

Chapter 5 Skills Practice

**LESSON 5-1** Graph each function by using a table. 1-6. See p. A56.

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

Using the graph of  $f(x) = x^2$  as a guide, describe the transformations, and then graph each function.

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

Use the description to write each quadratic function in vertex form.

7. The parent function  $f(x) = x^2$  is vertically stretched by a factor of 3 and translated 6 units right to create  $g(x) = 3(x-6)^2$ .

8. The parent function  $f(x) = x^2$  is reflected across the  $x$ -axis and translated 12 units down to create  $g(x) = -x^2 - 12$ .

**LESSON 5-2** Identify the axis of symmetry for the graph of each function.

9.  $f(x) = 2x^2 + 1$     10.  $f(x) = (x+3)^2 - 5$     11.  $f(x) = 3(x-2)^2$   
 $x = 0$      $x = -3$      $x = 2$

For each function, (a) determine whether the graph opens upward or downward, (b) find the axis of symmetry, (c) find the vertex, (d) find the  $y$ -intercept, and (e) graph the function. 12-14. See p. A56.

12.  $f(x) = 2x^2 - 4x + 5$     13.  $f(x) = -\frac{1}{2}x^2 - 2x + 3$     14.  $f(x) = -x^2 - 8x - 6$

Find the minimum or maximum value of each function. Then state the domain and range of the function.

15.  $f(x) = 3x^2 + 60x + 294$     16.  $f(x) = -2x^2 + 28x - 95$     17.  $f(x) = 2x^2 + 14x + 30$   
 min.: -6; D: R; R:  $\{y | y \geq -6\}$     max.: 3; D: R; R:  $\{y | y \leq 3\}$     min.: 5.5; D: R; R:  $\{y | y \geq 5.5\}$

**LESSON 5-3** Find the zeros of each function by using a graph and a table.

18.  $f(x) = x^2 + 5x + 6$     19.  $f(x) = x^2 - 3x - 28$     20.  $f(x) = -x^2 + 12x - 20$   
 $x = -3, -2$      $x = -4, 7$      $x = 2, 10$

Find the zeros of each function by factoring.

21.  $f(x) = x^2 + 2x - 35 = -7, 5$     22.  $f(x) = x^2 - 8x - 9 = -1, 9$     23.  $f(x) = 2x^2 - 9x + 0, \frac{9}{2}$

24.  $f(x) = x^2 + 10x + 25 = -5$     25.  $f(x) = x^2 - 49 = -7, 7$     26.  $f(x) = x^2 - 12x + 36 = 6$

Write a quadratic function in standard form for each given set of zeros. Possible answers:

27. 5 and 8    28. -3 and 1    29. 6 and 6    30. 12 and 0

$f(x) = x^2 - 13x + 40$      $f(x) = x^2 + 2x - 3$      $f(x) = x^2 - 12x + 36$      $f(x) = x^2 - 12x$

**LESSON 5-4** Solve each equation.

31.  $4x^2 - 10 = 90$     32.  $x^2 + 8x + 16 = 10$     33.  $x^2 + 4x + 4 = 8$   
 $x = \pm 5$      $x = -4 \pm \sqrt{10}$      $x = -2 \pm 2\sqrt{2}$

Complete the square for each expression. Write the resulting expression as a binomial squared.

34.  $x^2 - 16x + \square$     35.  $x^2 + 22x + \square$     36.  $x^2 + 7x + \frac{49}{4} = \left(\frac{x+7}{2}\right)^2$   
 $x^2 - 16x + 64 = (x-8)^2$      $x^2 + 22x + 121 = (x+11)^2$      $x^2 + 7x + \frac{49}{4} = \left(\frac{x+7}{2}\right)^2$

Solve each equation by completing the square.

37.  $x^2 + 8x = -10$      $x = -4 \pm \sqrt{6}$     38.  $x^2 - 12x = 13$      $x = 1, 13$     39.  $x^2 + 20 = 10x$      $x = 5 \pm \sqrt{5}$

40.  $2x^2 + 12x = 14$      $x = -7, 1$     41.  $3x^2 - 18 = 48x$      $x = \pm \sqrt{10}$     42.  $x^2 - 5 = 2x$      $x = 1 \pm \sqrt{6}$

Write each function in vertex form, and identify its vertex.

