



**I. Course Proficiency Purpose:**

*The purpose of this study guide is to aid the students who wish to take the proficiency assessment for the credit flex option. Items that the student will be required to know for proficiency will be administered in two portions. First part of the assessment is a multiple choice test and the second part is a problem set to be completed without the use of a calculator, or any technology.*

**II. Description of the Assessment Format:**

- A. The multiple choice portion has 75 questions and is worth 75/125 total points.
- B. The written portion of the exam includes 29 questions consisting of a variety of problems and graphs that will count for 50/125 total points.

**III. Proficiency Content:**

The list of topics covered and sample questions can be found in the attached study guide.

**IV. Suggested Resources:**

McDougal Littell Algebra 2 textbook (Chapters 1-8, and 13)  
Attached Study Guide

# Algebra 2

Credit Flex Review

**1.1 Graph the numbers on a number line.**

1.  $-2, \frac{5}{3}, 0.2, -\sqrt{2}, -\frac{5}{4}$

2.  $-\frac{4}{3}, 1, -1.2, \sqrt{3}, 1.9$

3.  $3.7, -\sqrt{7}, -\frac{1}{2}, 4, \sqrt{15}$

**1.1 Perform the indicated conversion.**

4. 18 feet to inches

5. 20 ounces to pounds

6. 3 years to hours

**1.2 Evaluate the expression for the given value of the variable.**

7.  $-2p + 5$  when  $p = -5$

8.  $3x^2 - x + 7$  when  $x = -1$

9.  $8z^3 - 6z$  when  $z = 2$

**1.2 Simplify the expression.**

10.  $2y^2 - 3y + 5y^2$

11.  $4r^2 - 5r + 2r^2 + 12$

12.  $-w^3 + w^2 - 7w^2 - 8w^3$

13.  $2(b + 5) + 3(2b - 10)$

14.  $-7(t^2 + 2) + 9(t - 2)$

15.  $4(m - 3) - 5(m^2 - m)$

**1.3 Solve the equation. Check your solution.**

16.  $3a + 2 = 11$

17.  $-9 = b - 14$

18.  $8 - 0.5c = 1$

19.  $-3n - 7 = -n + 17$

20.  $12m = 15m - 7.5$

21.  $6p + 1 = 21 - 4p$

22.  $6(x + 1) = 2x - 10$

23.  $4(y - 3) = 2(y + 8)$

24.  $11(z - 5) = 2(z + 6) - 13$

**1.4 Solve the equation for  $y$ . Then find the value of  $y$  for the given value of  $x$ .**

25.  $6y - x = 18; x = 2$

26.  $2x + 3y = 12; x = -6$

27.  $4y - 9x = -30; x = 6$

28.  $3x - xy = 20; x = 8$

29.  $4y + 6xy = 10; x = -2$

30.  $5x + 8y + 4xy = 0; x = -1$

**1.6 Solve the inequality. Then graph the solution.**

33.  $x + 2 > 9$

34.  $-13 - 3x < 11$

35.  $4x - 9 \leq 2x + 1$

36.  $-3x - 8 \geq -9x + 10$

37.  $-7 < x + 3 \leq 1$

38.  $-4 \leq 3x - 7 \leq 4$

39.  $-9 \leq 5 - 2x < 7$

40.  $x + 3 < -2$  or  $x - 7 > 0$

41.  $2x + 9 \geq 3$  or  $-5x + 1 \leq 0$

**1.7 Solve the equation. Check for extraneous solutions.**

42.  $|g + 5| = 4$

43.  $\left|\frac{1}{3}q - \frac{2}{3}\right| = 1$

44.  $|10 - 3t| = t + 4$

45.  $|3z + 1| = -6z$

**1.7 Solve the inequality. Then graph the solution.**

46.  $|a| < 2$

47.  $|2c| > 14$

48.  $|g + 11| \geq 2$

49.  $|4j - 7| \leq 9$

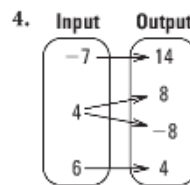
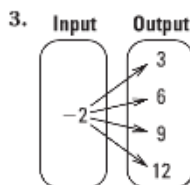
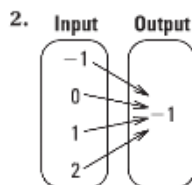
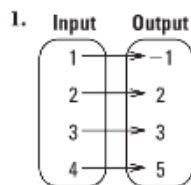
50.  $|0.25m + 3| \geq 1$

51.  $|10 - 2p| > 9$

52.  $|0.6r + 8| \leq 17$

53.  $|5t - 9| + 9 < 10$

**2.1** Tell whether the relation is a function. *Explain.*



**2.2** Find the slope of the line passing through the given points. Then tell whether the line rises, falls, is horizontal, or is vertical.

5.  $(-3, 0), (5, -4)$

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

7.  $(3, 5), (3, -12)$

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

**2.2** Tell whether the lines are parallel, perpendicular, or neither.

9. Line 1: through  $(5, -4)$  and  $(-4, 2)$   
Line 2: through  $(-5, -4)$  and  $(-2, -2)$

10. Line 1: through  $(0, -4)$  and  $(-2, 2)$   
Line 2: through  $(4, -3)$  and  $(5, -6)$

**2.3** Graph the equation using any method.

11.  $y = 2x - 2$

12.  $y = -x + 2$

13.  $f(x) = \frac{2}{3}x - 1$

14.  $x + 2y = -6$

15.  $-4x + 5y = 10$

16.  $y - 2 = 0$

17.  $-2x = 6y + 5$

18.  $2y + 10 = -2.5x$

**2.4** Write an equation of the line that satisfies the given conditions.

19.  $m = 7, b = -3$

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

21.  $m = 0$ , passes through  $(7, -2)$

22.  $m = -\frac{1}{4}$ , passes through  $(3, 6)$

23. passes through  $(-1, -3)$  and  $(2, 7)$

24. passes through  $(4, -2)$  and  $(0, 4)$

**2.5** The variables  $x$  and  $y$  vary directly. Write an equation that relates  $x$  and  $y$ . Then find  $y$  when  $x = -2$ .

25.  $x = 2, y = 4$

26.  $x = -1, y = 3$

27.  $x = -28, y = -7$

28.  $x = 6, y = -4$

**2.6** In Exercises 29 and 30, (a) draw a scatter plot of the data, (b) approximate the best-fitting line, and (c) estimate  $y$  when  $x = 12$ .

29. 

| $x$ | 1 | 2  | 3  | 4  | 5  |
|-----|---|----|----|----|----|
| $y$ | 8 | 11 | 13 | 16 | 18 |

30. 

| $x$ | 1  | 2  | 3  | 4  | 5  |
|-----|----|----|----|----|----|
| $y$ | 50 | 41 | 37 | 22 | 20 |

**2.7** Graph the function. Compare the graph with the graph of  $y = |x|$ .

31.  $y = |x + 3|$

32.  $y = -2|x - 5|$

33.  $y = 3|x + 1| - 2$

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

**2.8** Graph the inequality in a coordinate plane.

35.  $x < 4$

36.  $y \geq -2$

37.  $y \leq -x - 1$

38.  $x + 2y > 8$

39.  $-x - 4y \leq 6$

40.  $3x + 4y > 12$

41.  $y < |x + 1|$

42.  $y \geq 3|x - 2| - 1$

**3.1** Graph the linear system and estimate the solution. Then check the solution algebraically.

1.  $y = 2x - 1$   
 $y = x - 4$

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

3.  $x + 2y = 6$   
 $-5x + 6y = -2$

4.  $-2x + 7y = -7$   
 $4x - 14y = 14$

**3.2** Solve the system using any algebraic method.

5.  $-5x - y = -3$   
 $x - 4y = 9$

6.  $4x - 2y = -6$   
 $-3x + y = -3$

7.  $4x + 3y = -5$   
 $12x + 4y = 10$

8.  $3x + 2y = 4$   
 $-7x - 5y = -7$

**3.3** Graph the system of inequalities.

9.  $x > 4$   
 $y \geq -1$

10.  $x + y < -2$   
 $x - 3y > 6$

11.  $x \leq 5$   
 $y > 3$   
 $y > x$

12.  $x > -3$   
 $x \leq 2$   
 $2x + 3y < 10$   
 $y > -4x$

**3.4** Solve the system using any algebraic method.

13.  $3x + y - z = -6$   
 $-x + 2y + 3z = -1$   
 $5x - 2y + 6z = 54$

14.  $x + y - z = 7$   
 $2x - 3y + z = 2$   
 $4x + 2y - 2z = 20$

15.  $-x + y - 2z = 1.5$   
 $4x - y + 5z = -6$   
 $2x + y - 2z = 6$

16.  $-6x + y + 9z = 4$   
 $2x - 3y - z = -6$   
 $8x + 5y - 4z = 10$

**3.5** Perform the indicated operation.

17.  $\begin{bmatrix} -6 & 7 \\ 0 & 3 \end{bmatrix} + \begin{bmatrix} -6 & 2 \\ -8 & 1 \end{bmatrix}$

18.  $-\frac{2}{3} \begin{bmatrix} -9 & 3 \\ 4 & -1 \end{bmatrix}$

19.  $\begin{bmatrix} 10 & 17 & -9 \\ -6 & 4 & 11 \end{bmatrix} - \begin{bmatrix} -6 & 8 & -2 \\ -4 & -9 & 4 \end{bmatrix}$

**3.6** Find the product. If the product is not defined, state the reason.

20.  $\begin{bmatrix} 4 & 1 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} -7 & 5 \\ 7 & -3 \end{bmatrix}$

21.  $\begin{bmatrix} -16 \\ 2 \end{bmatrix} \begin{bmatrix} 4 \\ 15 \end{bmatrix}$

22.  $\begin{bmatrix} 5 & -1 & 0 \\ 4 & -2 & 9 \end{bmatrix} \begin{bmatrix} 12 \\ -7 \\ 3 \end{bmatrix}$

**3.7** Evaluate the determinant of the matrix.

23.  $\begin{bmatrix} 5 & 8 \\ -2 & 10 \end{bmatrix}$

24.  $\begin{bmatrix} 13 & 7 \\ -11 & -4 \end{bmatrix}$

25.  $\begin{bmatrix} 1 & -3 & -2 \\ 7 & 4 & 0 \\ -7 & 2 & 3 \end{bmatrix}$

26.  $\begin{bmatrix} 6 & 0 & 5 \\ -4 & 2 & 1 \\ 1 & 0 & 0.5 \end{bmatrix}$

**3.7** Use Cramer's rule to solve the linear system.

27.  $2x + y = -8$   
 $-5x - 2y = 13$

28.  $8x + 3y = 1$   
 $7x + 3y = -1$

29.  $2x - 2y - 3z = 9$   
 $3x + z = 10$   
 $x + y = 0$

30.  $2x + y + 3z = 4$   
 $-8x + 4y + z = -7$   
 $x + 2y + 3z = -1$

**3.8** Find the inverse of the matrix.

31.  $\begin{bmatrix} 3 & 7 \\ 3 & 8 \end{bmatrix}$

32.  $\begin{bmatrix} 1 & 4 \\ 0 & 5 \end{bmatrix}$

33.  $\begin{bmatrix} -2 & -5 \\ 3 & 8 \end{bmatrix}$

34.  $\begin{bmatrix} 9 & 2 \\ 18 & 5 \end{bmatrix}$

**3.8** Use an inverse matrix to solve the linear system.

35.  $x + 3y = -4$   
 $-2x + y = -34$

36.  $2x + 3y = 6$   
 $-x - 6y = -9$

37.  $3x - 8y = 0$   
 $2x + y = -19$

38.  $x + y = 7$   
 $-5x + 3y = -3$

**4.1 Graph the function. Label the vertex and axis of symmetry.**

1.  $y = 3x^2 + 5$       2.  $y = -x^2 - 4x - 4$       3.  $y = -2x^2 + 4x + 1$       4.  $y = 2x^2 + 5x + 6$

**4.2 Graph the function. Label the vertex and axis of symmetry.**

5.  $y = 4(x - 2)^2 + 1$       6.  $y = -(x + 3)^2 - 2$       7.  $y = 3(x - 1)(x - 5)$       8.  $y = \frac{1}{2}(x + 3)(x + 2)$

**4.2 Write the quadratic function in standard form.**

9.  $y = 7(x + 2)(x + 4)$       10.  $y = 2(x + 5)(x - 3)$       11.  $y = (x - 7)^2 + 7$       12.  $y = -(x + 1)^2 - 4$

