Answers for Lesson 7-1   Exercises

1. 15, −15

2. 0.07, −0.07

3. none

4. $\frac{8}{13}$, −$\frac{8}{13}$

5. −4

6. 0.5

7. −$\frac{1}{2}$

8. 0.07

9. 2, −2

10. none

11. 0.3, −0.3

12. $\frac{10}{3}$, −$\frac{10}{3}$

13. 6

14. −6

15. no real-number root

16. 0.6

17. −4

18. −4

19. −3

20. no real-number root

21. $4|x|$

22. $0.5|x^3|$

23. $x^4|y^9|$

24. $8b^{24}$

25. −4a

26. $3y^2$

27. $x^2|y^3|$

28. $2y^2$

29. 1.34 in.

30. 1.68 ft

31. 0.48 cm

32. 0.08 mm

33. 10, −10

34. 1, −1

35. 0.5, −0.5

36. $\frac{2}{3}$, −$\frac{2}{3}$

37. $\sqrt[3]{-64}$, $\sqrt[6]{64}$, −$\sqrt[3]{-64}$, $\sqrt{64}$

38. a. ≈35 ft

   b. ≈20 ft longer

39. 0.5

40. $\frac{1}{3}$

41. 0.2

42. $\frac{1}{4}$

43. $2|c|$

44. $3xy^2\sqrt[3]{3}$

45. $12y^2z^2|x|\sqrt{xy}$

46. y^4

47. $-y^4$

48. k^3

49. $-k^3$

50. $|x+3|$

51. $(x+1)^2$

52. $|x|$

53. x^2

54. $|x^3|$

Answers for Lesson 7-1   Exercises (cont.)

55. Answers may vary. Sample: $\sqrt[3]{-8x^6}, -\sqrt[4]{16x^8}, \sqrt[5]{-32x^{10}}$

56. a. for all positive integers
    b. for all odd positive integers

57. Yes, because 10 is really 10^1.

58. All; x^2 is always nonnegative.

59. Some; true only for $x \geq 0$.

60. Some; true only for $x = -1, 0, 1$.

61. Some; true only for $x \geq 0$.

62. $|m|$ **63.** m^2 **64.** $|m^3|$ **65.** m^4

66. m **67.** m^2 **68.** m^3 **69.** m^4

Answers for Lesson 7-2   Exercises

1. 16

2. 4

3. -9

4. 4

5. not possible

6. 5

7. -6

8. 6

9. $2x\sqrt{5x}$

10. $3\sqrt[3]{3x^2}$

11. $5x^2\sqrt{2x}$

12. $2a\sqrt[3]{4a^2}$

13. $3y^3\sqrt[3]{2y}$

14. $10a^3b^3\sqrt{2b}$

15. $-5x^2y\sqrt[3]{2y^2}$

16. $2y\sqrt[4]{4x^3y^2}$

17. $2\sqrt[3]{12}$

18. $8y^3\sqrt{5y}$

19. $7x^3y^4\sqrt{6y}$

20. $40xy\sqrt{3}$

21. $30y^2\sqrt[3]{2y}$

22. $-2x^2y\sqrt[3]{30x}$

23. 10

24. $\frac{4x}{y}$

25. $2x^2y^2\sqrt{2}$

26. $5x\sqrt[3]{x^2y^2}$

27. $\frac{\sqrt{2x}}{2}$

28. $\frac{\sqrt{10x}}{4x}$

29. $\frac{\sqrt[3]{4x}}{2}$

30. $\frac{\sqrt[3]{45x^2}}{3x}$

31. $\frac{\sqrt[4]{250}}{5}$

32. $5x^2\sqrt{5}$

33. $\frac{\sqrt{15y}}{5y}$

34. $\frac{x\sqrt{10}}{2y}$

35. $r = \dfrac{\sqrt{Gm_1m_2F}}{F}$

36. a. $\dfrac{\sqrt{6}\ +\ 3}{15}$

   b. $\dfrac{\sqrt{6}\ +\ 3}{15}$

   c. Answers may vary. Sample: First simplify the denominator. Since $\sqrt{98} = \sqrt{2 \cdot 49} = 7\sqrt{2}$, to rationalize the denominator, multiply the fraction by $\frac{\sqrt{2}}{\sqrt{2}}$. This yields $\dfrac{\sqrt{2} \cdot 2\ +\ \sqrt{3} \cdot 2}{7\sqrt{2} \cdot 2} = \dfrac{2\ +\ \sqrt{6}}{14}$.