43.  $f(x) = x^2 - 2x + 17$     44.  $f(x) = x^2 + 4x - 8$     45.  $f(x) = 4x^2 - 24x + 31$   
 $f(x) = (x-1)^2 + 16; (1, 16)$      $f(x) = (x+2)^2 - 12; (-2, -12)$      $f(x) = 4(x-3)^2 - 5; (3, -5)$

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**LESSON 5-5** Express each number in terms of  $i$ .

46.  $2\sqrt{-81}$     18*i*    47.  $-\sqrt{-144}$     -12*i*    48.  $\sqrt{-128}$      $8i\sqrt{2}$     49.  $5\sqrt{-48}$      $20i\sqrt{3}$

Solve each equation.

50.  $169 + x^2 = 0 \pm 13i$     51.  $2x^2 = -200 \pm 10i$     52.  $x^2 = -90 \pm 3i\sqrt{10}$

Find the zeros of each function.

53.  $f(x) = x^2 + 8x + 20$     54.  $f(x) = x^2 - 14x + 65$     55.  $f(x) = x^2 - 2x + 46$   
 $-4 \pm 2i$      $7 \pm 4i$      $1 \pm 3i\sqrt{5}$

Find each complex conjugate.

56.  $12i$     57.  $3 - 6i$     58.  $10i - 3$     59.  $2\sqrt{7} - 10i$   
 $-12i$      $3 + 6i$      $-3 - 10i$      $2\sqrt{7} + 10i$

**LESSON 5-6** Find the zeros of each function by using the Quadratic Formula.

60.  $f(x) = x^2 - 10x + 3$     61.  $f(x) = 2x^2 + 5x + 1$     62.  $f(x) = -x^2 + 8x - 3$

63.  $f(x) = x^2 - 6x + 40$     64.  $f(x) = x^2 + 7x + 13$     65.  $f(x) = 2x^2 - 9x + 25$

Find the type and number of solutions for each equation.

66.  $x^2 + 8x = -16$     67.  $x^2 + 3y = 10x$     68.  $5 + 2x^2 = 12x$     69.  $4x^2 + 2x = -9$   
 one distinct real solution    two distinct real solutions    two distinct real solutions    two distinct nonreal complex solutions

**LESSON 5-7** Graph each inequality.

70.  $y \geq (x+3)^2 + 2$     71.  $y < 2x^2 - 4x - 1$     72.  $y < -x^2 + 11x - 24$

70-72. See p. A56.

Solve each inequality.

73.  $x^2 + 13x + 20 \leq -2$     74.  $x^2 - 11x \geq -10$     75.  $x^2 + 6x + 3 > 10$   
 $-11 \leq x < -2$      $x \leq 1$  or  $x \geq 10$      $x < -7$  or  $x > 1$

76.  $x^2 - 2x - 20 \leq 28$     77.  $2x^2 - 9x \leq 5$     78.  $3x^2 + 1 \geq 4x$      $x \leq \frac{1}{3}$  or  $x \geq 1$   
 $x < -6$  or  $x \geq 8$      $-\frac{1}{2} \leq x \leq 5$

**LESSON 5-8** Determine whether each data set could represent a quadratic function. Explain.

79. 

x	3	4	5	6	7
y	-2	-5	-6	-5	-2

    80. 

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

    81. 

x	-6	-5	-4	-3	-2
y	19	10	7	10	19

79-81. See p. A57.

Write a quadratic function that fits each set of points.

82.  $(-2, 0)$ ,  $(1, 6)$ , and  $(3, -10)$     83.  $(-4, -25)$ ,  $(0, -9)$ , and  $(2, 5)$   
 $f(x) = -2x^2 + 8$      $f(x) = \frac{1}{2}x^2 + 6x - 9$

**LESSON 5-9** Graph each complex number.

84.  $-3$     85.  $2i$     86.  $2 + 4i$     87.  $-3 - 3i$

84-87. See p. A57.

Find each absolute value.

88.  $|-9|$     89.  $|-3 + 4i|$     90.  $|-7i|$   
 $3\sqrt{13}$     5    7

Simplify. Write the result in the form  $a + bi$ .