**4.3 Factor the expression. If the expression cannot be factored, say so.**

13.  $x^2 - 4x + 4$       14.  $t^2 - 11t - 26$       15.  $x^2 + 21x + 108$       16.  $b^2 - 400$

**4.3 Solve the equation.**

17.  $x^2 + 5x - 14 = 0$       18.  $x^2 - 11x + 24 = 0$       19.  $c^2 + 6c = 55$       20.  $n^2 = 5n$

**4.4 Factor the expression. If the expression cannot be factored, say so.**

21.  $2x^2 + x - 15$       22.  $10a^2 - 19a + 7$       23.  $3r^2 + 9r - 4$       24.  $4t^2 + 8t + 3$

**4.4 Find the zeros of the function by rewriting the function in intercept form.**

25.  $y = 81x^2 - 16$       26.  $y = 2x^2 - 9x - 5$       27.  $y = 4x^2 + 18x + 18$       28.  $y = -3x^2 - 30x - 27$

**4.5 Simplify the expression.**

29.  $\sqrt{56}$       30.  $3\sqrt{2} \cdot \sqrt{50}$       31.  $\sqrt{\frac{4}{7}}$       32.  $\frac{6}{1 + \sqrt{2}}$

**4.5 Solve the equation.**

33.  $b^2 = 8$       34.  $p^2 + 6 = 127$       35.  $(x - 5)^2 = 10$       36.  $3(x + 2)^2 - 4 = 11$

**4.6 Write the expression as a complex number in standard form.**

37.  $(5 + 2i) + (6 - 5i)$       38.  $-3i(7 + i)$       39.  $\frac{1 + 2i}{3 - 8i}$       40.  $\frac{(3 - 2i) + 2i}{(-1 + 7i) - (2 + 3i)}$

**4.7 Solve the equation by completing the square.**

41.  $x^2 + 6x = 10$       42.  $x^2 - 9x - 2 = 0$       43.  $2c^2 - 12c + 6 = 0$       44.  $3z^2 - 3z + 9 = 0$

**4.8 Use the quadratic formula to solve the equation.**

45.  $x^2 + 10x - 10 = 0$       46.  $x^2 - x - 1 = 0$       47.  $4s^2 + 3s = 12$       48.  $-2r^2 = r + 17$

**4.9 Solve the inequality using any method.**

49.  $x^2 - 10x \geq 0$       50.  $x^2 - 8x + 12 < 0$       51.  $-x^2 + 7x + 6 > 1$       52.  $3x^2 + 16x + 2 \leq 3x$

**4.10 Write a quadratic function in standard form for the parabola that passes through the given points.**

53.  $(-1, -6), (0, -7), (2, 9)$       54.  $(-2, -1), (1, 2), (3, -6)$       55.  $(-3, 36), (0, 36), (2, 16)$

**5.1 Write the answer in scientific notation.**

1.  $(3.4 \times 10^3)(2.8 \times 10^8)$

2.  $(5.8 \times 10^{-6})^4$

3.  $\frac{4.6 \times 10^{-7}}{9.2 \times 10^{-9}}$

**5.1 Simplify the expression. Tell which properties of exponents you used.**

4.  $\frac{-14x^{-3}y^5}{35xy^3}$

5.  $(4a^5b^{-2})^{-3}$

6.  $(2r^3s^3)(r^{-7}s^5)$

7.  $\frac{xy^{-1}}{x^2y} \cdot \frac{7x^3}{y^{-4}}$

**5.2 Graph the polynomial function.**

8.  $f(x) = x^4$

9.  $f(x) = x^3 + x + 4$

10.  $f(x) = -x^3 + 3x$

11.  $f(x) = x^5 + 2x^3$

**5.3 Perform the indicated operation.**

12.  $(4z^3 + 9) + (3z^2 - 4z - 2)$

13.  $(x^2 + 3x - 1) - (4x^2 + 7)$

14.  $(3x - 4)^3$

**5.4 Factor the polynomial completely using any method.**

15.  $3x^4 + 18x^3 + 27x^2$

16.  $343x^3 + 1000$

17.  $2x^3 + x^2 - 8x - 4$

**5.4 Find the real-number solutions of the equation.**

18.  $3x^3 + 18x^2 = 48x$

19.  $x^4 + 32 = 14x^2$

20.  $2x^3 + 48 = 3x^2 + 32x$

**5.5 Divide using polynomial long division or synthetic division.**

21.  $(2x^3 + 4x^2 - 5x + 16) \div (x - 3)$

22.  $(x^4 + 2x^3 - 7x^2 - 14) \div (x + 2)$

**5.6 Find all real zeros of the function.**

23.  $f(x) = 2x^3 + 3x^2 - 8x + 3$

24.  $f(x) = 2x^4 + x^3 - 53x^2 - 14x + 20$

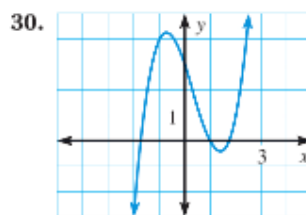
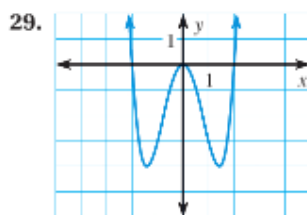
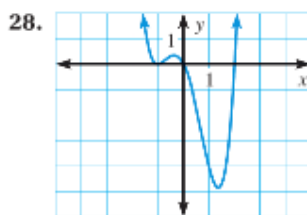
**5.7 Determine the possible numbers of positive real zeros, negative real zeros, and imaginary zeros of the function.**

25.  $f(x) = -x^3 + 2x^2 - 11x - 1$

26.  $f(x) = 4x^5 + 3x^2 - 8x - 10$

27.  $f(x) = x^4 - 3x^3 - 7x - 13$

**5.8 Estimate the coordinates of each turning point and state whether each corresponds to a local maximum or a local minimum. Then estimate all real zeros and determine the least degree the function can have.**



**6.1** Find the indicated real  $n$ th root(s) of  $a$ .

1.  $n = 4, a = 81$

2.  $n = 3, a = 512$

3.  $n = 5, a = -243$

**6.1** Evaluate the expression without using a calculator.

4.  $36^{-1/2}$

5.  $64^{5/6}$

6.  $(\sqrt[3]{216})^{-2}$

7.  $(\sqrt[5]{-32})^4$

**6.1** Solve the equation. Round the result to two decimal places when appropriate.

8.  $x^3 = -8$

9.  $x^4 + 9 = 90$

10.  $(x - 3)^5 = 60$

11.  $-4x^6 = -400$

**6.2** Simplify the expression.

12.  $4^{5/2} \cdot 4^{-1/2}$

13.  $\frac{17^{3/7}}{17^{4/7}}$

14.  $(\sqrt[4]{5} \cdot \sqrt{5})^4$

15.  $\frac{\sqrt[3]{135}}{\sqrt[3]{5}}$

16.  $5\sqrt[5]{7} - 7\sqrt[5]{7}$

17.  $\sqrt[3]{2} + 2\sqrt[3]{128}$

18.  $\frac{324^{1/4}}{4^{-1/4}}$

19.  $4\sqrt[3]{108} \cdot 2\sqrt[3]{4}$

**6.2** Write the expression in simplest form. Assume all variables are positive.

20.  $\sqrt{20x^6y^7}$

21.  $\sqrt[5]{18x^3y^{14}z^{20}}$

22.  $\sqrt[4]{\frac{x^5}{y^{16}}}$

23.  $\sqrt[3]{16x^7y^2} \cdot \sqrt[3]{6xy^5}$

**6.3** Let  $f(x) = -x + 4$ ,  $g(x) = x^3$ , and  $h(x) = \frac{x}{4}$ . Perform the indicated operation and state the domain.

24.  $f(x) + g(x)$

25.  $g(x) - f(x)$

26.  $g(x) \cdot h(x)$

27.  $\frac{f(x)}{g(x)}$

28.  $f(g(x))$

29.  $g(h(x))$

30.  $h(f(x))$

31.  $f(f(x))$

**6.4** Verify that  $f$  and  $g$  are inverse functions.

32.  $f(x) = 2x - 4, g(x) = \frac{1}{2}x + 2$

33.  $f(x) = 3x^2 + 1, x \geq 0; g(x) = \left(\frac{x-1}{3}\right)^{1/2}$

**6.4** Find the inverse of the function.

34.  $f(x) = 5x - 3$

35.  $f(x) = \frac{4}{3}x + 2$

36.  $f(x) = \frac{1}{2}x^2, x \geq 0$

37.  $f(x) = -x^6 + 2, x \leq 0$

38.  $f(x) = \frac{4x^4 - 1}{18}, x \geq 0$

39.  $f(x) = 32x^5 + 4$

**6.5** Graph the function. Then state the domain and range.

40.  $y = -\frac{1}{3}\sqrt{x}$

41.  $y = \frac{2}{5}\sqrt[3]{x}$

42.  $y = \frac{5}{6}\sqrt{x}$

43.  $y = \sqrt{x+2} - 3$

44.  $y = -2\sqrt[3]{x-1} + 2$

45.  $f(x) = 3\sqrt[3]{x}$

46.  $g(x) = -\frac{1}{2}\sqrt{x-2}$

47.  $h(x) = -\sqrt{x+3} + 4$

**6.6** Solve the equation. Check your solution.

48.  $\sqrt{2x+3} = 7$

49.  $-5\sqrt{x+1} + 12 = 2$

50.  $\sqrt[3]{5x-1} + 6 = 10$

51.  $2\sqrt[3]{8x} + 9 = 5$

52.  $7x^{4/3} = 175$

53.  $(x-2)^{3/4} = 1$

54.  $x - 8 = \sqrt{18x}$

55.  $x = \sqrt{4x-3}$

56.  $\sqrt{2x+1} + 5 = \sqrt{x+12} - 8$

**7.1** Graph the function. State the domain and range.

1.  $y = \left(\frac{4}{3}\right)^x$

2.  $y = -2 \cdot 2^x$

3.  $y = 3^{x-3} - 2$

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

**7.2** Graph the function. State the domain and range.

5.  $y = \left(\frac{3}{5}\right)^x$

6.  $y = -2\left(\frac{1}{4}\right)^x$

7.  $y = (0.8)^{x-3} - 2$

8.  $y = 2\left(\frac{2}{3}\right)^x + 1$

**7.3** Simplify the expression.

9.  $e^{-3} \cdot e^{-8}$

10.  $(2e^{2x})^{-5}$

11.  $\sqrt{81e^{8x}}$

12.  $\frac{28e^{3x}}{21e^{-x}}$

**7.3** Graph the function. State the domain and range.

13.  $y = 0.5e^{3x}$

14.  $y = 2e^{-x} - 2$

15.  $y = 1.5e^{x+1} + 3$

16.  $y = e^{3(x-2)} + 1$

**7.4** Evaluate the logarithm without using a calculator.

17.  $\log_4 \frac{1}{16}$

18.  $\log_6 6$

19.  $\log_5 125$

20.  $\log_{3/4} \frac{64}{27}$

**7.4** Simplify the expression.

21.  $5^{\log_5 x}$

22.  $10^{\log 9}$

23.  $\log_4 16^x$

24.  $e^{\ln 5}$

**7.4** Graph the function. State the domain and range.

25.  $y = \log_7 x$

26.  $y = \log_{1/2} (x - 4)$

27.  $y = \log_5 x + 3$

28.  $y = \log_3 (x - 2) + 1$

**7.5** Expand the expression.

29.  $\log_5 \frac{2x}{5}$

30.  $\log \frac{100x^2}{y}$

31.  $\ln 20x^3y^2$

32.  $\log_2 \sqrt[3]{8x^4}$

**7.5** Condense the expression.

33.  $\log_4 20 + 4 \log_4 x$

34.  $\log 7 + 2 \log x - 5 \log y$

35.  $0.5 \ln 100 - 2 \ln x + 8 \ln y$

**7.5** Use the change-of-base formula to evaluate the logarithm.

36.  $\log_2 5$

37.  $\log_4 80$

38.  $\log_5 100$

39.  $\log_7 27$

**7.6** Solve the equation. Check for extraneous solutions.

40.  $2^{4x+2} = 8^{x+2}$

41.  $\left(\frac{1}{9}\right)^{x-3} = 3^{3x+1}$

42.  $7^{9x} = 18$

43.  $\ln(3x+7) = \ln(x-1)$

44.  $\log_5(3x+2) = 3$

45.  $\log_6(x+9) + \log_6 x = 2$

**7.7** Write an exponential function  $y = ab^x$  whose graph passes through the given points.

46. (1, 8), (2, 32)

47. (1, 3), (3, 12)

48. (2, -9), (5, -243)

49. (1, 4), (2, 4)

**7.7** Write a power function  $y = ax^b$  whose graph passes through the given points.

50. (2, 2), (5, 16)

51. (3, 27), (6, 432)

52. (1, 4), (8, 17)

53. (5, 36), (10, 220)

**8.1** The variables  $x$  and  $y$  vary inversely. Use the given values to write an equation relating  $x$  and  $y$ . Then find  $y$  when  $x = -5$ .

