CHAPTER 2

Chapter Summary

WHAT did you learn?	*WHY did you learn it?*
Represent relations and functions. (2.1)	Determine if the diameters of trees are a function of their ages. (p. 68)
Graph and evaluate linear functions. (2.1)	Model the distance a hot-air balloon travels. (p. 70)
Find and use the slope of a line. (2.2)	Find the average rate of change in temperature. (p. 81)
Write linear equations. (2.4)	Predict the number of African-American women who will hold elected public office in 2010. (p. 93)
Write direct variation equations. (2.4)	Model calories burned while dancing. (p. 97)
Use a scatter plot to identify the correlation shown by a set of data. (2.5)	Identify the relationship between when and for how long Old Faithful will erupt. (p. 104)
Approximate the best-fitting line for a set of data. (2.5)	Predict how many people will enroll in City Year in 2010. (p. 105)
Graph linear equations, inequalities, and functions.	
• linear equations (2.3)	Identify relationships between sales of student and adult basketball tickets. (p. 88)
• linear inequalities in two variables (2.6)	Model blood pressures in your arm and ankle. (p. 112)
• piecewise functions (2.7)	Determine the cost of ordering T-shirts. (p. 119)
• absolute value functions (2.8)	Model the sound level of an orchestra. (p. 127)
Use linear equations, inequalities, and functions to solve real-life problems. (2.3–2.8)	Determine how much your summer job will pay. (p. 116)

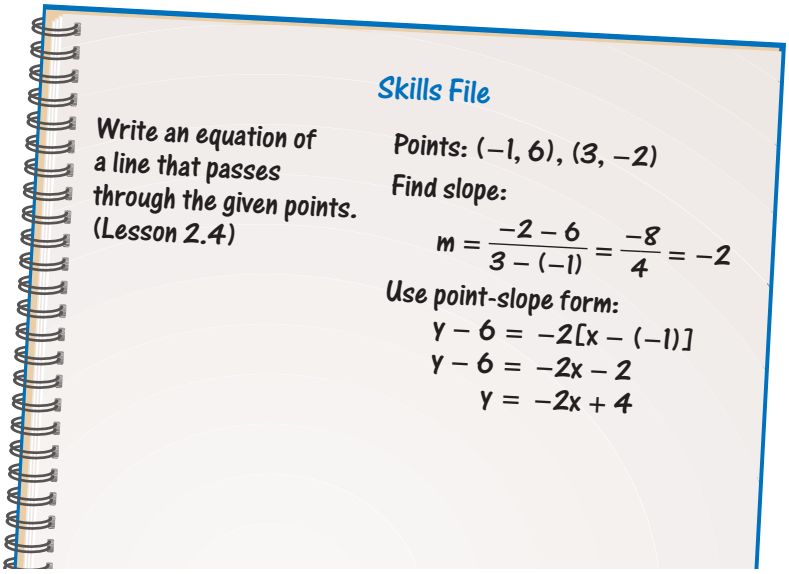
How does Chapter 2 fit into the BIGGER PICTURE of algebra?

Your study of functions began in Chapter 2 and will continue throughout Algebra 2 and in future mathematics courses. To represent different kinds of functions with graphs and equations is a very important part of algebra. A relationship between two variables or two sets of data is often linear, but as you will see later in this course, it can also be quadratic, cubic, exponential, logarithmic, or trigonometric.

STUDY STRATEGY

How did you make and use a skills file?

Here is an example of a skill from Lesson 2.4 for your skills file, following the **Study Strategy** on page 66.



CHAPTER 2

Chapter Review

VOCABULARY

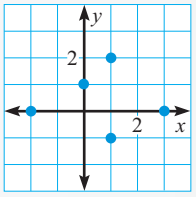
- relation, p. 67
- domain, p. 67
- range, p. 67
- function, p. 67
- ordered pair, p. 67
- coordinate plane, p. 67
- equation in two variables, p. 69
- solution of an equation in two variables, p. 69
- independent variable, p. 69
- dependent variable, p. 69
- graph of an equation in two variables, p. 69
- linear function, p. 69
- function notation, p. 69
- slope, p. 75
- parallel lines, p. 77
- perpendicular lines, p. 77
- *y*-intercept, p. 82
- slope-intercept form of a linear equation, p. 82
- standard form of a linear equation, p. 84
- *x*-intercept, p. 84
- direct variation, p. 94
- constant of variation, p. 94
- scatter plot, p. 100
- positive correlation, p. 100
- negative correlation, p. 100
- relatively no correlation, p. 100
- linear inequality in two variables, p. 108
- solution of a linear inequality in two variables, p. 108
- graph of a linear inequality in two variables, p. 108
- half-plane, p. 108
- piecewise function, p. 114
- step function, p. 115
- vertex of an absolute value graph, p. 122

2.1 Functions and Their Graphs

Examples on pp. 67–70

EXAMPLE You can represent a relation with a table of values or a graph of ordered pairs.

x	0	1	−2	3	1
y	1	−1	0	0	2



This relation is not a function because $x = 1$ is paired with both $y = -1$ and $y = 2$.