91.  $(3 + 7i) + (-2 + 3i)$     92.  $(-9 - 4i) + (5 + i)$     93.  $(10 + 6i) - (3i - 12)$   
 $1 + 10i$      $-4 - 3i$      $22 + \frac{3}{2}i$

94.  $-3i(9 - 2i) - 6 - 27i$     95.  $(2 - i)(4 + 3i) + 11 + 2i$     96.  $(6 + 4i)(4 - 5i) - 44 - 14i$   
 $-27 + 27i - 6 - 27i$      $8 + 11i + 12 + 2i$      $22 + 3i - 20 + 20i - 20 - 20i - 20 - 20i$

97.  $\frac{11 + 3i}{2 + i} - 5 - i$     98.  $\frac{-44 - 40i}{-8 + 2i} + 4 + 6i$     99.  $\frac{5 + 12i}{3 + 2i} + 3 + 2i$

Chapter 6 Skills Practice

**LESSON 6-1** Identify the degree of each monomial.

1.  $7x^2$     2.  $-12x$     3.  $2x^3y^3$     4. 8    0

Rewrite each polynomial in standard form. Then identify the leading coefficient, degree, and number of terms. Name the polynomial. 5-7. See p. A57.

5.  $5x^2 + 6 + 9x - 10x^3$     6.  $3 - 12x^4 - 6x^2$     7.  $14x + 15x^2$

Add or subtract. Write your answer in standard form.

8.  $(12x^2 + 4x - 9) + (3x^2 - 7x^2 - 1)$     9.  $(34 + 8x^2 - 9x^2) - (3x^2 + 10x^2 - 4x - 4)$   
 $3x^2 + 5x^2 + 4x - 10$      $5x^2 - 19x^2 + 4x + 38$

Graph each polynomial function on a calculator. Describe the graph, and identify the number of real zeros. 10-12. See p. A57.

10.  $f(x) = 5x^2 + 4x - 6$     11.  $g(x) = 2x^3 - 12x + 3$     12.  $h(x) = 3x^3 - 4x + 1$

**LESSON 6-2** Find each product.

13.  $6a^2b - 15a^2b^2 + 27ab^2$     14.  $-40cd^4 - 15c^2d^5 + 6c^3d^4$     15.  $2x^3 + 5x^2 + 3x + 18$

16.  $(2x - 1)(-x^2 + 5x + 5)$     17.  $(2x + 6)^3$     18.  $(y - 2)^4$   
 $-2x^3 + 11x^2 + 5x - 5$      $8x^3 + 72x^2 + 216x + 216$      $y^4 - 8y^3 + 24y^2 - 32y + 16$

Expand each expression.

19.  $(x - y)^3$     20.  $(y + 4)^4$     21.  $(2x + y)^5$     22.  $(x - 2y)^4$

**LESSON 6-3** Divide by using long division.

23.  $(6x^2 + 7x - 2) \div (x + 4)$     24.  $(2x^2 - 9x + 10) \div (2x - 1)$      $\frac{2x - 4}{(2x - 1)} + \frac{6}{(2x - 1)}$

Divide by using synthetic division.

25.  $3x^2 + 10x + 20 \div \frac{3x - 2}{x - 2}$     26.  $(2x^3 + 3x^2 - 6x - 4) \div (x - 1)$      $\frac{2x^2 + 5x - 1}{x - 1} - \frac{5}{x - 1}$

Use synthetic division to evaluate the polynomial for the given value.

27.  $P(x) = -2x^3 + 7x^2 - 3x - 9$  for  $x = -2$     28.  $P(x) = 6x^3 - 7x^2 + 10$  for  $x = 0.5$   
 $P(-2) = 41$      $P(0.5) = 9$

Determine whether the given binomial is a factor of the polynomial  $P(x)$ .

29.  $(x + 2)$ ;  $P(x) = 3x^3 + 11x^2 + 2x - 16$     yes    30.  $(x - 4)$ ;  $P(x) = 12x^3 + 9x^2 - 2x + 8$     no

31.  $(x + 1)$ ;  $P(x) = x^4 - 3x^3 + 10x + 4$     no    32.  $(x - 3)$ ;  $P(x) = x^3 - 3x^2 - 4x + 12$     yes

Factor each expression. 33-38. See p. A57.

