Chapter Summary

WHAT did you learn?

Write an equation of a line in slope-intercept form.
- given its slope and its *y*-intercept **(5.1)**
- given its slope and one of its points **(5.2)**
- given two of its points **(5.3)**

Write equations of perpendicular lines. **(5.3)**

Fit a line to data. **(5.4)**

Write an equation of a line in point-slope form. **(5.5)**

Write an equation of a line in standard form. **(5.6)**

Create a linear model for a real-life situation. **(5.1–5.6)**

Predict using a linear model. **(5.7)**

WHY did you learn it?

Calculate the cost of a phone call. **(p. 275)**

Predict the number of vacations trips in 2005. **(p. 281)**

Estimate height at an archaeological dig. **(p. 287)**

Write equations for sides of geometric figures. **(p. 286)**

Represent winning Olympic discus throws. **(p. 294)**

Find the optimal running pace for a given temperature. **(p. 302)**

Plan possible purchases. **(p. 310)**

Make predictions and estimates. **(pp. 274 and 281)**

Estimate the amount spent in 2015 on advertising. **(p. 318)**

How does Chapter 5 fit into the BIGGER PICTURE of algebra?

In this chapter you studied techniques for writing equations of lines. Using the slope-intercept form that you saw in Chapter 4, you learned the point-slope form and standard form of an equation. You used many techniques you learned in earlier chapters: the problem-solving strategies in Chapter 1; the rules of simplification in Chapter 2; the equation solving in Chapter 3; and the graphing methods in Chapter 4.

Knowing which form of a linear equation is best to use is a basic problem solving strategy you will continue to apply in the following chapters.

STUDY STRATEGY

How did you use your practice test?

A practice test you may have written using the **Study Strategy** on page 272 may have begun like this one.

Practice Test

Lesson 5.1 Write an equation of the line in slope-intercept form.

1. $m = 3; b = -2$

2. $m = -\frac{1}{2}; b = 5$

Lesson 5.2 Write an equation of the line that passes through the point and has the given slope.

4. $(2, 6), m = \frac{2}{3}$

5. $(-3, -3), m = -1$

Chapter Review

- slope-intercept form, p. 273
- best-fitting line, p. 292
- positive correlation, p. 295
- negative correlation, p. 295
- point-slope form, p. 300
- standard form, p. 308
- linear interpolation, p. 318
- linear extrapolation, p. 318

5.1   WRITING LINEAR EQUATIONS: SLOPE-INTERCEPT FORM

Examples on pp. 273–275

> **EXAMPLES**   Write an equation of the line with a slope of $\frac{1}{2}$ and a y-intercept of -2.
>
> $y = mx + b$ **Write slope-intercept form.**
>
> $y = \frac{1}{2}x - 2$ **Substitute $\frac{1}{2}$ for m and -2 for b.**

Write an equation of the line with the given slope and y-intercept.

1. $m = 2; b = -2$ **2.** $m = -\frac{1}{2}; b = 5$ **3.** $m = -8; b = -3$

5.2   WRITING LINEAR EQUATIONS GIVEN THE SLOPE AND A POINT

Examples on pp. 279–281

> **EXAMPLES**   Write an equation of the line through $(2, -1)$ with a slope of 3.
>
> $y = mx + b$ **Write slope-intercept form.**
>
> $-1 = 3(2) + b$ **Substitute -1 for y, 2 for x, and 3 for m.**
>
> $-7 = b$ **Simplify and solve for b.**
>
> $y = 3x - 7$ **Substitute 3 for m and -7 for b in slope-intercept form.**

Write an equation of the line that passes through the point and has the given slope.

4. $(4, -3), m = 6$ **5.** $(-9, 4), m = 2$ **6.** $(-3, 2), m = -1$

5.3   WRITING LINEAR EQUATIONS GIVEN TWO POINTS

Examples on pp. 285–287

> **EXAMPLES**   Write an equation of the line that passes through $(-2, -6)$ and $(3, 4)$.
>
> $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{4 - (-6)}{3 - (-2)} = \dfrac{10}{5} = 2$ **Find the slope of the line.**
>
> Now use the slope $m = 2$ and one of the given points to write an equation of the line as in the Example for Lesson 5.2 above. An equation is $y = 2x - 2$.