Graph the relation. Then tell whether the relation is a function.

1.

x	−1	0	1	2	3
y	10	7	4	1	−2

2.

x	6	1	0	4	3	5
y	2	4	2	1	5	0

2.2 Slope and Rate of Change

Examples on pp. 75–78

EXAMPLE You can find the slope of a line passing through two given points.

Points: (5, 0) and (−3, 4) **Slope:** $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 0}{-3 - 5} = \frac{4}{-8} = -\frac{1}{2}$

Find the slope of the line passing through the given points.

3. (3, 6), (−6, 0) **4.** (2, 4), (−2, 4) **5.** (−7, 2), (−1, −4) **6.** (5, 1), (5, 4)

2.3 Quick Graphs of Linear Equations

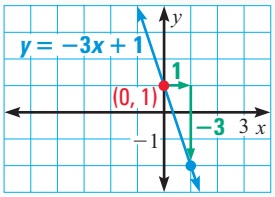
Examples on pp. 82–85

EXAMPLES You can graph a linear equation in slope-intercept or in standard form.

$y = -3x + 1$

slope $= -3$

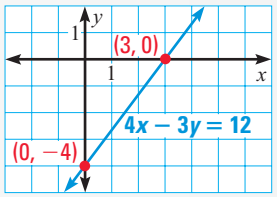
y-intercept $= 1$



$4x - 3y = 12$

x-intercept $= 3$

y-intercept $= -4$



Graph the equation.

7. $y = -x + 3$ **8.** $y = \frac{1}{2}x - 7$ **9.** $4x + y = 2$ **10.** $-4x + 8y = -16$

2.4 Writing Equations of Lines

Examples on pp. 91–94

EXAMPLES You can write an equation of a line using (**a**) the slope and y-intercept, (**b**) the slope and a point on the line, or (**c**) two points on the line.

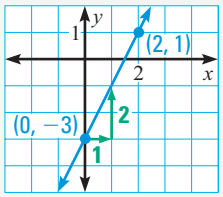
a. Slope-intercept form, $m = 2$ and $b = -3$: $y = 2x - 3$

b. Point-slope form, $m = 2$ and $(x_1, y_1) = (2, 1)$: $y - 1 = 2(x - 2)$

$y = 2x - 3$

c. Points $(0, -3)$ and $(2, 1)$: $\text{slope} = \frac{1 - (-3)}{2 - 0} = 2$

Use either slope-intercept form or point-slope form: $y = 2x - 3$



Write an equation of the line that has the given properties.

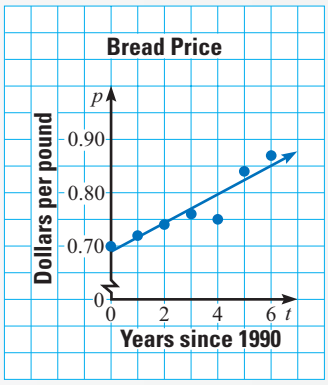
11. slope: -1, y-intercept: 2 **12.** slope: 3, point: $(-4, 1)$ **13.** points: $(3, -8)$, $(8, 2)$

2.5 Correlation and Best-Fitting Lines

Examples on pp. 100–102

EXAMPLE You can graph paired data to see what relationship, if any, exists. The table shows the price p (in dollars per pound) of bread where t is the number of years since 1990.

t	0	1	2	3	4	5	6
p	0.70	0.72	0.74	0.76	0.75	0.84	0.87



Approximate the best-fitting line using (4, 0.80) and (6, 0.85),

$m = \frac{0.85 - 0.80}{6 - 4} = 0.025$ $y - 0.80 = 0.025(x - 4)$

$y = 0.025x + 0.70$

2.5 continued

Approximate the best-fitting line for the data.

14.

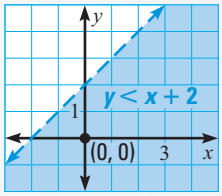
x	14	11	21	3	4	19	10	1	17	6
y	4	6	1	10	9	0	5	10	2	7

2.6 Linear Inequalities in Two Variables

Examples on pp. 108–110

EXAMPLE You can graph a linear inequality in two variables in a coordinate plane.

To graph $y < x + 2$, first graph the boundary line $y = x + 2$. Use a dashed line since the symbol is $<$, not $\leq$. Test the point $(0, 0)$. Since $(0, 0)$ *is* a solution of the inequality, shade the half-plane that contains it.



Graph the inequality in a coordinate plane.

