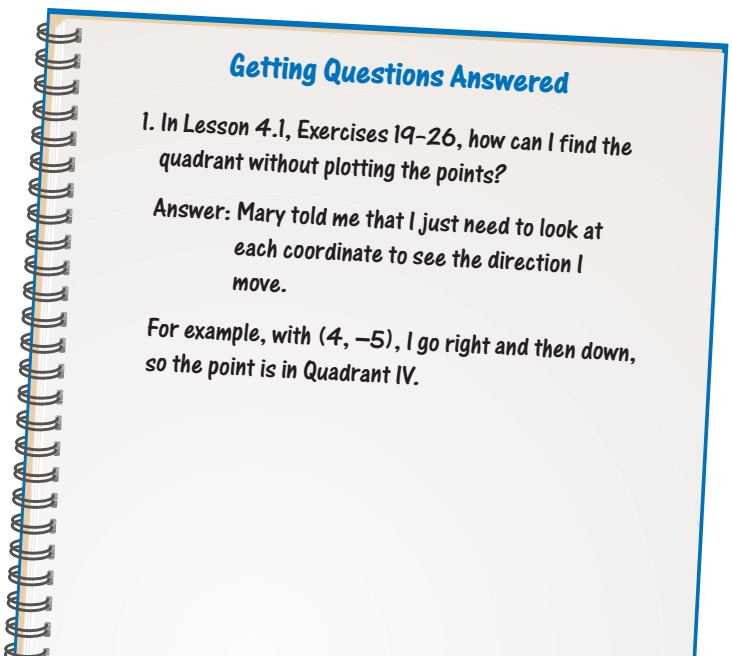
How does Chapter 4 fit into the BIGGER PICTURE of algebra?

In this chapter you saw that relationships between variables may be expressed in algebraic form as an equation or in geometric form as a graph. Recognizing and using the connection between equations and graphs is one of the most important skills you can acquire to help you solve real-life problems.

STUDY STRATEGY

How did you use your list of questions?

The list of questions and answers you made, using the **Study Strategy** on page 202, may resemble this one.



Getting Questions Answered

1. In Lesson 4.1, Exercises 19–26, how can I find the quadrant without plotting the points?

Answer: Mary told me that I just need to look at each coordinate to see the direction I move.

For example, with (4, –5), I go right and then down, so the point is in Quadrant IV.

CHAPTER 4

Chapter Review

VOCABULARY

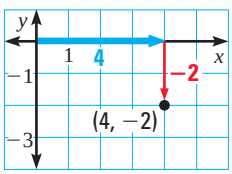
- coordinate plane, p. 203
- ordered pair, p. 203
- *x*-coordinate, p. 203
- *y*-coordinate, p. 203
- *x*-axis, p. 203
- *y*-axis, p. 203
- origin, p. 203
- quadrants, p. 203
- graph of an ordered pair, p. 203
- scatter plot, p. 204
- solution of an equation, p. 210
- graph of an equation, p. 210
- *x*-intercept, p. 218
- *y*-intercept, 218
- slope, p. 226
- rate of change, p. 229
- constant of variation, p. 234
- direct variation, p. 234
- slope-intercept form, p. 241
- parallel lines, p. 242
- relation, p. 256
- function notation, p. 257
- graph of a function, p. 257

4.1 Coordinates and Scatter Plots

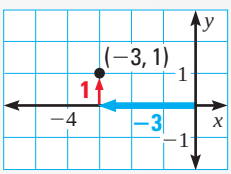
Examples on pp. 203–205

EXAMPLES

To plot the point $(4, -2)$, start at the origin. Move 4 units to the right and 2 units down.



To plot the point $(-3, 1)$, start at the origin. Move 3 units to the left and 1 unit up.



1. Make a scatter plot of the data in the table at the right.

Time (h)	1	1.5	3	4.5
Distance (mi)	20	24	32.5	41

Plot and label the ordered pair in a coordinate plane.