1.  $x = 2, y = -10$

2.  $x = \frac{1}{3}, y = 24$

3.  $x = -3, y = -5$

4.  $x = 25, y = -\frac{2}{5}$

**8.1** Determine whether  $x$  and  $y$  show *direct variation*, *inverse variation*, or *neither*.

5.

| $x$ | $y$  |
|-----|------|
| 2.5 | 32   |
| 4   | 20   |
| 5   | 16   |
| 6.4 | 12.5 |
| 8   | 10   |

6.

| $x$ | $y$  |
|-----|------|
| 1   | 2.5  |
| 3.5 | 8.75 |
| 5   | 12.5 |
| 8   | 20   |
| 9   | 22.5 |

7.

| $x$ | $y$ |
|-----|-----|
| 11  | 30  |
| 14  | 61  |
| 16  | 85  |
| 24  | 92  |
| 27  | 105 |

8.

| $x$ | $y$ |
|-----|-----|
| 1   | 12  |
| 3   | 4   |
| 8   | 1.5 |
| 12  | 1   |
| 15  | 0.8 |

**8.2** Graph the function. State the domain and range.

9.  $y = \frac{6}{x}$

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

11.  $y = \frac{5}{x-1} - 2$

12.  $y = \frac{4x+19}{x+3}$

**8.3** Graph the function.

13.  $y = \frac{x}{x^2-4}$

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

15.  $y = \frac{x^2+2x-3}{x+2}$

16.  $f(x) = \frac{2x^2-8}{x^2-2x}$

**8.4** Simplify the rational expression, if possible.

17.  $\frac{x^2+x-6}{x^2+9x+18}$

18.  $\frac{x^3-100x}{x^4+20x^3+100x^2}$

19.  $\frac{x^2-5x-84}{2x^2-98}$

20.  $\frac{x^2+7x+10}{x^2-7x+10}$

**8.4** Multiply or divide the expressions. Simplify the result.

21.  $\frac{6x^2y}{xy^2} \cdot \frac{2y}{9x^3}$

22.  $\frac{2x^2-x-6}{2x^2+5x+3} \cdot \frac{x^2+x}{x^2-4}$

23.  $\frac{3x^2+15x}{x^2-12x+36} \cdot (x^2-x-30)$

24.  $\frac{12x^8y}{5y^5} \div \frac{3y^2}{x^2}$

25.  $\frac{6x^2+x-1}{4x^3+4x^2} \div \frac{6x^2-2x}{x^2-4x-5}$

26.  $\frac{x^2-4x-32}{2x^2-13x-24} \div \frac{x}{4x^2-9}$

**8.5** Add or subtract the expressions. Simplify the result.

27.  $\frac{x^2}{x+1} - \frac{1}{x+1}$

28.  $\frac{x+5}{x+6} + \frac{1}{x-2}$

29.  $\frac{5}{x+2} + \frac{35}{x^2-3x-10}$

**8.5** Simplify the complex fraction.

30.  $\frac{\frac{x}{2x+1}}{5+\frac{3}{x}}$

31.  $\frac{\frac{x}{3}+2}{\frac{1}{x}+3}$

32.  $\frac{\frac{3}{x^2-4}}{\frac{2}{x+2} - \frac{x+1}{x^2-x-6}}$

**8.6** Solve the equation. Check for extraneous solutions.

33.  $\frac{7}{3x-7} = \frac{14}{x+1}$

34.  $\frac{1}{3} + \frac{2}{x} = -\frac{3}{x^2}$

35.  $2 - \frac{4}{x+2} = \frac{2}{x}$

36.  $\frac{4}{x-2} + \frac{6x^2}{x^2-4} = \frac{3x}{x+2}$

**13.1** Let  $\theta$  be an acute angle of a right triangle. Find the values of the other five trigonometric functions of  $\theta$ .

1.  $\sin \theta = \frac{3}{5}$

2.  $\tan \theta = \frac{8}{15}$

3.  $\sec \theta = 2$

4.  $\cos \theta = \frac{\sqrt{7}}{4}$

**13.1** Solve  $\triangle ABC$  using the diagram and the given measurements.

5.  $A = 21^\circ, c = 8$

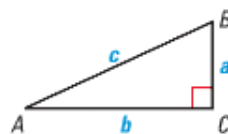
6.  $B = 66^\circ, a = 14$

7.  $B = 60^\circ, c = 20$

8.  $A = 29^\circ, b = 6$

9.  $A = 18^\circ, c = 18$

10.  $B = 56^\circ, c = 7$



**13.2** Convert the degree measure to radians or the radian measure to degrees.

11.  $100^\circ$

12.  $-6^\circ$

13.  $\frac{3\pi}{4}$

14.  $-\frac{\pi}{6}$

**13.2** Find the arc length and area of a sector with the given radius  $r$  and central angle  $\theta$ .

15.  $r = 5$  ft,  $\theta = 90^\circ$

16.  $r = 2$  in.,  $\theta = 300^\circ$

17.  $r = 12$  cm,  $\theta = \pi$

**13.3** Sketch the angle. Then find its reference angle.

18.  $250^\circ$

19.  $-30^\circ$

20.  $\frac{8\pi}{3}$

21.  $-\frac{11\pi}{6}$

**13.3** Evaluate the function without using a calculator.

22.  $\sin(-60^\circ)$

23.  $\csc 240^\circ$

24.  $\tan \frac{7\pi}{4}$

25.  $\cos\left(-\frac{5\pi}{4}\right)$

**13.4** Evaluate the expression without using a calculator. Give your answer in both radians and degrees.

26.  $\sin^{-1} 0$

27.  $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

28.  $\cos^{-1} 3$

29.  $\tan^{-1} 1$

**13.4** Solve the equation for  $\theta$ .

30.  $\sin \theta = 0.25; 90^\circ < \theta < 180^\circ$

31.  $\cos \theta = 0.9; 270^\circ < \theta < 360^\circ$

32.  $\tan \theta = 2; 180^\circ < \theta < 270^\circ$

**13.5** Solve  $\triangle ABC$ . (Hint: Some of the “triangles” may have no solution and some may have two solutions.)

33.  $A = 34^\circ, a = 6, b = 7$

34.  $A = 50^\circ, C = 65^\circ, b = 60$

35.  $B = 86^\circ, b = 13, c = 11$

**13.5** Find the area of  $\triangle ABC$  with the given side lengths and included angle.

36.  $A = 35^\circ, b = 50, c = 120$

37.  $B = 35^\circ, a = 7, c = 12$

38.  $C = 20^\circ, a = 10, b = 16$

**13.6** Solve  $\triangle ABC$ .

39.  $a = 16, b = 23, c = 17$

40.  $C = 50^\circ, a = 12, b = 14$

41.  $A = 80^\circ, b = 7, c = 5$

**13.6** Find the area of  $\triangle ABC$  with the given side lengths.

42.  $a = 6, b = 3, c = 4$

43.  $a = 14, b = 30, c = 27$

44.  $a = 16, b = 16, c = 20$

# Extra Practice

## EXTRA PRACTICE

### Chapter 1

**1.1** Graph the numbers on a number line. **1–3. See margin.**

1.  $-2, \frac{5}{3}, 0.2, -\sqrt{2}, -\frac{5}{4}$       2.  $-\frac{4}{3}, 1, -1.2, \sqrt{3}, 1.9$       3.  $3.7, -\sqrt{7}, -\frac{1}{2}, 4, \sqrt{15}$

**1.1** Perform the indicated conversion.

4. 18 feet to inches **216 in.**      5. 20 ounces to pounds **1.25 lb**      6. 3 years to hours **26,280 h**

**1.2** Evaluate the expression for the given value of the variable.

7.  $-2p + 5$  when  $p = -5$  **15**      8.  $3x^2 - x + 7$  when  $x = -1$  **11**      9.  $8z^3 - 6z$  when  $z = 2$  **52**

**1.2** Simplify the expression.

10.  $2y^2 - 3y + 5y^2$   **$7y^2 - 3y$**       11.  $4r^2 - 5r + 2r^2 + 12$   **$6r^2 - 5r + 12$**       12.  $-w^3 + w^2 - 7w^2 - 8w^3$   **$-9w^3 - 6w^2$**   
 13.  $2(b + 5) + 3(2b - 10)$   **$8b - 20$**       14.  $-7(t^2 + 2) + 9(t - 2)$   **$-7t^2 + 9t - 32$**       15.  $4(m - 3) - 5(m^2 - m)$   **$-5m^2 + 9m - 12$**

**1.3** Solve the equation. Check your solution.

16.  $3a + 2 = 11$  **3**      17.  $-9 = b - 14$  **5**      18.  $8 - 0.5c = 1$  **14**  
 19.  $-3n - 7 = -n + 17$  **-12**      20.  $12m = 15m - 7.5$  **2.5**      21.  $6p + 1 = 21 - 4p$  **2**  
 22.  $6(x + 1) = 2x - 10$  **-4**      23.  $4(y - 3) = 2(y + 8)$  **14**      24.  $11(z - 5) = 2(z + 6) - 13$  **6**

**1.4** Solve the equation for  $y$ . Then find the value of  $y$  for the given value of  $x$ . **25–30. See margin.**

25.  $6y - x = 18; x = 2$       26.  $2x + 3y = 12; x = -6$       27.  $4y - 9x = -30; x = 6$   
 28.  $3x - xy = 20; x = 8$       29.  $4y + 6xy = 10; x = -2$       30.  $5x + 8y + 4xy = 0; x = -1$

**1.5** Look for a pattern in the table. Then write an equation that represents the table.

31.

|     |    |    |    |    |
|-----|----|----|----|----|
| $x$ | 0  | 1  | 2  | 3  |
| $y$ | 25 | 22 | 19 | 16 |

**$y = -3x + 25$**

32.

|     |     |   |     |   |
|-----|-----|---|-----|---|
| $x$ | 0   | 1 | 2   | 3 |
| $y$ | 1.5 | 4 | 6.5 | 9 |

**$y = 2.5x + 1.5$**

**1.6** Solve the inequality. Then graph the solution. **33–41. See margin for art.**

33.  $x + 2 > 9$   **$x > 7$**       34.  $-13 - 3x < 11$   **$x > -8$**       35.  $4x - 9 \leq 2x + 1$   **$x \leq 5$**   
 36.  $-3x - 8 \geq -9x + 10$   **$x \geq 3$**       37.  $-7 < x + 3 \leq 1$   **$-10 < x \leq -2$**       38.  $-4 \leq 3x - 7 \leq 4$   **$1 \leq x \leq \frac{11}{3}$**   
 39.  $-9 \leq 5 - 2x < 7$   **$-1 < x \leq 7$**       40.  $x + 3 < -2$  or  $x - 7 > 0$   **$x < -5$  or  $x > 7$**       41.  $2x + 9 \geq 3$  or  $-5x + 1 \leq 0$   **$x \geq -3$**

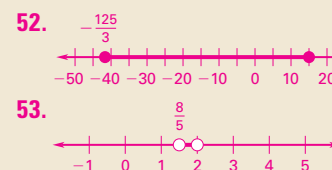
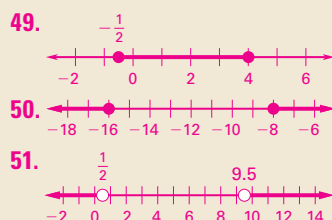
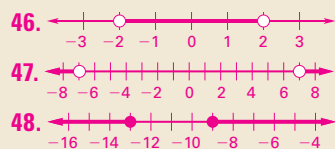
**1.7** Solve the equation. Check for extraneous solutions.