15. $2x < 6$ **16.** $y \leq 7$ **17.** $y \geq -x + 4$ **18.** $x + 8y > 8$

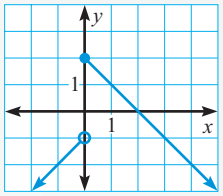
2.7 Piecewise Functions

Examples on pp. 114–116

EXAMPLE You can graph a piecewise function by graphing each piece separately.

$$y = \begin{cases} x - 1, & \text{if } x < 0 \\ -x + 2, & \text{if } x \geq 0 \end{cases}$$

Graph $y = x - 1$ to the left of $x = 0$.
Graph $y = -x + 2$ to the right of and including $x = 0$.



Graph the function.

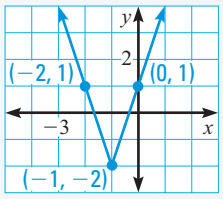
19. $y = \begin{cases} 2x, & \text{if } x < -1 \\ 2x + 1, & \text{if } x \geq -1 \end{cases}$ **20.** $y = \begin{cases} -x, & \text{if } x \leq 0 \\ 3x, & \text{if } x > 0 \end{cases}$ **21.** $y = \begin{cases} -2, & \text{if } x \leq 2 \\ 2, & \text{if } x > 2 \end{cases}$

2.8 Absolute Value Functions

Examples on pp. 122–124

EXAMPLE You can graph an absolute value function using symmetry.

The graph of $y = 3|x + 1| - 2$ has vertex $(-1, -2)$. Plot a second point such as $(0, 1)$. Use symmetry to plot a third point, $(-2, 1)$. Note that $a = 3 > 0$ and $|a| > 1$, so the graph opens up and is narrower than the graph of $y = |x|$.



Graph the function.

22. $y = -|x| + 1$ **23.** $y = |x - 4| + 3$ **24.** $y = 2|x| - 5$ **25.** $y = 3|x + 6| - 2$

CHAPTER 2

Chapter Test

Graph the relation. Then tell whether the relation is a function.

1.

x	-4	-2	0	2	4
y	-1	0	1	2	3

2.

x	2	-3	4	0	-3	1
y	2	-2	0	2	3	-1

Evaluate the function for the given value of x.

3. $f(x) = 80 - 3x$; $f(5)$ **4.** $f(x) = x^2 + 4x - 7$; $f(-1)$ **5.** $f(x) = 3|x - 4| + 2$; $f(2)$

Graph the equation.

6. $y = -\frac{2}{3}x + 2$ **7.** $y = -3$ **8.** $5x - 2y = 10$ **9.** $x = 4$

Write an equation of the line with the given characteristics.

10. slope: $\frac{3}{4}$, y-intercept: -5 **11.** slope: -1, point: $(2, -4)$ **12.** points: $(-2, 5)$, $(-6, 8)$

13. Write an equation of the line that passes through $(-3, 2)$ and is parallel to the line $x - y = 7$.

14. Write an equation of the line that passes through $(1, 4)$ and is perpendicular to the line $y = -3x + 1$.

Graph the inequality in a coordinate plane.

15. $x + 4y \leq 0$ **16.** $y > 3x - 1$ **17.** $x - y > 3$ **18.** $-x \geq 2$

Graph the function.

19. $f(x) = \begin{cases} -2x + 3, & \text{if } x \leq 1 \\ x, & \text{if } x > 1 \end{cases}$

20. $f(x) = \begin{cases} 2, & \text{if } -4 < x \leq -2 \\ 5, & \text{if } -2 < x \leq 0 \\ 7, & \text{if } 0 < x \leq 2 \\ 10, & \text{if } 2 < x \leq 4 \end{cases}$

21. $f(x) = \begin{cases} x - 2, & \text{if } x \leq 0 \\ x + 2, & \text{if } x > 0 \end{cases}$

22. $y = -|x + 3|$ **23.** $y = 2|x| - 1$ **24.** $y = -\frac{1}{3}|x - 2| + 2$

25. ROLLER COASTERS One of the world's faster roller coasters is located in a theme park in Valencia, California. Riders go from 0 to 100 miles per hour in 7 seconds. Find the acceleration of the roller coaster during this time interval in miles per second squared.

26. MIRROR LENGTH To be able to see your complete reflection in a mirror that is hanging on a wall, the mirror must have a minimum length of m inches. The value of m varies directly with your height h (in inches). A person 71 inches tall requires a 35.5 inch mirror. Write a linear model that gives m as a function of h. Then find the minimum mirror length required for a person who is 66 inches tall.

27. PATENTS The table shows the number p (in thousands) of patents issued to United States residents where t is the number of years since 1985. Draw a scatter plot of the data and describe the correlation shown. Then approximate the best-fitting line for the data.

▶ Source: *Statistical Abstract of the United States*

t	0	1	2	3	4	5	6	7	8	9	10
p	43.3	42.0	47.7	44.6	54.6	52.8	57.7	58.7	61.1	64.2	64.4