33.  $2x^3 + 12x^2 - 4x - 24$     34.  $2x^3 + 5x^2 - 18x - 45$     35.  $4x^3 + 12x^2 + 12x + 36$   
 $2(x - 2)(x + 3)(x + 2)$      $(x + 3)(2x^2 + x - 15)$      $4(x + 1)(x + 2)(x + 3)$

36.  $a^3 + 27$     37.  $128b - 2b^4$     38.  $4c^3 + 32c^2$

**LESSON 6-5** Solve each polynomial equation by factoring.

39.  $2x^3 + 3x^2 - 8x - 12 = 0$      $x = -2, \frac{3}{2}, 4$     40.  $-3x^3 + 30x^2 + 5x - 50 = 0$      $x = \pm \sqrt{\frac{5}{3}}, 10$

Identify the roots of each equation. State the multiplicity of each root. 41-46. See p. A57.

41.  $x^3 + 15x^2 + 75x + 125 = 0$     42.  $x^3 - 2x^2 - 32x + 96 = 0$

43.  $8x^3 - 12x^2 + 6x - 1 = 0$     44.  $4x^3 + 16x^2 - 25x - 100 = 0$

Identify all of the real roots of each equation.

45.  $2x^4 - x^3 - 14x^2 - 5x + 6 = 0$     46.  $6x^3 - 11x^2 - 19x - 6 = 0$

Chapter 6 Skills Practice

**LESSON 6-6** Write the simplest polynomial function with the given zeros. 47-50. See p. A57.

47. -1, 1, 4    48.  $-3, \frac{1}{2}, \frac{1}{3}$     49.  $-3, 1, \frac{2}{3}$     50. -5, 1, 2

Solve each equation by finding all roots.

51.  $x^4 - 5x^3 + 15x^2 - 45x + 54 = 0$     52.  $2x^4 + 5x^3 - 10x^2 + 10x + 8 = 0$   
 $\frac{2}{3}, 3, 3i, -3i$

Write the simplest polynomial function with the given zeros. 53-58. See p. A57.

53.  $3\sqrt{5}$     54.  $1 + i, 2$     55.  $-2, 2i$     56.  $1, \sqrt{2}, i$

**LESSON 6-7** Identify the leading coefficient, degree, and end behavior.

57.  $P(x) = 7x^3 - 12x^2 + 9x - 10$     58.  $Q(x) = -3x^5 + 8x^4 - 16x + 1$

Identify whether the function graphed has an odd or even degree and a positive or negative leading coefficient.

59.    even; negative    odd; positive    odd; negative

Graph each function. 62-69. For graphs, see p. A57.

62.  $Q(x) = -4x^3 - 12x^2 + x + 3$     63.  $R(x) = 2x^4 + x^3 - 19x^2 - 9x + 9$

Graph each function on a calculator, and estimate the local maxima and minima.

64.  $S(x) = -2x^4 + x^3 + 5x^2 + 6$     65.  $T(x) = x^3 + 5x^2 + 3x + 1$   
 max.: 8.03, 10.94; min.: 6    max.: 10; min.: 0.52

For  $f(x) = 2x^2 - 3$ , write the rule for each function and sketch the graph.

66.  $g(x) = f(x) + 6$     67.  $h(x) = 2(f(x-2))^2 - 3$     68.  $j(x) = f(-x)$     69.  $k(x) = \frac{1}{3}f(x)$   
 $g(x) = 2x^2 + 3$      $h(x) = 2(x-2)^2 - 3$      $j(x) = -2x^2 - 3$      $k(x) = x^2 - \frac{3}{2}$

Let  $f(x) = -3x^4 + 2x^2 - 7x + 10$ . Write a function  $g$  that performs each transformation.

70. Reflect  $f(x)$  across the  $y$ -axis.    71. Reflect  $f(x)$  across the  $x$ -axis.  
 $g(x) = -3x^4 + 2x^2 + 7x + 10$      $g(x) = 3x^4 - 2x^2 + 7x - 10$

Let  $f(x) = x^3 - 7x^2 + 5$ . Graph  $f$  and  $g$  on the same coordinate plane. Describe  $g$  as a transformation of  $f$ . 72-76. See p. A57.

72.  $g(x) = f(x + 4)$     73.  $g(x) = -2f(x)$     74.  $g(x) = f(-x) - 3$

Write a function that transforms  $f(x) = 3x^3 - 5x^2 + x + 1$  in each of the following ways. Support your solution by using a graphing calculator.