37. $10\sqrt{2}$

38. $4\sqrt[3]{5}$

39. $3x^6y^5\sqrt{2y}$

40. $20x^2y^3\sqrt{y}$

41. $10 + 7\sqrt{2}$

42. $15 + 3\sqrt{21}$

43. $5 + 5\sqrt{3}$

44. $2x\sqrt[3]{2}$

45. $3x^2\sqrt[3]{x}$

Answers for Lesson 7-2   Exercises (cont.)

46. $\dfrac{x\sqrt{10y}}{2y^2}$

47. $\dfrac{5\sqrt{14x}}{21x}$

48. $\dfrac{\sqrt[3]{3x^2}}{3x}$

49. $\dfrac{2\sqrt[3]{25x}}{x}$

50. $\dfrac{\sqrt[3]{2xy^2}}{xy}$

51. $-\dfrac{\sqrt{33x}}{4x}$

52. $-4\sqrt[3]{4} - 6\sqrt[3]{2}$

53. $\dfrac{3\sqrt{5}+5}{5}$

54. $\dfrac{\sqrt{6}-2}{4}$

55. about 212 mi/h greater

56. $20\sqrt{22}\ \text{cm}^2$

57. A product of two square roots can be simplified in this way only if the square roots are real numbers. $\sqrt{-2}$ and $\sqrt{-8}$ are not.

58. $288a^5$ ft

59. For some values; it is easy to see that the equation is true if $x = 0$ or $x = 1$. But when $x < 0$, $\sqrt{x^3}$ is not a real number, although $\sqrt[3]{x^2}$ is.

60. Check students' work.

61. $2xy$

62. $2xy^2$

63. $2\sqrt{5}$

64. $\dfrac{\sqrt[3]{x^2y}}{xy}$

65. $\dfrac{\sqrt[5]{yx}}{x}$

66. $\dfrac{\sqrt[6]{x^4y^3}}{y}$

67. $a = -2c, b = -6d$

68. No changes need to be made; since they are both odd roots, there is no need for absolute value symbols.

Answers for Lesson 7-3   Exercises

1. $6\sqrt{6}$

2. $4\sqrt[3]{3}$

3. cannot combine

4. $-2\sqrt{x}$

5. cannot combine

6. $5\sqrt[3]{x^2}$

7. $33\sqrt{2}$

8. $13\sqrt{5}$

9. $7\sqrt{2}$

10. $5\sqrt[3]{2}$

11. $9\sqrt[3]{3} - 6\sqrt[3]{2}$

12. $2\sqrt[4]{2} + 2\sqrt[4]{3}$

13. $8 + 4\sqrt{5}$

14. $23 + 7\sqrt{7}$

15. $63 - 38\sqrt{2}$

16. $8 + 2\sqrt{15}$

17. $49 + 12\sqrt{13}$

18. $38 + 12\sqrt{10}$

19. 14

20. 4

21. -40

22. -2

23. $-2 + 2\sqrt{3}$

24. $\dfrac{12\sqrt{3} + 8}{23}$

25. $13 + 7\sqrt{3}$

26. $\dfrac{11 + 8\sqrt{2}}{-14}$

27. $13\sqrt{2}$

28. $8\sqrt{3}$

29. $48\sqrt{2x}$

30. $5\sqrt{3} - 4\sqrt{2}$

31. $33y\sqrt{6}$

32. $-2\sqrt[3]{2}$

33. $-11 + \sqrt{21}$

34. $8 + \sqrt{10}$

35. $17 + 31\sqrt{2}$

36. $-36 - 15\sqrt{2}$

37. $x + 3\sqrt{3x} + 6$

38. $8y - 22\sqrt{2y} + 30$

39. $\dfrac{89 + 42\sqrt{3}}{-239}$

40. $2\sqrt{3} - \sqrt{2}$

41. $\dfrac{\sqrt{3} - \sqrt{7}}{2}$

42. $\dfrac{2 + 3\sqrt[3]{4}}{2}$

43. $\dfrac{x + 5\sqrt[4]{x^3}}{x}$

44. $2\sqrt[3]{2} - \sqrt[3]{12}$

45. The reciprocal is $\dfrac{-1 + \sqrt{5}}{2}$, which is one less than $\dfrac{1 + \sqrt{5}}{2}$.

46. a must be twice a perfect square.