If two lines are perpendicular their slopes are negative reciprocals.

A line perpendicular to the line $y = -5x + 3$ has a slope of $\frac{1}{5}$.

Write the slope-intercept form of an equation of the line that passes through the points.

7. $(4, -9), (-3, 2)$ **8.** $(1, 8), (-2, -1)$ **9.** $(2, 5), (-8, 2)$

10. Write the slope-intercept form of an equation of the line perpendicular to the line in Exercise 7 with a y-intercept of -3.

5.4 FITTING A LINE TO DATA

Examples on pp. 292–295

EXAMPLES On the scatter plot, sketch a line to approximate the data. Choose two points on your line, say $(11, 5)$ and $(6, -5)$. Find the slope.
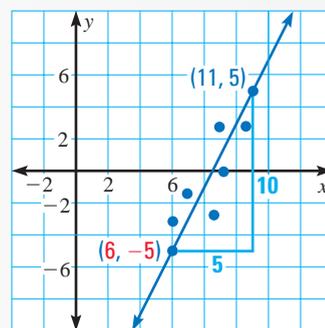
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-5)}{11 - 6} = \frac{10}{5} = 2$$

$y = mx + b$ **Write slope-intercept form.**

$-5 = 2(6) + b$ **Substitute for y, x, and m.**

$-17 = b$ **Solve for b.**

An equation that approximates the best-fitting line is $y = 2x - 17$.

Draw a scatter plot of the data. Find an equation of the line that corresponds closely to the data and that best fits the data.

11.

x	−1	−3	5	9	12
y	−1	−4	9	20	25

12.

x	2	1	−2	−4	−6
y	10	5	0	−5	−10

5.5 POINT-SLOPE FORM OF A LINEAR EQUATION

Examples on pp. 300–302

EXAMPLES Write an equation of the line through $(5, -4)$ and $(-3, 4)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-4)}{-3 - 5} = \frac{8}{-8} = -1$$

$y - y_1 = m(x - x_1)$ **Write point-slope form.**

$y - (-4) = (-1)(x - 5)$ **Substitute for m, x_1, and y_1.**

$y = -x + 1$ **Simplify.**

Write an equation in point-slope form of the line that passes through the two points. Then rewrite the equation in slope-intercept form.

13. $(-4, 4), (2, 5)$ **14.** $(-2, 3), (5, 0)$ **15.** $(1, -2), (-1, 8)$

THE STANDARD FORM OF A LINEAR EQUATION

EXAMPLES The standard form of a linear equation is $Ax + By = C$.

Write the equation $y = -\frac{2}{3}x + 6$ in standard form with integer coefficients.

$$y = -\frac{2}{3}x + 6 \qquad \text{Write given form.}$$

$$3y = -2x + 18 \qquad \text{Multiply each side by 3.}$$

$$2x + 3y = 18 \qquad \text{Add } 2x \text{ to each side.}$$

Rewrite the equation in standard form with integer coefficients.

16. $y = 2x + 9$ 　　　　　**17.** $3y = -8x + 2$ 　　　　　**18.** $2y = -2x + 6$

19. $y = -\frac{1}{3}x + \frac{2}{3}$ 　　　　**20.** $y = \frac{3}{4}x + \frac{1}{2}$ 　　　　**21.** $\frac{1}{2}y = \frac{2}{3}x - 2$

PREDICTING WITH LINEAR MODELS

EXAMPLES You can use linear models to make predictions. Use the graph showing the number of World Wide Web users (in millions) for different years, with x representing the number of years since 1996. Predict the number of World Wide Web users in the year 2005.