75. Stretch vertically by a factor of 3 and move 1 unit to the right.

76. Reflect across the  $y$ -axis and move 1 unit down.

**LESSON 6-9** Use finite differences to determine the degree of the polynomial that best describes the data.

77. 

x	-2	-1	0	1	2	3
y	-24	-4	6	12	20	36

    78. 

x	-2	-1	0	1	2	3
y	-27	0	9	12	69	288

cubic    quartic

## Chapter 7 Skills Practice

**LESSON 7-1** Tell whether the function shows growth or decay. Then graph. 1–3. For graphs, see p. A58.

1.  $f(x) = 12(2.4)^x$  growth    2.  $f(x) = 20\left(\frac{4}{5}\right)^x$  decay    3.  $f(x) = 0.25(5)^x$  growth

Explain whether each function is exponential. 4–8. See p. A58.

4.  $f(x) = 4x^2$     5.  $f(x) = 0.6^x$     6.  $f(x) = 10(0)^x$

**LESSON 7-2** Graph the relation and connect the points. Then graph the inverse. Identify the domain and range of each relation.

7. 

x	1	2	3	4
y	-1	0	2	4

8. 

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

Use inverse operations to write the inverse of each function.

9.  $f(x) = 15x$   $f^{-1}(x) = \frac{x}{15}$     10.  $f(x) = x + 9$   $f^{-1}(x) = x - 9$     11.  $f(x) = \frac{x}{7}$   $f^{-1}(x) = 7x$   
 12.  $f(x) = 3x + 2$   $f^{-1}(x) = \frac{x-2}{3}$     13.  $f(x) = \frac{5-x}{2}$   $f^{-1}(x) = \frac{4}{5}(x-5)$     14.  $f(x) = \frac{2x+1}{5}$   $f^{-1}(x) = \frac{5x-1}{2}$

Graph each function. Then write and graph its inverse. 15–17. See p. A58.

15.  $f(x) = 2x + 4$     16.  $f(x) = 0.8x + 1$     17.  $f(x) = \frac{4x-5}{3}$

**LESSON 7-3** Write each exponential equation in logarithmic form.

18.  $3^5 = 243$     19.  $5^{10} = 1$     20.  $16^{15} = 64$     21.  $7^x = 343$   
 $\log_3 243 = 5$      $\log_5 1 = 0$      $\log_{16} 64 = 1.5$      $\log_7 343 = x$

Write each logarithmic equation in exponential form.

22.  $\log_6 512 = 1.5$     23.  $\log_3 0.125 = -3$     24.  $\log_2 x = 70$     25.  $\log_2 12 = 3$   
 $64^{1.5} = 512$      $2^{-3} = 0.125$      $4^{70} = x$      $x^3 = 12$

Evaluate by using mental math.

26.  $\log_{10} 1000$     27.  $\log_3 0.2$     28.  $\log_{0.5} 0.125$     29.  $\log_{0.1} 1.21$   
 $\frac{3}{-1}$

Use the given x-values to graph each function. Then graph its inverse. Describe the domain and range of the inverse function. 30–31. See p. A58.

30.  $f(x) = 4^x$ ;  $x = -2, -1, 0, 1, 2$     31.  $f(x) = 0.2^x$ ;  $x = -2, -1, 0, 1, 2$

32.  $\log_3 128 = 7$     33.  $\log_4 16 = 2$     34.  $\log_5 5 = 1$

**LESSON 7-4** Express as a single logarithm. Simplify, if possible.

32.  $\log_2 10 + \log_2 12.8$     33.  $\log_8 8 + \log_8 2$     34.  $\log_5 1.25 + \log_5 4$   
 35.  $\log_2 144 - \log_2 4$     36.  $\log_{10} 0.000 - \log_{10} 100$     37.  $\log_8 8 - \log_8 1$   
 $\log_2 36 = 2$      $\log_{10} 100 = 2$      $\log_8 8 = 1$

Simplify, if possible.

38.  $\log_6 64^4 \cdot 8$     39.  $\log_7 49^5 \cdot 10$     40.  $\log_3 1^4 \cdot 0$   
 41.  $\log_3 3^{5x+8} \cdot 5x + 8$     42.  $4^{\log_2 12} \cdot 12$     43.  $\log_{0.1} 1.4^5 \cdot 5$

Evaluate.