47. Answers may vary. Sample: Without simplifying first, you must estimate three separate square roots, and then add the estimates. If they are first simplified, then they can be combined as $13\sqrt{2}$. Then only one square root need be estimated.

Answers for Lesson 7-3   Exercises (cont.)

48. $\frac{60 - 20\sqrt{2}}{7}$ s, or about 4.53 s

49. Answers may vary.
Samples: $(\sqrt{7} + 2)(\sqrt{7} - 2); (2\sqrt{2} + \sqrt{5})(2\sqrt{2} - \sqrt{5})$

50. D **51.** $-\frac{1}{2}$ **52.** $4\sqrt{3}$

53. $(a = 0 \text{ and } b \geq 0)$ or $(b = 0 \text{ and } a \geq 0)$

54. In the second step the exponent was incorrectly distributed: $(a - b)^x \neq a^x - b^x$.

55. a. m and n can be any positive integers.

b. m must be even or n must be odd.

c. m must be even, and n can be any positive integer.

Answers for Lesson 7-4   Exercises

1. 6

2. 3

3. 7

4. 10

5. -3

6. 6

7. 8

8. 3

9. 3

10. $\sqrt[6]{x}$

11. $\sqrt[5]{x}$

12. $\sqrt[7]{x^2}$ or $\left(\sqrt[7]{x}\right)^2$

13. $\sqrt[5]{y^2}$ or $\left(\sqrt[5]{y}\right)^2$

14. $\frac{1}{\sqrt[8]{y^9}}$ or $\frac{1}{\left(\sqrt[8]{y}\right)^9}$

15. $\frac{1}{\sqrt[4]{t^3}}$ or $\frac{1}{\left(\sqrt[4]{t}\right)^3}$

16. $\sqrt{x^3}$ or $\left(\sqrt{x}\right)^3$

17. $\sqrt[5]{y^6}$ or $\left(\sqrt[5]{y}\right)^6$

18. $(-10)^{\frac{1}{2}}$

19. $7^{\frac{1}{2}} x^{\frac{3}{2}}$

20. $(7x)^{\frac{3}{2}}$

21. $(7x)^{\frac{3}{2}}$

22. $a^{\frac{2}{3}}$

23. $a^{\frac{2}{3}}$

24. $c^{\frac{1}{2}}$

25. $25x^2y^2$

26. ≈ 72.8 m

27. ≈ 15.1 m

28. ≈ 7.9 m

29. ≈ 1.6 m

30. 4

31. 16

32. 4

33. 64

34. $\frac{1}{16}$

35. 8

36. 64

37. 1000

38. $\frac{1}{x^2}$

39. $\frac{1}{x^4}$

40. $\frac{1}{3x^{\frac{2}{3}}}$

41. $\frac{5}{x^{\frac{2}{3}}}$

42. $-\frac{3}{x^3}$

43. $-2y^3$

44. $\frac{1}{x}$

45. $x^{\frac{13}{3}}$

46. $\frac{y^4}{x^3}$

47. $\frac{y^2}{x^8}$

48. x^3y^9

49. $\frac{y^5}{x^{10}}$

50. -7

51. -3

52. 64

53. 729

54. 2,097,152

55. 1,000,000,000 or 10^9

56. $\frac{1}{4}$

57. $\frac{1}{8}$

58. $\frac{1}{36}$

59. 16

Answers for Lesson 7-4   Exercises (cont.)