42.  $|g + 5| = 4$  **-9, -1**      43.  $|\frac{1}{3}q - \frac{2}{3}| = 1$  **-1, 5**      44.  $|10 - 3t| = t + 4$  **1.5, 7**      45.  $|3z + 1| = -6z$   **$-\frac{1}{9}$**

**1.7** Solve the inequality. Then graph the solution. **46–53. See margin for art.**

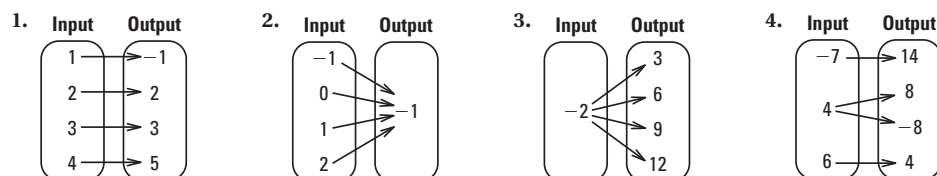
46.  $|a| < 2$   **$-2 < a < 2$**       47.  $|2c| > 14$   **$c < -7$  or  $c > 7$**       48.  $|g + 11| \geq 2$   **$g \leq -13$  or  $g \geq -9$**       49.  $|4j - 7| \leq 9$   **$-\frac{1}{2} \leq j \leq 4$**   
 50.  $|0.25m + 3| \geq 1$   **$m \leq -16$  or  $m \geq -8$**       51.  $|10 - 2p| > 9$   **$p < \frac{1}{2}$  or  $p > 9.5$**       52.  $|0.6r + 8| \leq 17$   **$-\frac{125}{3} \leq r \leq 15$**       53.  $|5t - 9| + 9 < 10$   **$\frac{8}{5} < t < 2$**

**1010** Student Resources



# Chapter 2

**2.1** Tell whether the relation is a function. *Explain.* 1–4. See margin.



**2.2** Find the slope of the line passing through the given points. Then tell whether the line rises, falls, is horizontal, or is vertical.

5.  $(-3, 0), (5, -4)$   $-\frac{1}{2}$ ; falls  
6.  $(2, -1), (8, -1)$  0; is horizontal  
7.  $(3, 5), (3, -12)$  undefined; is vertical  
8.  $(1, 8), (-1, -4)$  6; rises

**2.2** Tell whether the lines are parallel, perpendicular, or neither.

9. Line 1: through  $(5, -4)$  and  $(-4, 2)$   
Line 2: through  $(-5, -4)$  and  $(-2, -2)$  neither  
10. Line 1: through  $(0, -4)$  and  $(-2, 2)$   
Line 2: through  $(4, -3)$  and  $(5, -6)$  parallel

**2.3** Graph the equation using any method. 11–18. See margin.

11.  $y = 2x - 2$  12.  $y = -x + 2$  13.  $f(x) = \frac{2}{3}x - 1$  14.  $x + 2y = -6$   
15.  $-4x + 5y = 10$  16.  $y - 2 = 0$  17.  $-2x = 6y + 5$  18.  $2y + 10 = -2.5x$

**2.4** Write an equation of the line that satisfies the given conditions.

19.  $m = 7, b = -3$   $y = 7x - 3$  20.  $m = \frac{1}{3}, b = 4$   $y = \frac{1}{3}x + 4$   
21.  $m = 0$ , passes through  $(7, -2)$   $y = -2$  22.  $m = -\frac{1}{4}$ , passes through  $(3, 6)$   $y = -\frac{1}{4}x + 6\frac{3}{4}$   
23. passes through  $(-1, -3)$  and  $(2, 7)$   $y = \frac{10}{3}x + \frac{1}{3}$  24. passes through  $(4, -2)$  and  $(0, 4)$   $y = -\frac{3}{2}x + 4$

**2.5** The variables  $x$  and  $y$  vary directly. Write an equation that relates  $x$  and  $y$ . Then find  $y$  when  $x = -2$ .

25.  $x = 2, y = 4$   $y = 2x$  26.  $x = -1, y = 3$   $y = -3x$  27.  $x = -28, y = -7$   $y = \frac{1}{4}x$  28.  $x = 6, y = -4$   $y = -\frac{2}{3}x$

**2.6** In Exercises 29 and 30, (a) draw a scatter plot of the data, (b) approximate the best-fitting line, and (c) estimate  $y$  when  $x = 12$ . 29, 30. See margin for art.

29.

| x | 1 | 2  | 3  | 4  | 5  |
|---|---|----|----|----|----|
| y | 8 | 11 | 13 | 16 | 18 |

c. about 36

30.

| x | 1  | 2  | 3  | 4  | 5  |
|---|----|----|----|----|----|
| y | 50 | 41 | 37 | 22 | 20 |

c. about -37

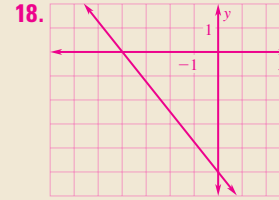
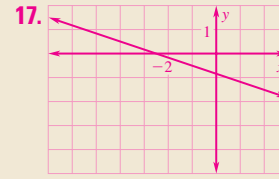
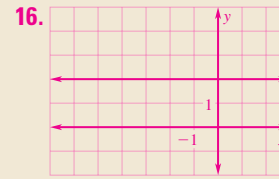
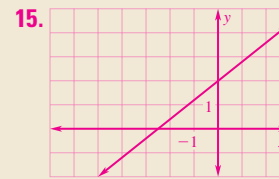
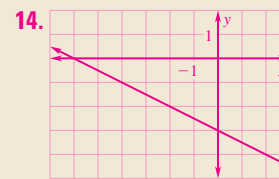
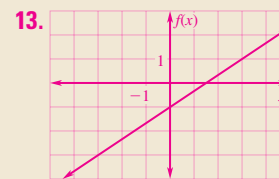
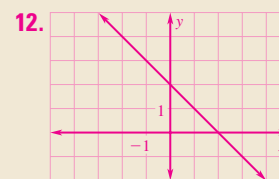
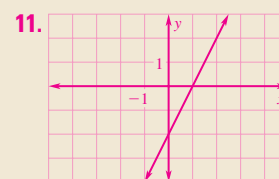
**2.7** Graph the function. Compare the graph with the graph of  $y = |x|$ . 31–34. See margin.

31.  $y = |x + 3|$  32.  $y = -2|x - 5|$  33.  $y = 3|x + 1| - 2$  34.  $y = -\frac{1}{2}|x + 2| + 3$

**2.8** Graph the inequality in a coordinate plane. 35–42. See margin.

35.  $x < 4$  36.  $y \geq -2$  37.  $y \leq -x - 1$  38.  $x + 2y > 8$   
39.  $-x - 4y \leq 6$  40.  $3x + 4y > 12$  41.  $y < |x + 1|$  42.  $y \geq 3|x - 2| - 1$

EXTRA PRACTICE



29a–b, 30a–b, 31–42. See Additional Answers beginning on p. AA1.

1. Function; for each input there is exactly one output.  
2. Function; for each input there is exactly one output.  
3. Not a function; there is more than one output for the input -2.  
4. Not a function; there is more than one output for the input 4.

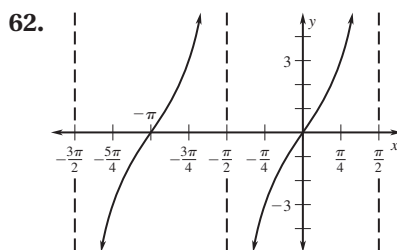
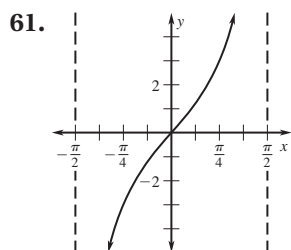
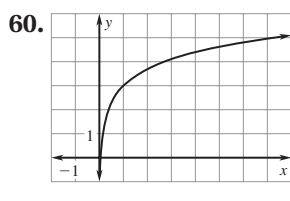
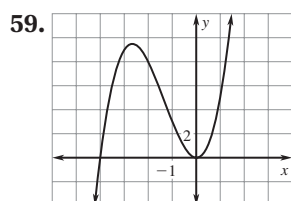
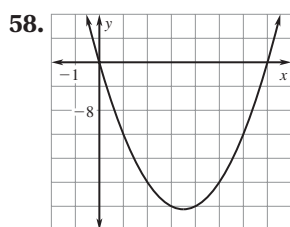
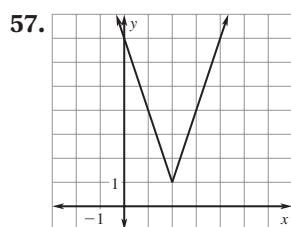
# 14.7 Problem Solving (pp. 961–962)

$$54. \text{ a. } y = r \ln \left[ \tan \left( \frac{\pi}{2} + L \right) \right] = r \ln \left[ \frac{1 - \cos \left( \frac{\pi}{2} + L \right)}{\sin \left( \frac{\pi}{2} + L \right)} \right]$$

$$= r \ln \left[ \frac{1 - \left( \cos \frac{\pi}{2} \cos L - \sin \frac{\pi}{2} \sin L \right)}{\sin \frac{\pi}{2} \cos L + \cos \frac{\pi}{2} \sin L} \right]$$

$$= r \ln \left[ \frac{1 + \sin L}{\cos L} \right]$$

# 14.7 Mixed Review (p. 962)

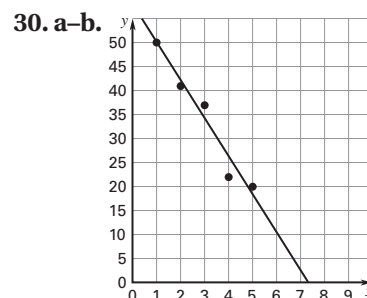
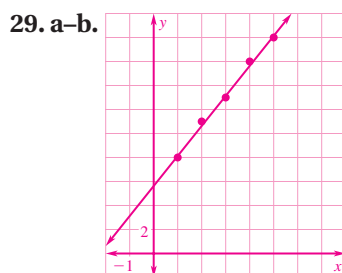


# Quiz for Lessons 14.6–14.7 (p. 962)

7.  $\sqrt{\frac{34 - 5\sqrt{34}}{68}}, \sqrt{\frac{34 + 5\sqrt{34}}{68}}, \frac{\sqrt{34} - 5}{3}$

# Extra Practice

## Chapter 2 (p. 1011)

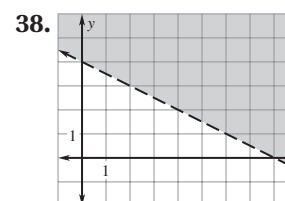
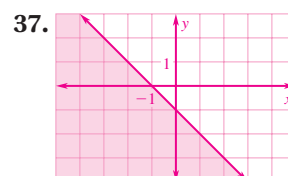
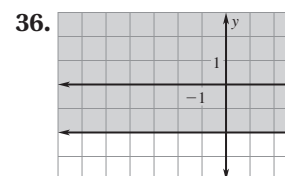
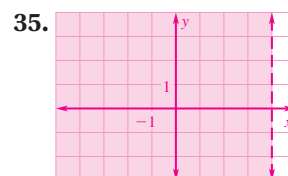


31. shifted left 3 units

32. reflected in the  $x$ -axis, shifted right 5 units, and stretched vertically by a factor of 2

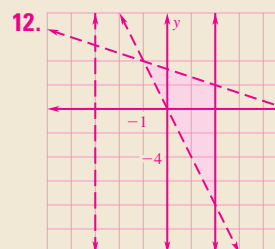
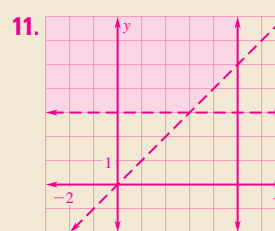
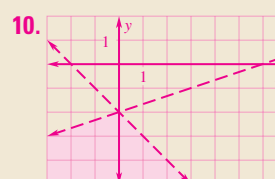
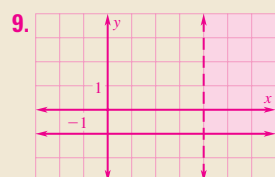
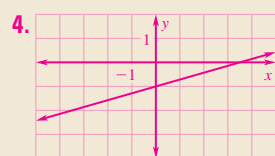
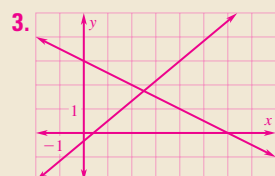
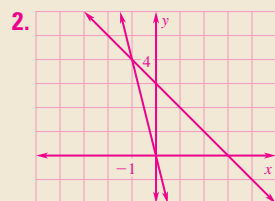
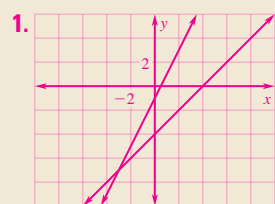
33. shifted down 2 units, left 1 unit, and stretched vertically by a factor of 3