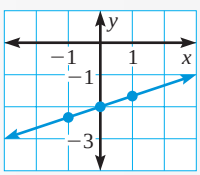
2. $A(4, 6)$ **3.** $B(0, -3)$ **4.** $C(-3.5, 5)$ **5.** $D(4, 0)$

4.2 Graphing Linear Equations

Examples on pp. 210–213

EXAMPLE To graph $3y = x - 6$, solve the equation for y, make a table of values, and plot the points.

x	-1	0	1
y	$-2\frac{1}{3}$	-2	$-1\frac{2}{3}$



$3y = x - 6$ **Write original equation.**

$y = \frac{x - 6}{3}$ **Divide each side by 3.**

Graph the equation.

6. $y = 2x + 2$ **7.** $y = 7 - \frac{1}{2}x$ **8.** $y = -4(x + 1)$ **9.** $x - 10 = 2y$

4.3 Quick Graphs Using Intercepts

Examples on pp. 218–220

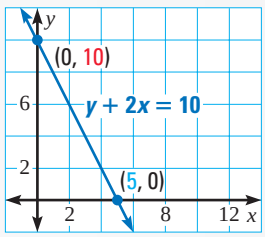
EXAMPLE To graph $y + 2x = 10$, first find the intercepts.

$y + 2x = 10$ $\qquad$ $y + 2x = 10$

$0 + 2x = 10$ $\qquad$ $y + 2(0) = 10$

$x = 5$ $\qquad$ $y = 10$

Plot $(5, 0)$ and $(0, 10)$. Then draw a line through the points.



Graph the equation. Label the intercepts.

10. $-x + 4y = 8$ **11.** $3x + 5y = 15$ **12.** $4x - 5y = -20$ **13.** $2x + 3y = 12$

4.4 The Slope of a Line

Examples on pp. 227–229

EXAMPLE To find the slope of the line passing through the points $(-2, 5)$ and $(4, -7)$, let $(x_1, y_1) = (-2, 5)$ and $(x_2, y_2) = (4, -7)$.

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ Write formula for slope.

$m = \dfrac{-7 - 5}{4 - (-2)}$ Substitute values.

$m = \dfrac{-12}{6}$ Simplify.

$m = -2$ Slope is negative.

Plot the points and find the slope of the line passing through the points.

14. $(2, 1), (3, 4)$ **15.** $(0, 8), (-1, 2)$ **16.** $(2, 4), (5, 0)$ **17.** $(0, 5), (-4, 5)$

4.5 Direct Variation

Examples on pp. 234–236

EXAMPLE If x and y vary directly, the equation that relates x and y is of the form $y = kx$. If $x = 3$ when $y = 18$, then you can write an equation that relates x and y.

$y = kx$ Write model for direct variation.

$18 = k(3)$ Substitute 3 for x and 18 for y.

$6 = k$ Divide each side by 3.

An equation that relates x and y is $y = 6x$.

The variables x and y vary directly. Use the given values of the variables to write an equation that relates x and y.

18. $x = 7, y = 35$ **19.** $x = 12, y = -4$ **20.** $x = 4, y = -16$ **21.** $x = 3, y = 10.5$

4.6 Quick Graphs Using Slope-Intercept Form

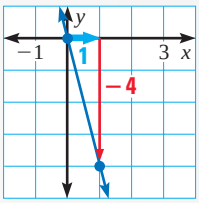
Examples on pp. 241–243

EXAMPLE Use the following steps to graph $4x + y = 0$.

STEP 1 Write the equation in $y = mx + b$ form: $y = -4x$.

STEP 2 Find the slope and the y-intercept: $m = -4$, $b = 0$.

STEP 3 Plot the point $(0, 0)$. Draw a slope triangle to locate a second point on the line. Draw a line through the two points.



Graph the equation.

22. $y = -x - 2$ **23.** $x - 4y = 12$ **24.** $-x + 6y = -24$

4.7 Solving Linear Equations Using Graphs

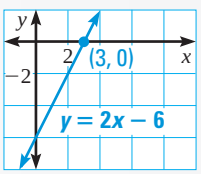
Examples on pp. 250–252

EXAMPLE You can solve the equation $2x - 4 = 2$ graphically.

$2x - 4 = 2$ **Write original equation.**

$2x - 6 = 0$ **Write in form $ax + b = 0$.**

$y = 2x - 6$ **Write related function $y = ax + b$.**



Graph $y = 2x - 6$. The x-intercept is 3, so the solution is $x = 3$.