60. $-\dfrac{1}{81}$

61. 10

62. about 78%, 61%, 37%

63. A

64. 768

65. $x^{\frac{1}{2}}$

66. $y^{\frac{4}{5}}$

67. $x^{\frac{1}{2}}$

68. $y^{\frac{1}{2}}$

69. $x^{\frac{1}{6}}y^{\frac{1}{4}}$

70. $\dfrac{1}{x^{\frac{1}{4}}y^{\frac{5}{6}}}$

71. $\dfrac{4x^7}{9y^9}$

72. $\dfrac{9y^8}{4x^6}$

73. $\dfrac{1}{x^{\frac{13}{36}}}$

74. $\dfrac{1}{x^{\frac{7}{24}}}$

75. $\dfrac{1}{x^{\frac{1}{3}}}$

76. $\dfrac{1}{(xy)^{\frac{1}{2}}}$

77. The cube root of -64 is -4, which equals $-(64)^{\frac{1}{3}}$. The square root of -64 is not a real number, but $-(64)^{\frac{1}{2}} = -\sqrt{64} = -8$.

78. The exponent $\frac{1}{2}$ applies only to the 5, not to the 25.

79. Answers may vary. Sample: $4 - 5^{\frac{1}{2}}, 2(4 - 5^{\frac{1}{2}}), \dfrac{4 - 5^{\frac{1}{2}}}{2}$; no, if a is rational and the product is rational, then $4 + 5^{\frac{1}{2}}$, must be rational.

80. a. $\sqrt{x} \cdot \sqrt{x} \cdot \sqrt{x} \cdot \sqrt{x} = x \cdot x = x^2$, so $\sqrt[4]{x^2} = \sqrt{x}$
b. $\sqrt[4]{x^2} = \left(x^2\right)^{\frac{1}{4}} = x^{\frac{2}{4}} = x^{\frac{1}{2}} = \sqrt{x}$

81. 49

82. 9

83. $x^{2\pi}$

84. 1

85. $3^{\sqrt{2}}$

86. 9

87. 33.13 mph

Answers for Lesson 7-5   Exercises

1. 16　　　　**2.** 1　　　　**3.** 22　　　　**4.** 4

5. 23　　　**6.** $\frac{2}{3}$　　　**7.** 3, −13　　　**8.** 29, −25

9. 18　　　**10.** 78　　　**11.** 8　　　**12.** 0

13. 30.6 ft　　**14.** 4 in.　　**15.** 3　　　**16.** 1

17. −3, −4　　**18.** 9　　　**19.** 1　　　**20.** 1

21. 3　　　**22.** −2　　　**23.** 1　　　**24.** 6

25. 2　　　**26.** −2　　　**27.** 5　　　**28.** −3

29. 5

30. −2

31. a.

b.

c.
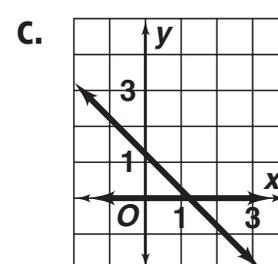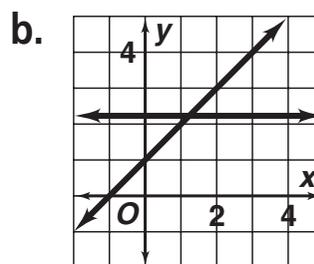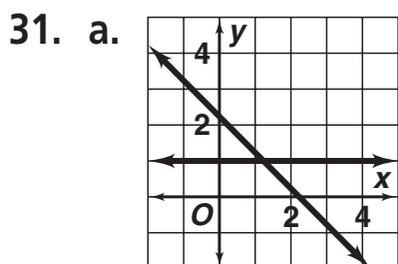
d. The graph of each pair consists of two straight lines, one of which is horizontal. They intersect at different points, but these points have the same x-value, about 1.236.

32. a. $s = \dfrac{\sqrt{2\sqrt{3}A}}{3}$　　　**33.** B

b. about 8.8 in.

c. about 15.2 in.

34. 8　　　**35.** 4　　　**36.** 5　　　**37.** 23

38. 1　　　**39.** 6.5　　　**40.** 9, −7　　　**41.** $\frac{81}{16}$

42. 9　　　**43.** 2　　　**44.** −1, −6　　　**45.** 2

46. 7　　　**47.** 25　　　**48.** 10　　　**49.** −1

50. $\frac{5}{4}$　　　**51.** $d = \frac{v^2}{64}$

Answers for Lesson 7-5   Exercises (cont.)