44.  $\log_4 256$     45.  $\log_4 \left(\frac{1}{64}\right)$     46.  $\log_3 7$     47.  $\log_4 13$   
 4     $\frac{1}{3}$      $\log_3 7 \approx 1.77$      $\log_4 13 \approx 1.85$

## Chapter 7 Skills Practice

**LESSON 7-5** Solve and check.

48.  $3^{x+1} = 9^4$     49.  $32^{x-2} = 8^x$     50.  $9^x = 12$     51.  $3.5^{2x-1} = 15$   
 $x = 7$      $x = 5$      $x \approx 1.13$      $x \approx 1.58$

Solve.

52.  $\log_6(4x-9) = \log_6(x)$     53.  $\log_2(10x+13) = 3$     54.  $\log_3(20x) - \log_3 4 = 20$   
 $x = 3$      $x = 3$      $x = 20$   
 55.  $\log_5 x^3 = 8$     56.  $\log_2 x + \log_2(2x-1) = 1$     57.  $\log_2\left(\frac{2}{x}\right) + 2 = 0$   
 $x = 9^2 \approx 350.47$      $x = \frac{5}{2}$      $x = 16$

Use a table and a graph to solve.

58.  $3^{4x-3} = 243$     59.  $3^{4x} \geq 1728$     60.  $\log_2 x^3 = x - 94$     61.  $3 \log_2 x^2 < 6$   
 $x = 2$      $x \geq 3$      $x = 100$      $-10 < x < 10 (x \neq 0)$

**LESSON 7-6** Graph. 62–65. See p. A55.

62.  $f(x) = e^x - 1$     63.  $f(x) = -2e^x + 3$     64.  $f(x) = 2 - e^{-x}$     65.  $f(x) = 1.5e^{x+1}$

Simplify.

66.  $\ln e^{20}$     67.  $\ln e^{2x+10}$     68.  $e^{\ln 5x^2}$     69.  $e^{2 \ln 2x}$   
 20     $2x + 10$      $5x^2$      $4x^2$

**LESSON 7-7** Make a table of values and graph each function. Describe the asymptote. Tell how the graph is transformed from the graph of  $f(x) = 4^x$ . 70–78. See pp. A58–59.

70.  $g(x) = 4^x - 2$     71.  $h(x) = 4^{x+2}$     72.  $f(x) = 4^{x-1} - 4$

Graph each exponential function. Find the y-intercept and the asymptote. Describe how the graph is transformed from the graph of its parent function.

73.  $g(x) = -\frac{1}{2}(3)^x$     74.  $h(x) = 3(2^{-x})$     75.  $f(x) = 5e^{x+1}$

Graph each logarithmic function. Find the asymptote. Then describe how the graph is transformed from the graph of its parent function.

76.  $g(x) = -4 \log x$     77.  $h(x) = 3 \ln(3-x)$     78.  $f(x) = \ln(0.5x) - 3$

Write each transformed function by using the given parent function and the indicated transformations.

79. The parent function  $f(x) = 6^x$  is horizontally stretched by a factor of 3 and translated 4 units to the left.  $g(x) = 6^{\frac{x}{3}}$

80. The parent function  $f(x) = \log x$  is vertically compressed by a factor of  $\frac{1}{5}$ , reflected across the y-axis, and translated 10 units down.  $g(x) = \frac{1}{5} \log(-x) - 10$

**LESSON 7-8** Determine whether  $f$  is an exponential function of  $x$ . If so, find the constant ratio.

81. 

x	-2	-1	1	2	3
y	0.4	2	10	50	250

  
 $f$  is an exponential function.  
 The constant ratio is 5.

82. 

x	-2	-1	0	1	2
y	-17	-2	13	28	43

  
 $f$  is not an exponential function.

83. 

x	-2	-1	0	1	2
y	4	2	1	0.5	0.25

  
 $f$  is an exponential function.  
 The constant ratio is  $\frac{1}{2}$ .

84. 

x	-2	-1	0	1	2
y	-6	1	12	37	54

  
 $f$  is not an exponential function.

## Chapter 8 Skills Practice

**LESSON 8-1** Given:  $y$  varies directly as  $x$ . Write and graph each direct variation function.

1.  $y = 8$  when  $x = 2$     2.  $y = 21$  when  $x = 3$     3.  $y = 4$  when  $x = 2.5$   
 $y = 4x$      $y = 7x$      $y = 1.6x$

Given:  $y$  varies inversely as  $x$ . Write and graph each inverse variation function.