34. reflected in the  $x$ -axis, shifted up 3 units, left 2 units, and shrunk vertically by a factor of  $\frac{1}{2}$



# Chapter 3

## EXTRA PRACTICE



**3.1** Graph the linear system and estimate the solution. Then check the solution algebraically. **1–4. See margin for art.**

1.  $y = 2x - 1$   
 $y = x - 4$  **(-3, -7)**

2.  $y = -x + 3$   
 $y = -4x$  **(-1, 4)**

3.  $x + 2y = 6$   
 $-5x + 6y = -2$   
**(2.5, 1.75)**

4.  $-2x + 7y = -7$   
 $4x - 14y = 14$   
**infinitely many solutions**

**3.2** Solve the system using any algebraic method.

5.  $-5x - y = -3$   
 $x - 4y = 9$  **(1, -2)**

6.  $4x - 2y = -6$   
 $-3x + y = -3$  **(6, 15)**

7.  $4x + 3y = -5$   
 $12x + 4y = 10$  **(5/2, -5)**

8.  $3x + 2y = 4$   
 $-7x - 5y = -7$  **(6, -7)**

**3.3** Graph the system of inequalities. **9–12. See margin.**

9.  $x > 4$   
 $y \geq -1$

10.  $x + y < -2$   
 $x - 3y > 6$

11.  $x \leq 5$   
 $y > 3$   
 $y > x$

12.  $x > -3$   
 $x \leq 2$   
 $2x + 3y < 10$   
 $y > -4x$

**3.4** Solve the system using any algebraic method.

13.  $3x + y - z = -6$   
 $-x + 2y + 3z = -1$   
 $5x - 2y + 6z = 54$   
**(2, -7, 5)**

14.  $x + y - z = 7$   
 $2x - 3y + z = 2$   
 $4x + 2y - 2z = 20$   
**(3, 0, -4)**

15.  $-x + y - 2z = 1.5$   
 $4x - y + 5z = -6$   
 $2x + y - 2z = 6$   
**(3/2, -3, -3)**

16.  $-6x + y + 9z = 4$   
 $2x - 3y - z = -6$   
 $8x + 5y - 4z = 10$   
**(1/6, 2/3, 1/3)**

**3.5** Perform the indicated operation. **17–19. See margin.**

17.  $\begin{bmatrix} -6 & 7 \\ 0 & 3 \end{bmatrix} + \begin{bmatrix} -6 & 2 \\ -8 & 1 \end{bmatrix}$

18.  $-\frac{2}{3} \begin{bmatrix} -9 & 3 \\ 4 & -1 \end{bmatrix}$

19.  $\begin{bmatrix} 10 & 17 & -9 \\ -6 & 4 & 11 \end{bmatrix} - \begin{bmatrix} -6 & 8 & -2 \\ -4 & -9 & 4 \end{bmatrix}$

**3.6** Find the product. If the product is not defined, state the reason. **20–22. See margin.**

20.  $\begin{bmatrix} 4 & 1 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} -7 & 5 \\ 7 & -3 \end{bmatrix}$

21.  $\begin{bmatrix} -16 \\ 2 \end{bmatrix} \begin{bmatrix} 4 \\ 15 \end{bmatrix}$

22.  $\begin{bmatrix} 5 & -1 & 0 \\ 4 & -2 & 9 \end{bmatrix} \begin{bmatrix} 12 \\ -7 \\ 3 \end{bmatrix}$

**3.7** Evaluate the determinant of the matrix.

23.  $\begin{bmatrix} 5 & 8 \\ -2 & 10 \end{bmatrix}$  **66**

24.  $\begin{bmatrix} 13 & 7 \\ -11 & -4 \end{bmatrix}$  **25**

25.  $\begin{bmatrix} 1 & -3 & -2 \\ 7 & 4 & 0 \\ -7 & 2 & 3 \end{bmatrix}$  **-9**

26.  $\begin{bmatrix} 6 & 0 & 5 \\ -4 & 2 & 1 \\ 1 & 0 & 0.5 \end{bmatrix}$  **-4**

**3.7** Use Cramer's rule to solve the linear system.

27.  $2x + y = -8$   
 $-5x - 2y = 13$   
**(3, -14)**

28.  $8x + 3y = 1$   
 $7x + 3y = -1$   
**(2, -5)**

29.  $2x - 2y - 3z = 9$   
 $3x + z = 10$   
 $x + y = 0$   
**(3, -3, 1)**

30.  $2x + y + 3z = 4$   
 $-8x + 4y + z = -7$   
 $x + 2y + 3z = -1$   
**(-2, -7, 5)**

**3.8** Find the inverse of the matrix. **31–34. See margin.**

31.  $\begin{bmatrix} 3 & 7 \\ 3 & 8 \end{bmatrix}$

32.  $\begin{bmatrix} 1 & 4 \\ 0 & 5 \end{bmatrix}$

33.  $\begin{bmatrix} -2 & -5 \\ 3 & 8 \end{bmatrix}$

34.  $\begin{bmatrix} 9 & 2 \\ 18 & 5 \end{bmatrix}$

**3.8** Use an inverse matrix to solve the linear system.

35.  $x + 3y = -4$   
 $-2x + y = -34$   
**(14, -6)**

36.  $2x + 3y = 6$   
 $-x - 6y = -9$  **(1, 4/3)**

37.  $3x - 8y = 0$   
 $2x + y = -19$   
**(-8, -3)**

38.  $x + y = 7$   
 $-5x + 3y = -3$   
**(3, 4)**

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17.  $\begin{bmatrix} -12 & 9 \\ -8 & 4 \end{bmatrix}$

18.  $\begin{bmatrix} 6 & -2 \\ -8 & 2 \\ 3 & 3 \end{bmatrix}$

19.  $\begin{bmatrix} 16 & 9 & -7 \\ -2 & 13 & 7 \end{bmatrix}$

20.  $\begin{bmatrix} -21 & 17 \\ 21 & -15 \end{bmatrix}$

21. Not defined; the number of columns in the left matrix does not equal the number of rows in the right matrix.

22.  $\begin{bmatrix} 67 \\ 89 \end{bmatrix}$

31.  $\begin{bmatrix} 8 & -7 \\ 3 & 3 \\ -1 & 1 \end{bmatrix}$

32.  $\begin{bmatrix} 1 & -4 \\ 0 & 1 \\ 5 & 5 \end{bmatrix}$

33.  $\begin{bmatrix} -8 & -5 \\ 3 & 2 \end{bmatrix}$

34.  $\begin{bmatrix} 5 & -2 \\ 9 & 9 \\ -2 & 1 \end{bmatrix}$

# Chapter 4

**4.1** Graph the function. Label the vertex and axis of symmetry. 1–4. See margin.

1.  $y = 3x^2 + 5$       2.  $y = -x^2 - 4x - 4$       3.  $y = -2x^2 + 4x + 1$       4.  $y = 2x^2 + 5x + 6$

**4.2** Graph the function. Label the vertex and axis of symmetry. 5–8. See margin.

5.  $y = 4(x - 2)^2 + 1$       6.  $y = -(x + 3)^2 - 2$       7.  $y = 3(x - 1)(x - 5)$       8.  $y = \frac{1}{2}(x + 3)(x + 2)$

**4.2** Write the quadratic function in standard form.

9.  $y = 7(x + 2)(x + 4)$       10.  $y = 2(x + 5)(x - 3)$       11.  $y = (x - 7)^2 + 7$       12.  $y = -(x + 1)^2 - 4$   
 $y = 7x^2 + 42x + 56$        $y = 2x^2 + 4x - 30$        $y = x^2 - 14x + 56$        $y = -x^2 - 2x - 5$

**4.3** Factor the expression. If the expression cannot be factored, say so.

13.  $x^2 - 4x + 4$        $(x - 2)^2$       14.  $t^2 - 11t - 26$       15.  $x^2 + 21x + 108$       16.  $b^2 - 400$   
 $(t - 13)(t + 2)$        $(x + 9)(x + 12)$        $(b - 20)(b + 20)$

**4.3** Solve the equation.

17.  $x^2 + 5x - 14 = 0$       18.  $x^2 - 11x + 24 = 0$       19.  $c^2 + 6c = 55$       20.  $n^2 = 5n$   
 $-7, 2$        $3, 8$        $-11, 5$        $0, 5$

**4.4** Factor the expression. If the expression cannot be factored, say so.

21.  $2x^2 + x - 15$       22.  $10a^2 - 19a + 7$       23.  $3r^2 + 9r - 4$       24.  $4t^2 + 8t + 3$   
 $(2x - 5)(x + 3)$        $(5a - 7)(2a - 1)$       not factorable       $(2t + 1)(2t + 3)$

**4.4** Find the zeros of the function by rewriting the function in intercept form.

25.  $y = 81x^2 - 16$        $-\frac{4}{9}, \frac{4}{9}$       26.  $y = 2x^2 - 9x - 5$       27.  $y = 4x^2 + 18x + 18$       28.  $y = -3x^2 - 30x - 27$   
 $-\frac{1}{2}, \frac{5}{2}$        $-3, -\frac{3}{2}$        $-9, -1$

**4.5** Simplify the expression.

29.  $\sqrt{56}$        $2\sqrt{14}$       30.  $3\sqrt{2} \cdot \sqrt{50}$       31.  $\sqrt{\frac{4}{7}} \cdot \frac{2\sqrt{7}}{7}$       32.  $\frac{6}{1 + \sqrt{2}}$        $-6 + 6\sqrt{2}$

**4.5** Solve the equation.

33.  $b^2 = 8$        $\pm 2\sqrt{2}$       34.  $p^2 + 6 = 127$        $\pm 11$       35.  $(x - 5)^2 = 10$       36.  $3(x + 2)^2 - 4 = 11$   
 $5 \pm \sqrt{10}$        $-2 \pm \sqrt{5}$

**4.6** Write the expression as a complex number in standard form.

37.  $(5 + 2i) + (6 - 5i)$       38.  $-3i(7 + i)$        $3 - 21i$       39.  $\frac{1 + 2i}{3 - 8i}$        $-\frac{13}{73} + \frac{14}{73}i$       40.  $\frac{(3 - 2i) + 2i}{(-1 + 7i) - (2 + 3i)}$   
 $11 - 3i$        $-\frac{9}{25} - \frac{12}{25}i$

**4.7** Solve the equation by completing the square.

41.  $x^2 + 6x = 10$       42.  $x^2 - 9x - 2 = 0$       43.  $2c^2 - 12c + 6 = 0$       44.  $3z^2 - 3z + 9 = 0$        $\frac{1}{2} \pm \frac{\sqrt{11}}{2}i$   
 $-3 \pm \sqrt{19}$        $\frac{9}{2} \pm \frac{\sqrt{89}}{2}$        $3 \pm \sqrt{6}$

**4.8** Use the quadratic formula to solve the equation.

45.  $x^2 + 10x - 10 = 0$       46.  $x^2 - x - 1 = 0$       47.  $4s^2 + 3s = 12$       48.  $-2r^2 = r + 17$   
 $-5 \pm \sqrt{35}$        $\frac{1}{2} \pm \frac{\sqrt{5}}{2}$        $-\frac{3}{8} \pm \frac{\sqrt{201}}{8}$        $-\frac{1}{4} \pm \frac{3\sqrt{15}}{4}i$

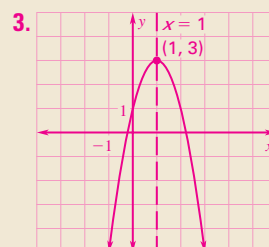
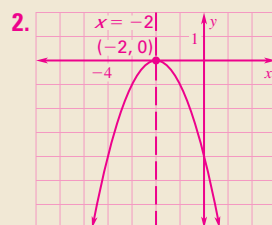
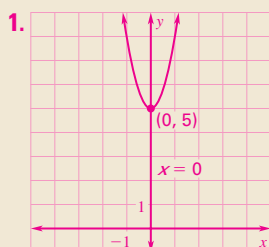
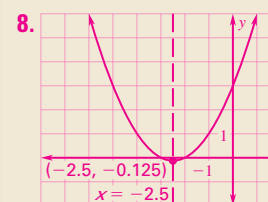
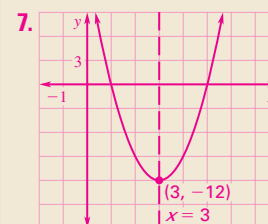
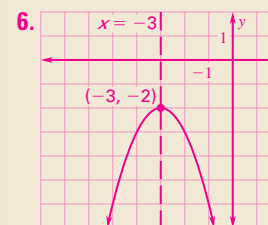
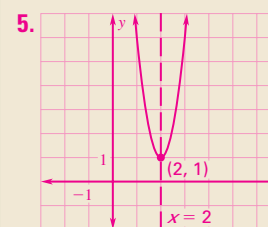
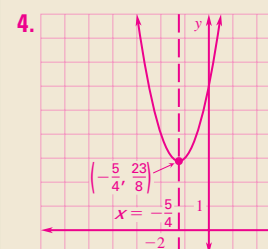
**4.9** Solve the inequality using any method.