52. Answers may vary. Sample: $\sqrt{x - 3} = \sqrt{3x + 5}$

53. 1   **54.** 0, 2   **55.** 2   **56.** 0

57. Plan 1: Use a calculator to evaluate $\sqrt{2} + 2$ and store the result as x. Evaluate $\sqrt{x + 2}$ and store the result as x. Continue this procedure about seven times until it becomes clear that the values are approaching 2. **Plan 2:** The given equation is equivalent to $x = \sqrt{2 + x}$. Solve this equation to find that $x = 2$.

58. a. A counterexample is $a = 3, b = -3$.

    b. A counterexample is $a = -5, b = 3$.

Answers for Lesson 7-6   Exercises

1. $x^2 + 3x + 5$ **2.** $x^2 - 3x - 5$ **3.** $-x^2 + 3x + 5$

4. $3x^3 + 5x^2$ **5.** $\dfrac{3x + 5}{x^2}$ **6.** $\dfrac{x^2}{3x + 5}$

7. $x^2 + 3x + 5$ **8.** $-x^2 + 3x + 5$ **9.** $x^2 - 3x - 5$

10. $3x^3 + 5x^2$ **11.** $\dfrac{3x + 5}{x^2}$ **12.** $\dfrac{x^2}{3x + 5}$

13. $2x^2 + 2x - 4$; domain: all real numbers

14. $-2x^2 + 2$; domain: all real numbers

15. $2x^2 - 2$; domain: all real numbers

16. $2x^3 - x^2 - 4x + 3$; domain: all real numbers

17. $2x + 3$; domain: all real numbers except 1

18. $\dfrac{1}{2x + 3}$; domain: all real numbers except $-\frac{3}{2}$ and 1

19. $27x^2$, domain: all real numbers; 3, domain: all real numbers except 0

20. $2x + 3$; 9, -1 **21.** $x^2 + 5$; 14, 9   **22.** 8

23. 104   **24.** 20   **25.** 16

26. 8   **27.** 10   **28.** 12

29. 68   **30.** 404   **31.** 1

32. 25   **33.** -3 **34.** 9

35. 9.25   **36.** 0.25   **37.** 6.25

38. -2.75 **39.** $c^2 - 6c + 9$ **40.** $c^2 - 3$

41. $a^2 + 6a + 9$ **42.** $a^2 - 3$

Answers for Lesson 7-6   Exercises (cont.)

43. a. $f(x) = 0.9x$

b. $g(x) = x - 2000$

c. $14,200

d. $14,400

44. a. $(g \circ f)(x) = 1.0968x$

b. 16.45 pesos

45. $x^2 - x + 7$ **46.** $6x + 13$ **47.** $x^2 - 5x - 3$

48. $-2x^2 + 8x + 1$ **49.** $-x^2 + 5x + 13$ **50.** $2x^2 + 2x + 24$

51. $-3x^2 + 2x + 16$, domain: all real numbers

52. $3x^2 - 12$, domain: all real numbers

53. $3x^3 + 8x^2 - 4x - 16$, domain: all real numbers

54. $-9x^3 - 24x^2 + 12x + 48$, domain: all real numbers

55. $3x - 4$, domain: all real numbers except -2

56. $15x - 20$, domain: all real numbers except -2

57. 7; answers may vary. Sample: First evaluate $f(3)$ since the expression is $(g \circ f)(3)$, and that means $g(f(3))$. Then evaluate $g(6)$.

58. 1 **59.** -4 **60.** 0 **61.** 2

62. a. ≈ 1963; the area after 2 seconds is about 1963 in.^{2}.

b. ≈ 7854 in.^{2}

63. $3x^2, 9x^2$ **64.** $x - 2, x - 2$

65. $12x^2 + 2, 6x^2 + 4$ **66.** $x - 3, x - 6$

67. $-4x - 7, -4x - 28$ **68.** $\dfrac{x^2 + 5}{2}, \dfrac{x^2 + 10x + 25}{4}$

Answers for Lesson 7-6   Exercises (cont.)