4.  $y = 4$  when  $x = 2$   $y = \frac{8}{x}$     5.  $y = 4$  when  $x = \frac{1}{2}$   $y = \frac{2}{x}$     6.  $y = \frac{3}{5}$  when  $x = 10$   $y = \frac{6}{x}$

Determine whether each data set represents a direct variation, an inverse variation, or neither.

7. 

x	1	3	6
y	2.5	7.5	15

 direct
8. 

x	2	4	8
y	6	10	18

 neither
9. 

x	2	8	20
y	5	1.25	0.5

 indirect

**LESSON 8-2** Simplify. Identify any x-values for which the expression is undefined. 10–12. See p. A59.

10.  $\frac{6x^3}{27x^2 + 12x}$     11.  $\frac{x^2 - x - 2}{3x - 6}$     12.  $\frac{-x^2 + 16}{-x^2 - 9x - 20}$

Multiply or divide. Assume that all expressions are defined.

13.  $\frac{4xy^3 \cdot 20x^2y^2}{5x^2 \cdot -16xy^2} \cdot \frac{x}{y^2}$     14.  $\frac{x^2 - 9}{2x + 10} \cdot \frac{x + 5}{x - 3} \cdot \frac{x + 3}{2}$     15.  $\frac{x - 4}{2x^2} \cdot \frac{x}{x - 12} \cdot \frac{1}{2x(x + 3)}$   
 16.  $\frac{3x^2}{4x + 4} \div \frac{9x}{x + 1} \cdot \frac{x^2}{12}$     17.  $\frac{12x^2y^6}{9xy} \div \frac{6y^2}{3x} \cdot \frac{2x^3y^2}{3}$     18.  $\frac{x^2 - 16}{x^2 + 4x + 3} \div \frac{x - 4}{x + 1} \cdot \frac{x + 4}{x + 3}$

**LESSON 8-3** Find the least common multiple for each pair.

19.  $6x^2y$  and  $2xy^2$     20.  $x^2 + 5x$  and  $x^2 - 25$     21.  $x^2 - 3x - 18$  and  $x^2 - 5x - 6$   
 $6x^2y^2$      $x(x-5)(x+5)$      $(x-6)(x+1)(x+3)$

Add or subtract. Identify any x-values for which the expression is undefined.

22.  $\frac{x + 9}{2x + 1} + \frac{3x + 6}{2x + 1}$     23.  $\frac{2}{x^2 + 3} + \frac{4x}{x^2 - 9}$     24.  $\frac{1}{x^2 + 6x + 8} + \frac{1}{x^2 - 6x - 16}$   
 25.  $\frac{x - 6}{x + 5} - \frac{8x + 7}{x + 5}$     26.  $\frac{x}{x + 1} - \frac{3}{x + 4}$     27.  $\frac{7}{x - 9} - \frac{2x - 6}{x^2 - 13x + 36}$

Simplify. Assume that all expressions are defined.

28.  $\frac{3x + 21}{x + 7} \cdot \frac{1}{9x}$     29.  $\frac{x - 1}{10x^2} - \frac{2}{-4x + 4}$     30.  $\frac{\frac{1}{x-2}}{\frac{x+3}{x^2-4}} \cdot \frac{x+2}{x+3}$

**LESSON 8-4** Using the graph of  $f(x) = \frac{1}{x}$  as a guide, describe the transformation and graph each function. 31–39. See p. A59.

31.  $g(x) = \frac{1}{x-4}$     32.  $g(x) = \frac{1}{x} + 6$     33.  $g(x) = \frac{1}{x+2} - 5$

Identify the zeros and asymptotes of each function. Then graph.

34.  $f(x) = \frac{x^2 - 5x - 24}{2x + 1}$     35.  $f(x) = \frac{2x^2 - 3x - 2}{x - 4}$     36.  $f(x) = \frac{-3x^2 + 8x - 4}{x^2 - 25}$

Identify holes in the graph of each function. Then graph.