49.  $x^2 - 10x \geq 0$       50.  $x^2 - 8x + 12 < 0$       51.  $-x^2 + 7x + 6 > 1$       52.  $3x^2 + 16x + 2 \leq 3x$   
 $x \leq 0$  or  $x \geq 10$        $2 < x < 6$        $-0.653 < x < 7.65$        $-4.17 \leq x \leq -0.160$

**4.10** Write a quadratic function in standard form for the parabola that passes through the given points.

53.  $(-1, -6), (0, -7), (2, 9)$       54.  $(-2, -1), (1, 2), (3, -6)$       55.  $(-3, 36), (0, 36), (2, 16)$   
 $y = 3x^2 + 2x - 7$        $y = -x^2 + 3$        $y = -2x^2 - 6x + 36$

EXTRA PRACTICE



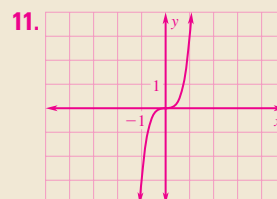
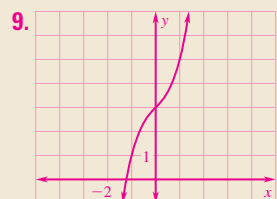
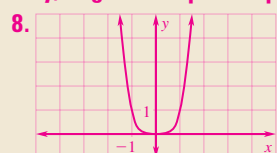
# Chapter 5

4.  $\frac{-2y^2}{5x^4}$ ; quotient of powers property, negative exponent property, product of powers property

5.  $\frac{b^6}{64a^{15}}$ ; power of a product property, negative exponent property

6.  $\frac{2s^8}{r^4}$ ; product of powers property, negative exponent property

7.  $7x^2y^2$ ; product of powers property, quotient of powers property, negative exponent property



25. positive: 2 or 0, negative: 1, imaginary: 2 or 0

26. positive: 1, negative: 2 or 0, imaginary: 4, 2, or 0

27. positive: 1, negative: 1, imaginary: 2

5.1 Write the answer in scientific notation.

1.  $(3.4 \times 10^3)(2.8 \times 10^8)$   
 $9.52 \times 10^{11}$

2.  $(5.8 \times 10^{-6})^4$   
 $1.1316496 \times 10^{-21}$

3.  $\frac{4.6 \times 10^{-7}}{9.2 \times 10^{-9}}$   $5 \times 10^1$

5.1 Simplify the expression. Tell which properties of exponents you used. 4–7. See margin.

4.  $\frac{-14x^{-3}y^5}{35xy^3}$

5.  $(4a^5b^{-2})^{-3}$

6.  $(2r^3s^3)(r^{-7}s^5)$

7.  $\frac{xy^{-1}}{x^2y} \cdot \frac{7x^3}{y^{-4}}$

5.2 Graph the polynomial function. 8–11. See margin.

8.  $f(x) = x^4$

9.  $f(x) = x^3 + x + 4$

10.  $f(x) = -x^3 + 3x$

11.  $f(x) = x^5 + 2x^3$

5.3 Perform the indicated operation.

12.  $(4z^3 + 9) + (3z^2 - 4z - 2)$   
 $4z^3 + 3z^2 - 4z + 7$

13.  $(x^2 + 3x - 1) - (4x^2 + 7)$   
 $-3x^2 + 3x - 8$

14.  $(3x - 4)^3$   
 $27x^3 - 108x^2 + 144x - 64$

5.4 Factor the polynomial completely using any method.

15.  $3x^4 + 18x^3 + 27x^2$   
 $3x^2(x + 3)^2$

16.  $343x^3 + 1000$   
 $(7x + 10)(49x^2 - 70x + 100)$

17.  $2x^3 + x^2 - 8x - 4$   
 $(x - 2)(x + 2)(2x + 1)$

5.4 Find the real-number solutions of the equation.

18.  $3x^3 + 18x^2 = 48x$   $-8, 0, 2$

19.  $x^4 + 32 = 14x^2$   $\pm \sqrt{7 \pm \sqrt{17}}$

20.  $2x^3 + 48 = 3x^2 + 32x$   $-4, \frac{3}{2}, 4$

5.5 Divide using polynomial long division or synthetic division.

21.  $(2x^3 + 4x^2 - 5x + 16) \div (x - 3)$   
 $2x^2 + 10x + 25 + \frac{91}{x - 3}$

22.  $(x^4 + 2x^3 - 7x^2 - 14) \div (x + 2)$   
 $x^3 - 7x + 14 + \frac{-42}{x + 2}$

5.6 Find all real zeros of the function.

23.  $f(x) = 2x^3 + 3x^2 - 8x + 3$   $-3, \frac{1}{2}, 1$

24.  $f(x) = 2x^4 + x^3 - 53x^2 - 14x + 20$   $-3 \pm \sqrt{5}, \frac{1}{2}, 5$

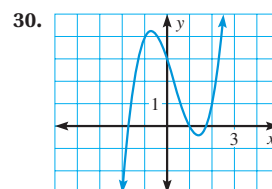
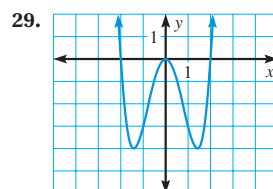
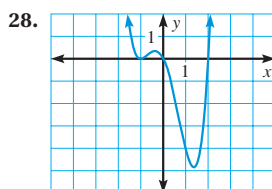
5.7 Determine the possible numbers of positive real zeros, negative real zeros, and imaginary zeros of the function. 25–27. See margin.

25.  $f(x) = -x^3 + 2x^2 - 11x - 1$

26.  $f(x) = 4x^5 + 3x^2 - 8x - 10$

27.  $f(x) = x^4 - 3x^3 - 7x - 13$

5.8 Estimate the coordinates of each turning point and state whether each corresponds to a local maximum or a local minimum. Then estimate all real zeros and determine the least degree the function can have. 28–30. See margin.



5.9 Use finite differences and a system of equations to find a polynomial function that fits the data in the table.

31.

|   |     |    |      |    |      |     |
|---|-----|----|------|----|------|-----|
| x | 1   | 2  | 3    | 4  | 5    | 6   |
| y | 2.5 | 11 | 27.5 | 55 | 96.5 | 155 |

$y = 0.5x^3 + x^2 + 2x - 1$

32.

|   |    |    |    |     |     |      |
|---|----|----|----|-----|-----|------|
| x | 1  | 2  | 3  | 4   | 5   | 6    |
| y | -7 | -6 | 39 | 188 | 525 | 1158 |

$y = x^4 - 3x^2 - 5x$

28.  $(-1, 0)$  local minimum,  $(-0.5, 0.25)$  local maximum,  $(1.5, -4.9)$  local minimum;  $(-1, 0)$ ,  $(-1, 0)$ ,  $(0, 0)$ ,  $(2, 0)$ , degree 4

29.  $(-0.5, -4)$  local minimum,  $(0, 0)$  local maximum,  $(0.5, -4)$  local minimum;  $(-2, 0)$ ,  $(0, 0)$ ,  $(0, 0)$ ,  $(2, 0)$ , degree 4

30.  $(-0.75, 4.25)$  local maximum,  $(1.25, -0.25)$  local minimum;  $(-1.75, 0)$ ,  $(1, 0)$ ,  $(1.75, 0)$ , degree 3

## Chapter 6

### 6.1 Find the indicated real $n$ th root(s) of $a$ .

1.  $n = 4, a = 81$  **3**

2.  $n = 3, a = 512$  **8**

3.  $n = 5, a = -243$  **-3**

### 6.1 Evaluate the expression without using a calculator.

4.  $36^{-1/2}$   **$\frac{1}{6}$**

5.  $64^{5/6}$  **32**

6.  $(\sqrt[3]{216})^{-2}$   **$\frac{1}{36}$**

7.  $(\sqrt[5]{-32})^4$  **16**

### 6.1 Solve the equation. Round the result to two decimal places when appropriate.

8.  $x^3 = -8$  **-2**

9.  $x^4 + 9 = 90$   **$\pm 3$**

10.  $(x - 3)^5 = 60$  **5.27**

11.  $-4x^6 = -400$   **$\pm 2.15$**

### 6.2 Simplify the expression.

12.  $4^{5/2} \cdot 4^{-1/2}$  **16**

13.  $\frac{17^{3/7}}{17^{4/7}}$   **$\frac{1}{17^{1/7}}$**

14.  $(\sqrt[4]{5} \cdot \sqrt{5})^4$  **125**

15.  $\frac{\sqrt[3]{135}}{\sqrt[3]{5}}$  **3**

16.  $5\sqrt[5]{7} - 7\sqrt[5]{7}$   **$-2\sqrt[5]{7}$**

17.  $\sqrt[3]{2} + 2\sqrt[3]{128}$   **$9\sqrt[3]{2}$**

18.  $\frac{324^{1/4}}{4^{-1/4}}$  **6**

19.  $4\sqrt[3]{108} \cdot 2\sqrt[3]{4}$   **$48\sqrt[3]{2}$**

### 6.2 Write the expression in simplest form. Assume all variables are positive.

20.  $\sqrt{20x^6y^7}$   **$2x^3y^3\sqrt{5y}$**

21.  $\sqrt[5]{18x^3y^{14}z^{20}}$   
 **$y^2z^4\sqrt[5]{18x^3y^4}$**

22.  $\sqrt[4]{\frac{x^5}{y^{16}}}$   **$\frac{x\sqrt[4]{x}}{y^4}$**

23.  $\sqrt[3]{16x^7y^2} \cdot \sqrt[3]{6xy^5}$   
 **$2x^2y^2\sqrt[3]{12x^2y}$**

### 6.3 Let $f(x) = -x + 4$ , $g(x) = x^3$ , and $h(x) = \frac{x}{4}$ . Perform the indicated operation and state the domain. 24–31. See margin.