69. Answers may vary. Sample:

   a. $g(x) = 0.12x$

   b. $f(x) = 9.50x$

   c. $(g \circ f)(x) = 1.14x$; your savings will be $1.14 for each hour you work.

70. **a.** $f(x)$ and $g(x)$

   b. $0, 15, 30; 3, 28, 103$

   c. $3x^2 + 9$

   d. $3{*}\text{A}1{\wedge}2 + 9, 9, 84, 309$

   e. $9x^2 + 3$

   f. $9{*}\text{A}1{\wedge}2 + 3, 3, 228, 903$

71. **a.** $P(x) = 5295x - 1000$

   b. $157,850

72. **a.** $g(x)$ is the bonus earned when x is the amount of sales over $5000. $h(x)$ is the excess of x sales over $5000.

   b. $(g \circ h)(x)$ because you first need to find the excess sales over $5000 to calculate the bonus.

73.
$$
\begin{aligned}
(f + g)(x) &= f(x) + g(x) && \text{Def. of Function Add.}\\
&= 3x - 2 + (x^2 + 1) && \text{Substitution}\\
&= x^2 + 3x - 2 + 1 && \text{Comm. Prop.}\\
&= x^2 + 3x - 1 && \text{arithmetic}
\end{aligned}
$$

74.
$$
\begin{aligned}
(f - g)(x) &= f(x) - g(x) && \text{def. of function subtraction}\\
&= 3x - 2 - (x^2 + 1) && \text{substitution}\\
&= 3x - 2 - x^2 - 1 && \text{Opp. of Sum Prop.}\\
&= -x^2 + 3x - 2 - 1 && \text{Comm. Prop.}\\
&= -x^2 + 3x - 3 && \text{arithmetic}
\end{aligned}
$$

Answers for Lesson 7-6   Exercises (cont.)

75. $(f \circ g)(x) = f(g(x))$ def. of comp. functions
$= f(x^2 + 1)$ substitution
$= 3(x^2 + 1) - 2$ substitution
$= 3x^2 + 3 - 2$ Dist. Prop.
$= 3x^2 + 1$ arithmetic

76. a. $f(x) = x + 10; g(x) = 1.09x$

b. Each grade is increased 9% before adding the 10-point bonus; 91.75.

c. Add the 10-point bonus and then increase the sum by 9%; 92.65.

d. no

77. $x^7 - x^6 - 16x^5 + 10x^4 + 85x^3 - 25x^2 - 150x$; domain: all real numbers

78. $\frac{x^2 + 2x}{x - 3}$; domain: all real numbers except 3, $\sqrt{5}$, and $-\sqrt{5}$

79. $\frac{x - 3}{x^2 + 2x}$; domain: all real numbers except 0, -2, $\sqrt{5}$, and $-\sqrt{5}$

80. x **81.** $\frac{1}{x}$ **82.** $\frac{6 - x}{8}$ **83.** 2

84. 4

Answers for Lesson 7-7   Exercises

1.

x	0	1	0	2
y	1	2	3	4
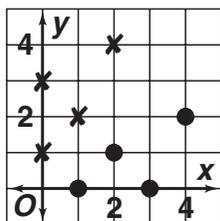
2.

x	0	1	2	3
y	1	2	3	4
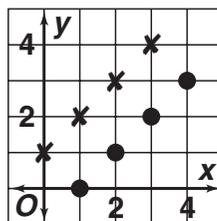
3.

x	0	1	4	9
y	0	1	2	3
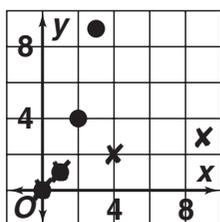
4.

x	2	2	2	2
y	−3	−2	−1	0
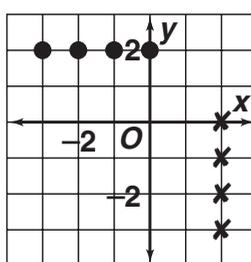
5. $y = \frac{1}{3}x - \frac{1}{3}$; yes

6. $y = \frac{1}{2}x + \frac{1}{2}$; yes

7. $y = -\frac{1}{3}x + \frac{4}{3}$; yes

8. $y = \pm\sqrt{\frac{5 - x}{2}}$; no

9. $y = \pm\sqrt{x - 4}$; no

10. $y = \pm\sqrt{\frac{x + 5}{3}}$; no

11. $y = \pm\sqrt{x} - 1$; no

12. $y = \pm\frac{\sqrt{x} + 4}{3}$; no

13. $y = \pm\frac{\sqrt{x - 5} - 1}{2}$; no

14.