37.  $f(x) = \frac{x^2 - 4x - 21}{x + 3}$     38.  $f(x) = \frac{x^2 - 4x - 5}{x^2 - 25}$     39.  $f(x) = \frac{x^2 - 3x}{4x - 12}$

## Chapter 8 Skills Practice

**LESSON 8-5** Solve each equation.

40.  $12 + \frac{2}{3x} = 6$     41.  $x - \frac{1}{x} = \frac{35}{3x} \pm 6$     42.  $\frac{x}{x+1} + \frac{x}{4} = \frac{-3x}{4x+4} - 2, 0$

43.  $\frac{x-1}{8} = \frac{x+6}{4}$     44.  $\frac{6x}{x+5} = \frac{2x-20}{x+5}$     45.  $\frac{4}{x-4} = \frac{-x}{x-4} + \frac{2}{3} \pm \sqrt{17}$   
 no solution

Solve each inequality by using a graph and a table.

46.  $\frac{2x+1}{x} \geq 3$     47.  $\frac{4}{x+3} < 2$     48.  $\frac{x-4}{2x} \geq 2$      $\frac{4}{3} \leq x < 0$   
 $0 < x < 1$      $x > -1$  or  $x < -3$

Solve each inequality algebraically.

49.  $\frac{3}{x+2} \leq 1$     50.  $\frac{10}{x-2} < 2$     51.  $\frac{15}{x+3} \leq 1$   
 $x < -2$  or  $x \geq 1$      $x < 2$  or  $x > 7$      $x < -3$  or  $x \geq 12$

**LESSON 8-6** Simplify each expression. Assume all variables are positive.

52.  $\sqrt{343x^3} \cdot 7x^2$     53.  $\sqrt{\frac{x^2}{32}} \cdot \frac{x}{2}$     54.  $\sqrt{\frac{x^2y^4}{10}} \cdot \frac{x^2y\sqrt{1000}}{10}$

Write each expression in radical form, and simplify.

55.  $81^{\frac{3}{2}}$  729    56.  $243^{\frac{2}{3}}$  9    57.  $(-8)^{\frac{1}{3}}$  16

Write each expression using rational exponents.

58.  $\sqrt[3]{10^2} \cdot 10^5$     59.  $\sqrt[3]{17^3} \cdot 17^{\frac{1}{3}}$     60.  $(\sqrt{6})^3 \cdot 8^{\frac{3}{2}}$

Simplify each expression.

61.  $8^{\frac{1}{2}} \cdot 8^{\frac{5}{2}}$  512    62.  $\frac{4^{\frac{2}{3}}}{4^{\frac{1}{3}}}$  64    63.  $(100^{\frac{1}{3}})^3$  1000

**LESSON 8-7** Graph each function, and identify its domain and range. 64–72. See pp. A59–60.

64.  $f(x) = \sqrt{x-4} + 1$     65.  $f(x) = -\frac{1}{2}\sqrt{x}$     66.  $f(x) = 2\sqrt{x+2}$

Using the graph of  $f(x) = \sqrt{x}$  as a guide, describe the transformation and graph each function.

67.  $g(x) = \sqrt{x-8}$     68.  $g(x) = -6\sqrt{x}$     69.  $g(x) = \frac{1}{3}\sqrt{x} + 2$

Graph each inequality.

70.  $y \geq \sqrt{x+2} - 3$     71.  $y < 2\sqrt{-x}$     72.  $y > -4\sqrt{x} + 4$

**LESSON 8-8** Solve each equation.

73.  $\sqrt{2x+10} = 10$  45    74.  $\sqrt{4x+4} = 2\sqrt{4x-9}$   $\frac{10}{3}$     75.  $3\sqrt[3]{x} = \sqrt[3]{7x+40}$  2

76.  $2x + 5 = \sqrt{4x+10}$  8    77.  $2x + 5 = \sqrt{4x+10}$  8    78.  $x + 6 = \sqrt{4x+21}$  -5, -3

79.  $(3x-5)^{\frac{1}{2}} = 4$     80.  $(x-4)^{\frac{1}{3}} = -2$   $-\frac{5}{2}$     81.  $(8x-7)^{\frac{1}{2}} = x$   
 7    -4    1, 7

Solve each inequality.

82.  $\sqrt{x-7} < 3$     83.  $\sqrt{3x+1} + 2 \leq 6$     84.  $\sqrt{2x-3} > 5$   
 $7 \leq x < 16$      $-\frac{1}{3} \leq x \leq 5$      $x > 14$