✓CHECK

$2x - 4 = 2$ **Write original equation.**

$2(3) - 4 \stackrel{?}{=} 2$ **Substitute 3 for x.**

$2 = 2$ **True statement.**

Solve the equation graphically. Check your solution algebraically.

25. $3x - 6 = 0$ **26.** $-5x - 3 = 0$ **27.** $3x + 8 = 4x$ **28.** $-4x - 1 = 7$

4.8 Functions and Relations

Examples on pp. 256–258

EXAMPLE To evaluate the function $f(x) = -\frac{1}{5}x + 1$ when $x = 15$, substitute the given value for x.

$f(x) = -\frac{1}{5}x + 1$ **Write original function.**

$f(15) = -\frac{1}{5}(15) + 1$ **Substitute 15 for x.**

$f(15) = -2$ **Simplify.**

Evaluate the function for the given value of x. Then graph the function.

29. $f(x) = x - 7$ when $x = -2$

30. $f(x) = -x + 4$ when $x = 4$

31. $f(x) = 2x + 6$ when $x = -3$

32. $f(x) = 1.5x - 4.2$ when $x = -9$

CHAPTER 4

Chapter Test

Plot and label the points in a coordinate plane.

1. $A(2, 6), B(-4, -1), C(-1, 4), D(3, -5)$

2. $A(-5, 1), B(0, 3), C(-1, -5), D(4, 6)$

3. $A(7, 3), B(-2, -2), C(0, 4), D(6, -2)$

4. $A(0, -1), B(-5, -6), C(7, -2), D(2, 4)$

Graph the line that has the given intercepts.

5. x-intercept: 3
y-intercept: -1

6. x-intercept: -5
y-intercept: 4

7. x-intercept: 6
y-intercept: 6

8. x-intercept: $-\frac{1}{2}$
y-intercept: -3

Use a table of values to graph the equation.

9. $y = -x + 3$

10. $y = 4$

11. $y = -(5 - x)$

12. $x = 6$

Graph the equation. Tell which method you used.

13. $2x + y - 11 = 0$

14. $3x - 2y - 2 = 0$

15. $-7x - y + 49 = 0$

16. $\frac{2}{3}x + y - 32 = 0$

Plot the points and find the slope of the line passing through the points.

17. $(0, 1), (-2, -6)$

18. $(-4, -1), (5, -7)$

19. $(-3, 5), (2, -2)$

20. $(-3, -1), (2, -1)$

The variables *x* and *y* vary directly. Use the given values of the variables to write an equation that relates *x* and *y*.

21. $x = -2, y = -2$

22. $x = 2, y = 10$

23. $x = -3, y = 7$

24. $x = \frac{1}{2}, y = 6$

25. $x = 1.3, y = 3.9$

26. $x = 16, y = 3.2$

In Exercises 27 and 28, decide whether the graphs of the two equations are parallel lines. Explain your answer.

27. $y = 4x + 3, y = -4x - 5$

28. $10y + 20 = 6x, 5y = 3x + 35$

29. Solve $x - 2 = -3x$ graphically. Check your solution algebraically.

In Exercises 30–32, evaluate the function when $x = 3$, $x = 0$, and $x = -4$.

30. $f(x) = 6x$

31. $f(x) = -(x - 2)$

32. $g(x) = 3.2x + 2.8$

33. **FLOOD WATERS** A river has risen 6 feet above flood stage. Beginning at time $t = 0$, the water level drops at a rate of two inches per hour. The number of feet above flood stage y after t hours is given by $y = 6 - \frac{1}{6}t$. Graph the equation over the 12-hour period from $t = 0$ to $t = 12$.

34. **SHOE SIZES** The table below shows how foot length relates to women's shoe sizes. Is shoe size a function of foot length? Why or why not?

Foot length (in inches), *x*	$9\frac{1}{4}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{15}{16}$	$10\frac{1}{4}$	$10\frac{1}{2}$
Shoe size, *y*	$6\frac{1}{2}$	7	7	8	8	$9\frac{1}{2}$	$9\frac{1}{2}$