15.

Answers for Lesson 7-7 Exercises (cont.)

16.

17.

18.

19.

20.

21.

22.
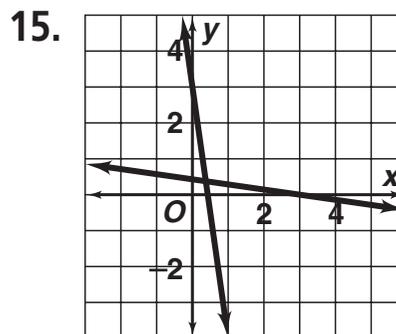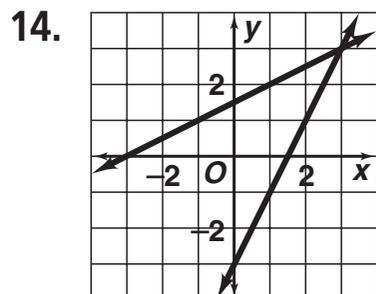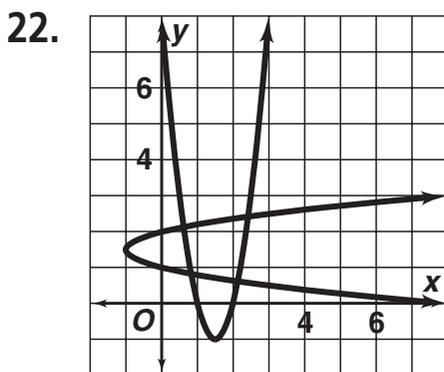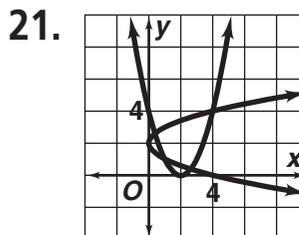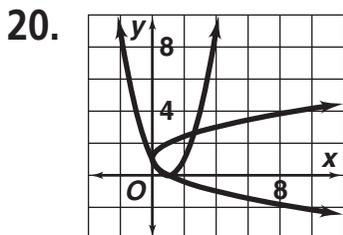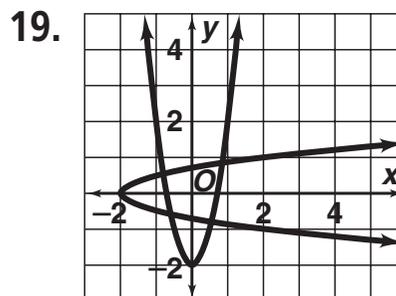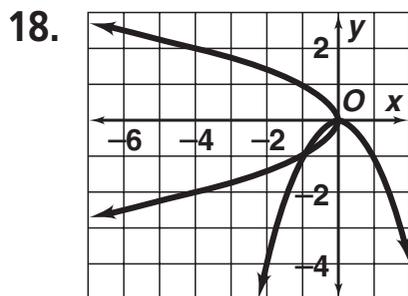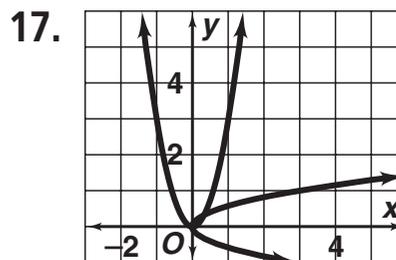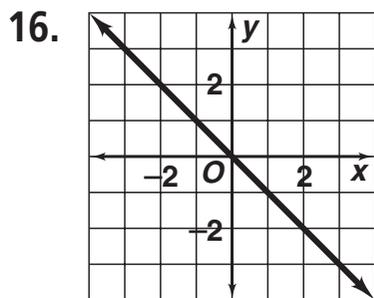
23. $f^{-1}(x) = \frac{x-4}{3}$, and the domain and range for both f and f^{-1} are all real numbers; f^{-1} is a function.