24.  $f(x) + g(x)$

25.  $g(x) - f(x)$

26.  $g(x) \cdot h(x)$

27.  $\frac{f(x)}{g(x)}$

28.  $f(g(x))$

29.  $g(h(x))$

30.  $h(f(x))$

31.  $f(f(x))$

### 6.4 Verify that $f$ and $g$ are inverse functions. 32–33. See margin.

32.  $f(x) = 2x - 4$ ,  $g(x) = \frac{1}{2}x + 2$

33.  $f(x) = 3x^2 + 1, x \geq 0$ ;  $g(x) = \left(\frac{x-1}{3}\right)^{1/2}$

### 6.4 Find the inverse of the function.

34.  $f(x) = 5x - 3$   **$f^{-1}(x) = \frac{x+3}{5}$**

35.  $f(x) = \frac{4}{3}x + 2$   **$f^{-1}(x) = \frac{3}{4}x - \frac{3}{2}$**

36.  $f(x) = \frac{1}{2}x^2, x \geq 0$   **$f^{-1}(x) = \sqrt{2x}$**

37.  $f(x) = -x^6 + 2, x \leq 0$   
 **$f^{-1}(x) = -\sqrt[6]{-x+2}$**

38.  $f(x) = \frac{4x^4 - 1}{18}, x \geq 0$   
 **$f^{-1}(x) = \sqrt[4]{\frac{18x+1}{4}}$**

39.  $f(x) = 32x^5 + 4$   **$f^{-1}(x) = \sqrt[5]{\frac{x-4}{32}}$**

### 6.5 Graph the function. Then state the domain and range. 40–47. See margin for art.

40.  $y = -\frac{1}{3}\sqrt{x}$

domain:  $x \geq 0$ , range:  $y \leq 0$  **See margin.**

41.  $y = \frac{2}{5}\sqrt[3]{x}$

**See margin.**

42.  $y = \frac{5}{6}\sqrt{x}$

domain:  $x \geq 0$ , range:  $y \geq 0$

43.  $y = \sqrt{x+2} - 3$

domain:  $x \geq -2$ , range:  $y \geq -3$

44.  $y = -2\sqrt[3]{x-1} + 2$

**See margin.**

45.  $f(x) = 3\sqrt[3]{x}$

**See margin.**

46.  $g(x) = -\frac{1}{2}\sqrt{x-2}$

domain:  $x \geq 2$ , range:  $y \leq 0$

47.  $h(x) = -\sqrt{x+3} + 4$

domain:  $x \geq -3$ , range:  $y \leq 4$

### 6.6 Solve the equation. Check your solution.

48.  $\sqrt{2x+3} = 7$  **23**

49.  $-5\sqrt{x+1} + 12 = 2$  **3**

50.  $\sqrt[3]{5x-1} + 6 = 10$  **13**

51.  $2\sqrt[3]{8x} + 9 = 5$  **-1**

52.  $7x^{4/3} = 175$   **$\pm 5\sqrt[3]{5}$**

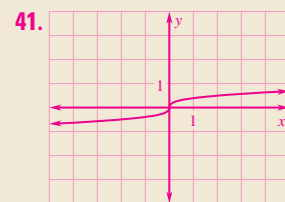
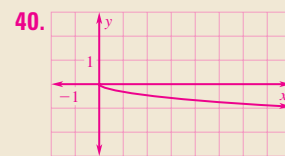
53.  $(x-2)^{3/4} = 1$  **3**

54.  $x - 8 = \sqrt{18x}$  **32**

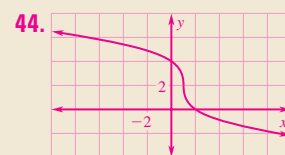
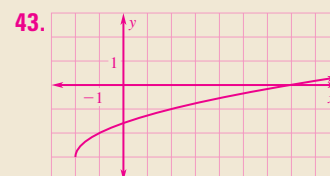
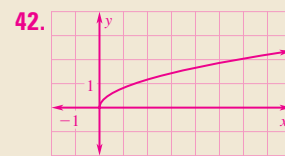
55.  $x = \sqrt{4x-3}$  **1, 3**

56.  $\sqrt{2x+1} + 5 = \sqrt{x+12} - 8$   
**no solution**

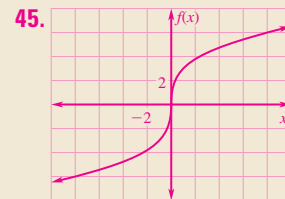
EXTRA PRACTICE



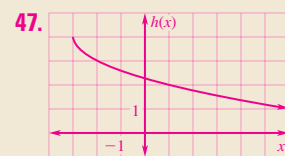
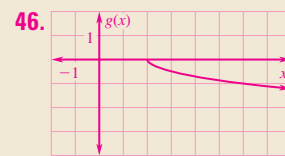
domain: all real numbers,  
range: all real numbers



domain: all real numbers,  
range: all real numbers



domain: all real numbers,  
range: all real numbers



24.  $x^3 - x + 4$ , all real numbers

25.  $x^3 + x - 4$ , all real numbers

26.  $\frac{x^4}{4}$ , all real numbers

27.  $\frac{-x+4}{x^3}$ , all real numbers  
except  $x = 0$

28.  $-x^3 + 4$ , all real numbers

29.  $\frac{x^3}{64}$ , all real numbers

30.  $-\frac{x}{4} + 1$ , all real numbers

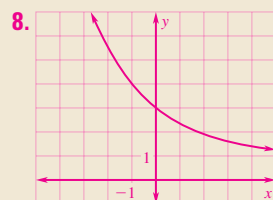
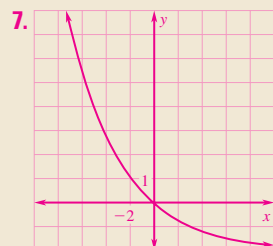
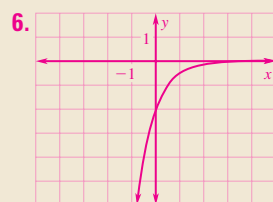
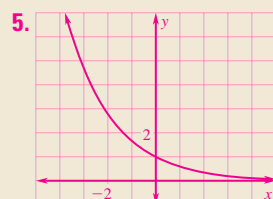
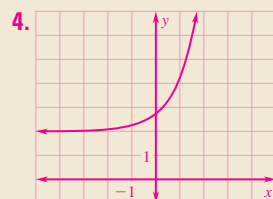
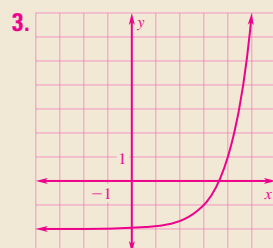
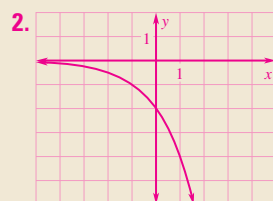
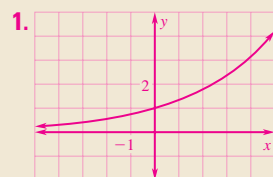
31.  $x$ , all real numbers

32, 33. See Additional Answers  
beginning on p. AA1.

Extra Practice 1015

# Chapter 7

## EXTRA PRACTICE



**7.1** Graph the function. State the domain and range. 1–4. See margin for art.

1.  $y = \left(\frac{4}{3}\right)^x$  domain: all real numbers, range:  $y > 0$  2.  $y = -2 \cdot 2^x$  domain: all real numbers, range:  $y < 0$  3.  $y = 3^{x-3} - 2$  domain: all real numbers, range:  $y > -2$  4.  $y = \frac{1}{4} \cdot 3^{x+1} + 2$  domain: all real numbers, range:  $y > 2$

**7.2** Graph the function. State the domain and range. 5–8. See margin for art.

5.  $y = \left(\frac{3}{5}\right)^x$  domain: all real numbers, range:  $y > 0$  6.  $y = -2\left(\frac{1}{4}\right)^x$  domain: all real numbers, range:  $y < 0$  7.  $y = (0.8)^{x-3} - 2$  domain: all real numbers, range:  $y > -2$  8.  $y = 2\left(\frac{2}{3}\right)^x + 1$  domain: all real numbers, range:  $y > 1$

**7.3** Simplify the expression.

9.  $e^{-3} \cdot e^{-8}$   $\frac{1}{e^{11}}$  10.  $(2e^{2x})^{-5}$   $\frac{1}{32e^{10x}}$  11.  $\sqrt{81e^{8x}}$   $9e^{4x}$  12.  $\frac{28e^{3x}}{21e^{-x}}$   $\frac{4}{3}e^{4x}$

**7.3** Graph the function. State the domain and range. 13–16. See margin for art.

13.  $y = 0.5e^{3x}$  domain: all real numbers, range:  $y > 0$  14.  $y = 2e^{-x} - 2$  domain: all real numbers, range:  $y > -2$  15.  $y = 1.5e^{x+1} + 3$  domain: all real numbers, range:  $y > 3$  16.  $y = e^{3(x-2)} + 1$  domain: all real numbers, range:  $y > 1$

**7.4** Evaluate the logarithm without using a calculator.

17.  $\log_4 \frac{1}{16}$   $-2$  18.  $\log_6 6$   $1$  19.  $\log_5 125$   $3$  20.  $\log_{3/4} \frac{64}{27}$   $-3$

**7.4** Simplify the expression.

21.  $5^{\log_5 x}$   $x$  22.  $10^{\log 9}$   $9$  23.  $\log_4 16^x$   $2x$  24.  $e^{\ln 5}$   $5$

**7.4** Graph the function. State the domain and range. 25–28. See margin for art.

25.  $y = \log_7 x$  domain:  $x > 0$ , range: all real numbers 26.  $y = \log_{1/2}(x-4)$  domain:  $x > 4$ , range: all real numbers 27.  $y = \log_5 x + 3$  domain:  $x > 0$ , range: all real numbers 28.  $y = \log_3(x-2) + 1$  domain:  $x > 2$ , range: all real numbers

**7.5** Expand the expression.

29.  $\log_5 \frac{2x}{5}$   $\log_5 2 + \log_5 x - 1$  30.  $\log \frac{100x^2}{y}$   $2 + 2 \log x - \log y$  31.  $\ln 20x^3y^2$   $\ln 20 + 3 \ln x + 2 \ln y$  32.  $\log_2 \sqrt[3]{8x^4}$   $1 + \frac{4}{3} \log_2 x$

**7.5** Condense the expression.

33.  $\log_4 20 + 4 \log_4 x$   $\log_4 20x^4$  34.  $\log 7 + 2 \log x - 5 \log y$   $\log \frac{7x^2}{y^5}$  35.  $0.5 \ln 100 - 2 \ln x + 8 \ln y$   $\ln \frac{10y^8}{x^2}$

**7.5** Use the change-of-base formula to evaluate the logarithm.

36.  $\log_2 5$  about 2.322 37.  $\log_4 80$  about 3.161 38.  $\log_5 100$  about 2.861 39.  $\log_7 27$  about 1.694

**7.6** Solve the equation. Check for extraneous solutions.

40.  $2^{4x+2} = 8^{x+2}$   $4$  41.  $\left(\frac{1}{9}\right)^{x-3} = 3^{3x+1}$   $1$  42.  $7^{9x} = 18$  about 0.165  
43.  $\ln(3x+7) = \ln(x-1)$  no solution 44.  $\log_5(3x+2) = 3$   $41$  45.  $\log_6(x+9) + \log_6 x = 2$   $3$

**7.7** Write an exponential function  $y = ab^x$  whose graph passes through the given points.

46. (1, 8), (2, 32)  $y = 2 \cdot 4^x$  47. (1, 3), (3, 12)  $y = \frac{3}{2} \cdot 2^x$  or  $y = -\frac{3}{2} \cdot (-2)^x$  48. (2, -9), (5, -243)  $y = -1 \cdot 3^x$  49. (1, 4), (2, 4)  $y = 4 \cdot 1^x$

**7.7** Write a power function  $y = ax^b$  whose graph passes through the given points.

50. (2, 2), (5, 16)  $y = 0.415x^{2.27}$  51. (3, 27), (6, 432)  $y = \frac{1}{3} \cdot x^4$  52. (1, 4), (8, 17)  $y = 4 \cdot x^{0.696}$  53. (5, 36), (10, 220)  $y = 0.538 \cdot x^{2.611}$

1016 Student Resources

13–16, 25–28. See Additional Answers beginning on p. AA1.

# Chapter 8

**8.1** The variables  $x$  and  $y$  vary inversely. Use the given values to write an equation relating  $x$  and  $y$ . Then find  $y$  when  $x = -5$ .