$$m = \frac{66 - 34}{3 - 1} = 16 \qquad \text{Find slope using } (\mathbf{1}, \mathbf{34}) \text{ and } (\mathbf{3}, \mathbf{66}).$$

$$\mathbf{34} = (\mathbf{16})\mathbf{1} + b \qquad \text{Substitute 34 for } y, \text{ 1 for } x, \text{ and 16 for } m \text{ in } y = mx + b.$$

$$b = 18 \qquad \text{Simplify and solve for } b.$$

$$y = 16x + 18 \qquad \text{Write equation with } m \text{ and } b.$$

$$y = 16(\mathbf{9}) + 18 \qquad \text{Substitute 9 to represent 2005.}$$

$$y = 162 \qquad \text{Simplify and solve.}$$

World Wide Web Users
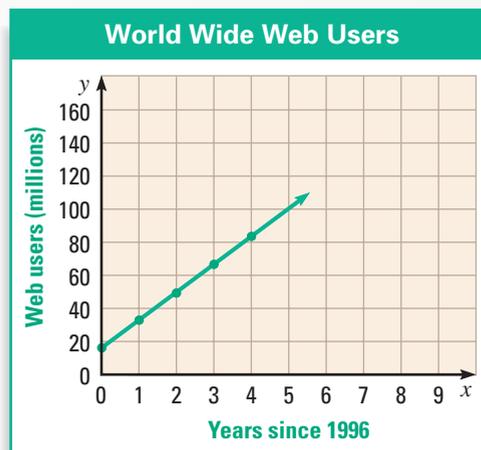
▶ Source: IDC Link

Using the linear model $y = 16x + 18$, you can estimate the number of World Wide Web users in 2005 to be 162 million.

Use the linear model in the Example above to estimate the number of World Wide Web users in the given year. Tell whether you use a *linear interpolation* or *linear extrapolation*.

22. 1995 　　　　**23.** 2010 　　　　**24.** 2002 　　　　**25.** 2006

Chapter Test

Write an equation of the line with the given slope and *y*-intercept. Write the equation in slope-intercept form.

1. $m = 2, b = -1$

2. $m = -4, b = 3$

3. $m = 6, b = 9$

4. $m = \frac{1}{4}, b = -3$

5. $m = -3, b = 3$

6. $m = 0, b = 4$

Write an equation of the line that passes through the given point and has the given slope. Write the equation in slope-intercept form.

7. $(2, 6), m = 2$

8. $(3, -9), m = -5$

9. $(-5, -6), m = -3$

10. $(1, 8), m = -4$

11. $(4, -2), m = \frac{1}{2}$

12. $\left(\frac{1}{3}, -5\right), m = 8$

Graph the line that passes through the points. Then write an equation of the line in slope-intercept form.

13. $(-3, 2), (4, -1)$

14. $(6, 2), (8, -4)$

15. $(-2, 5), (2, 4)$

16. $(-2, -8), (-1, 0)$

17. $(-5, 2), (2, 4)$

18. $(9, -1), (1, -9)$

19. Write an equation of a line that is perpendicular to $y = -2x + 6$ and passes through $(-4, 7)$.

In Exercises 20–25, rewrite the equation in standard form with integer coefficients.

20. $4y = 24 + 2x$

21. $y = 7x + 8$

22. $6y = -18x + 3$

23. $\frac{1}{2} - x = 9y$

24. $5y = 25x$

25. $-2y + \frac{1}{2}x = 4$

26. Rewrite the equation $y = \frac{5}{13}x + 4$ in standard form with integer coefficients.

27. **NICKELS AND DIMES** Maria needs $2.20 to buy a magazine. The only money she has is a jar of nickels and dimes. Write an equation in standard form for the different amounts of nickels x and dimes y she could use.

28. **MONTHLY PAY** A salesperson for an appliance store earns a monthly pay of $1250 plus a 4% commission on the sales. Write an equation in slope-intercept form that gives the total monthly pay y in terms of sales x.

CELLULAR PHONE INDUSTRY **In Exercises 29–33, use the following information. The table shows the number of employees in the cellular telephone industry in the United States from 1990 through 1995.**

▶ Source: Cellular Telecommunications Industry Association

29. Make a scatter plot and fit a line to the data.

30. Write an equation of the line in slope-intercept form.

31. Use the linear model to estimate the number of employees in 1994. Did you use *linear interpolation* or *linear extrapolation*?

32. Use the linear model to estimate the number of employees in 2004. Did you use *linear interpolation* or *linear extrapolation*?

33. Use the linear model to estimate the year in which the number of employees was 0. Did you use *linear interpolation* or *linear extrapolation*? Is this a realistic prediction? Why or why not?

Cellular Telephone Industry	
Years since 1990	**Employees**
0	21,400
1	26,300
2	34,300
3	39,800
4	?
5	68,200