1.  $x = 2, y = -10$   
 $y = \frac{-20}{x}; 4$

2.  $x = \frac{1}{3}, y = 24$   
 $y = \frac{8}{x}; -\frac{8}{5}$

3.  $x = -3, y = -5$   
 $y = \frac{15}{x}; -3$

4.  $x = 25, y = -\frac{2}{5}$   
 $y = \frac{-10}{x}; 2$

**8.1** Determine whether  $x$  and  $y$  show *direct variation*, *inverse variation*, or *neither*.

5.

| $x$ | $y$  |
|-----|------|
| 2.5 | 32   |
| 4   | 20   |
| 5   | 16   |
| 6.4 | 12.5 |
| 8   | 10   |

inverse variation

6.

| $x$ | $y$  |
|-----|------|
| 1   | 2.5  |
| 3.5 | 8.75 |
| 5   | 12.5 |
| 8   | 20   |
| 9   | 22.5 |

direct variation

7.

| $x$ | $y$ |
|-----|-----|
| 11  | 30  |
| 14  | 61  |
| 16  | 85  |
| 24  | 92  |
| 27  | 105 |

neither

8.

| $x$ | $y$ |
|-----|-----|
| 1   | 12  |
| 3   | 4   |
| 8   | 1.5 |
| 12  | 1   |
| 15  | 0.8 |

inverse variation

**8.2** Graph the function. State the domain and range. **9–12. See margin.**

9.  $y = \frac{6}{x}$

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

11.  $y = \frac{5}{x-1} - 2$

12.  $y = \frac{4x+19}{x+3}$

**8.3** Graph the function. **13–16. See margin.**

13.  $y = \frac{x}{x^2-4}$

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

15.  $y = \frac{x^2+2x-3}{x+2}$

16.  $f(x) = \frac{2x^2-8}{x^2-2x}$

**8.4** Simplify the rational expression, if possible.

17.  $\frac{x^2+x-6}{x^2+9x+18} \cdot \frac{x-2}{x+6}$

18.  $\frac{x^3-100x}{x^4+20x^3+100x^2}$

19.  $\frac{x^2-5x-84}{2x^2-98} \cdot \frac{x-10}{x(x+10)}$

20.  $\frac{x^2+7x+10}{x^2-7x+10}$   
 simplified

**8.4** Multiply or divide the expressions. Simplify the result.

21.  $\frac{6x^2y}{xy^2} \cdot \frac{2y}{9x^3} \cdot \frac{4}{3x^2}$

22.  $\frac{2x^2-x-6}{2x^2+5x+3} \cdot \frac{x^2+x}{x^2-4} \cdot \frac{x}{x+2}$

23.  $\frac{3x^2+15x}{x^2-12x+36} \cdot (x^2-x-30)$   
 $3x(x+5)^2$

24.  $\frac{12x^8y}{5y^5} \div \frac{3y^2}{x^2} \cdot \frac{4x^{10}}{5y^6}$

25.  $\frac{6x^2+x-1}{4x^3+4x^2} \div \frac{6x^2-2x}{x^2-4x-5}$   
 $(2x+1)(x-5)$

26.  $\frac{x^2-4x-32}{2x^2-13x-24} \div \frac{x-6}{4x^2-9}$   
 $(x+4)(2x-3)$

**8.5** Add or subtract the expressions. Simplify the result.  $8x^3$

27.  $\frac{x^2}{x+1} - \frac{1}{x+1} \cdot x-1$

28.  $\frac{x+5}{x+6} + \frac{1}{x-2} \cdot \frac{x^2+4x-4}{(x+6)(x-2)}$

29.  $\frac{5}{x+2} + \frac{35}{x^2-3x-10} \cdot \frac{5}{(x-5)}$

**8.5** Simplify the complex fraction.

30.  $\frac{\frac{x}{2x+1}}{5 + \frac{3}{x}} \cdot \frac{x^2}{(5x+3)(2x+1)}$

31.  $\frac{\frac{x}{3} + 2}{\frac{1}{1} + 3} \cdot \frac{x(x+6)}{3(1+3x)}$

32.  $\frac{\frac{3}{x^2-4}}{\frac{2}{x+2} - \frac{x+1}{x^2-x-6}} \cdot \frac{3(x-3)}{(x-2)(x-7)}$

**8.6** Solve the equation. Check for extraneous solutions.

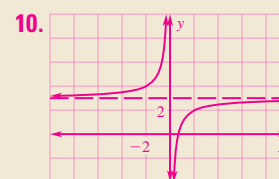
33.  $\frac{7}{3x-7} = \frac{14}{x+1} \cdot 3$

34.  $\frac{1}{3} + \frac{2}{x} = -\frac{3}{x^2} \cdot -3$

35.  $2 - \frac{4}{x+2} = \frac{2}{x} \cdot -1, 2$

36.  $\frac{4}{x-2} + \frac{6x^2}{x^2-4} = \frac{3x}{x+2} \cdot \frac{4}{3}$

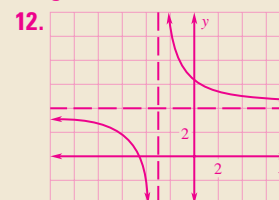
Extra Practice 1017



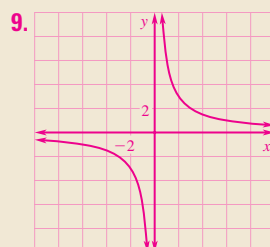
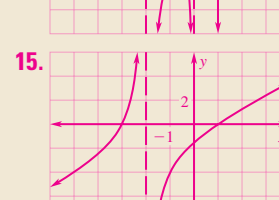
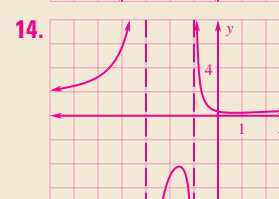
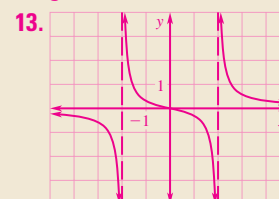
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range: all real numbers except 3



domain: all real numbers except 1,  
range: all real numbers except -2



domain: all real numbers except -3,  
range: all real numbers except 4



domain: all real numbers except 0,  
range: all real numbers except 0

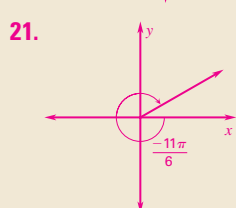
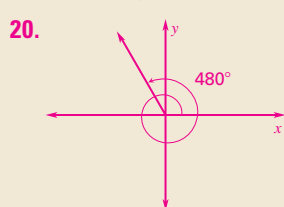
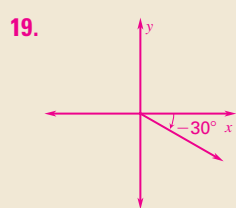
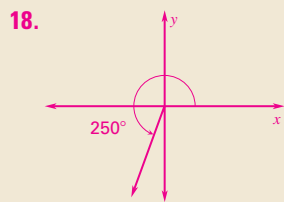
## Chapter 13

$$1. \cos \theta = \frac{4}{5}, \tan \theta = \frac{3}{4}, \csc \theta = \frac{5}{3}, \\ \sec \theta = \frac{5}{4}, \cot \theta = \frac{4}{3}$$

$$2. \sin \theta = \frac{8}{17}, \cos \theta = \frac{15}{17}, \\ \csc \theta = \frac{17}{8}, \sec \theta = \frac{17}{15}, \cot \theta = \frac{15}{8}$$

$$3. \sin \theta = \frac{\sqrt{3}}{2}, \cos \theta = \frac{1}{2}, \\ \tan \theta = \sqrt{3}, \csc \theta = \frac{2\sqrt{3}}{3}, \\ \cot \theta = \frac{\sqrt{3}}{3}$$

$$4. \sin \theta = \frac{3}{4}, \tan \theta = \frac{3\sqrt{7}}{7}, \\ \csc \theta = \frac{4}{3}, \sec \theta = \frac{4\sqrt{7}}{4}, \cot \theta = \frac{\sqrt{7}}{3}$$



$$33. B \approx 40.7^\circ, C \approx 105.3^\circ, c \approx 10.35 \\ \text{or } B \approx 6.72^\circ, C \approx 139.3^\circ, c \approx 7.0$$

**13.1** Let  $\theta$  be an acute angle of a right triangle. Find the values of the other five trigonometric functions of  $\theta$ . 1–4. See margin.

$$1. \sin \theta = \frac{3}{5}$$

$$2. \tan \theta = \frac{8}{15}$$

$$3. \sec \theta = 2$$

$$4. \cos \theta = \frac{\sqrt{7}}{4}$$

**13.1** Solve  $\triangle ABC$  using the diagram and the given measurements.

$$5. A = 21^\circ, c = 8$$

$$B = 69^\circ, a \approx 2.867, b \approx 7.469$$

$$7. B = 60^\circ, c = 20$$

$$A = 30^\circ, a = 10, b = 10\sqrt{3}$$

$$9. A = 18^\circ, c = 18$$

$$B = 72^\circ, a \approx 5.562, b \approx 17.119$$

$$6. B = 66^\circ, a = 14$$

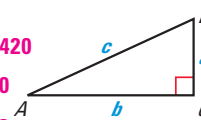
$$A = 24^\circ, b \approx 31.445, c \approx 34.420$$

$$8. A = 29^\circ, b = 6$$

$$B = 61^\circ, a \approx 3.326, c \approx 6.860$$

$$10. B = 56^\circ, c = 7$$

$$A = 34^\circ, a \approx 3.914, b \approx 5.803$$



**13.2** Convert the degree measure to radians or the radian measure to degrees.

$$11. 100^\circ \quad \frac{5\pi}{9}$$

$$12. -6^\circ \quad -\frac{\pi}{30}$$

$$13. \frac{3\pi}{4} \quad 135^\circ$$

$$14. -\frac{\pi}{6} \quad -30^\circ$$

**13.2** Find the arc length and area of a sector with the given radius  $r$  and central angle  $\theta$ .

$$15. r = 5 \text{ ft}, \theta = 90^\circ \quad \frac{5\pi}{2} \text{ ft}, \frac{25\pi}{4} \text{ ft}^2$$

$$16. r = 2 \text{ in.}, \theta = 300^\circ$$

$$\frac{10\pi}{3} \text{ in.}, \frac{10\pi}{3} \text{ in.}^2$$

$$17. r = 12 \text{ cm}, \theta = \pi$$

$$12\pi \text{ cm}, 72\pi \text{ cm}^2$$

**13.3** Sketch the angle. Then find its reference angle. 18–21. See margin for art.

$$18. 250^\circ \quad 70^\circ$$

$$19. -30^\circ \quad 30^\circ$$

$$20. \frac{8\pi}{3} \quad \frac{\pi}{3}$$

$$21. -\frac{11\pi}{6} \quad \frac{\pi}{6}$$

**13.3** Evaluate the function without using a calculator.

$$22. \sin(-60^\circ) \quad -\frac{\sqrt{3}}{2}$$

$$23. \csc 240^\circ \quad -\frac{2\sqrt{3}}{3}$$

$$24. \tan \frac{7\pi}{4} \quad -1$$

$$25. \cos\left(-\frac{5\pi}{4}\right) \quad -\frac{\sqrt{2}}{2}$$

**13.4** Evaluate the expression without using a calculator. Give your answer in both radians and degrees.

$$26. \sin^{-1} 0 \quad 0, 0^\circ$$

$$27. \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$$

$$\frac{5\pi}{6}, 150^\circ$$

$$28. \cos^{-1} 3 \quad \text{undefined}$$

$$29. \tan^{-1} 1 \quad \frac{\pi}{4}, 45^\circ$$

**13.4** Solve the equation for  $\theta$ .

$$30. \sin \theta = 0.25; 90^\circ < \theta < 180^\circ$$

$$\text{about } 165.52^\circ$$

$$31. \cos \theta = 0.9; 270^\circ < \theta < 360^\circ$$

$$\text{about } 334.16^\circ$$

$$32. \tan \theta = 2; 180^\circ < \theta < 270^\circ$$

$$\text{about } 243.43^\circ$$

**13.5** Solve  $\triangle ABC$ . (Hint: Some of the “triangles” may have no solution and some may have two solutions.)

$$33. A = 34^\circ, a = 6, b = 7$$

$$\text{See margin.}$$

$$34. A = 50^\circ, C = 65^\circ, b = 60$$

$$B = 65^\circ, a \approx 50.71, c = 60$$

$$35. B = 86^\circ, b = 13, c = 11$$

$$A \approx 36.4^\circ, C \approx 57.6^\circ, a \approx 7.73$$

**13.5** Find the area of  $\triangle ABC$  with the given side lengths and included angle.

$$36. A = 35^\circ, b = 50, c = 120$$

$$\text{about } 1720$$

$$37. B = 35^\circ, a = 7, c = 12$$

$$\text{about } 24.1$$

$$38. C = 20^\circ, a = 10, b = 16$$

$$\text{about } 27.4$$

**13.6** Solve  $\triangle ABC$ .

$$39. a = 16, b = 23, c = 17$$

$$A \approx 44.1^\circ, B \approx 88.3^\circ, C \approx 47.6^\circ$$

$$40. C = 50^\circ, a = 12, b = 14$$

$$A \approx 55.7^\circ, B \approx 74.3^\circ, c \approx 11.14$$

$$41. A = 80^\circ, b = 7, c = 5$$

$$B \approx 61.3^\circ, C \approx 38.7^\circ, a \approx 7.86$$

**13.6** Find the area of  $\triangle ABC$  with the given side lengths.

$$42. a = 6, b = 3, c = 4$$

$$\text{about } 5.33$$

$$43. a = 14, b = 30, c = 27$$

$$\text{about } 189$$

$$44. a = 16, b = 16, c = 20$$

$$\text{about } 125$$

EXTRA PRACTICE

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