24. $f^{-1}(x) = x^2 + 5$ $x \geq 0$, domain f: $\{x \mid x \geq 5\}$, range f: $\{y \mid y \geq 0\}$, domain f^{-1}: $\{x \mid x \geq 0\}$, and range f^{-1}: $\{y \mid y \geq 5\}$; f^{-1} is a function.

Answers for Lesson 7-7   Exercises (cont.)

25. $f^{-1}(x) = x^2 - 7$ $x \geq 0$, domain f: $\{x \mid x \geq -7\}$, range f: $\{y \mid y \geq 0\}$, domain f^{-1}: $\{x \mid x \geq 0\}$, and range f^{-1}: $\{y \mid y \geq -7\}$; f^{-1} is a function.

26. $f^{-1}(x) = \frac{3 - x^2}{2}$ $x \geq 0$, domain f: $\{x \mid x \leq \frac{3}{2}\}$, range f: $\{y \mid y \geq 0\}$, domain f^{-1}: $\{x \mid x \geq 0\}$, and range f^{-1}: $\{y \mid y \leq \frac{3}{2}\}$; f^{-1} is a function.

27. $f^{-1}(x) = \pm\sqrt{\frac{x - 2}{2}}$ $x \geq 2$, domain f: all reals, range f: $\{y \mid y \geq 2\}$, domain f^{-1}: $\{x \mid x \geq 2\}$, and range f^{-1}: all reals; f^{-1} is not a function.

28. $f^{-1}(x) = \pm\sqrt{1 - x}$ $x \leq 1$, domain f: all reals, range f: $\{y \mid y \leq 1\}$, domain f^{-1}: $\{x \mid x \leq 1\}$, and range f^{-1}: all reals; f^{-1} is not a function.

29. a. $F = \frac{5}{9}(C - 32)$; yes

    b. $-3.89°F$

30. a. $r = \sqrt[3]{\frac{3V}{4\pi}}$; yes

    b. 20.29 ft

31. 10   **32.** -10 **33.** 0.2   **34.** d

35. $f^{-1}(x) = \pm\sqrt{\frac{2x + 8}{3}}$ no   **36.** $f^{-1}(x) = \pm 2\sqrt{\frac{x}{3}}$; no

37. $f^{-1}(x) = \frac{x^2 - 6x + 10}{2}$, $x \geq 3$; yes

38. $f^{-1}(x) = \pm\sqrt{x} - 1$; no   **39.** $f^{-1}(x) = \frac{1 \pm \sqrt{x}}{2}$; no

40. $f^{-1}(x) = -1 \pm \sqrt{x + 1}$; no

41. $f^{-1}(x) = \sqrt[3]{x}$; yes   **42.** $f^{-1}(x) = \pm\sqrt[4]{x}$; no

43. $f^{-1}(x) = \pm\sqrt{\frac{5x - 5}{2}}$; no   **44.** $x = \frac{v^2}{64}$; 25 ft, 6.25 ft

45. The range of the inverse is the domain of f, which is $x \geq 1$.

Answers for Lesson 7-7   Exercises (cont.)

46. 2 and 5

47. $f^{-1}(x) = x^2$ $x \le 0$, domain of f: $\{x \mid x \ge 0\}$, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: $\{y \mid y \ge 0\}$, and f^{-1} is a function.

48. $f^{-1}(x) = (x - 3)^2$ $x \ge 3$, domain of f: $\{x \mid x \ge 0\}$, range of f: $\{y \mid y \ge 3\}$, domain of f^{-1}: $\{x \mid x \ge 3\}$, range of f^{-1}: $\{y \mid y \ge 0\}$, and f^{-1} is a function.

49. $f^{-1}(x) = 3 - x^2$ $x \ge 0$, domain of f: $\{x \mid x \le 3\}$, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: $\{y \mid y \le 3\}$, and f^{-1} is a function.

50. $f^{-1}(x) = x^2 - 2$ $x \ge 0$, domain of f: $\{x \mid x \ge -2\}$, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: $\{y \mid y \ge -2\}$, and f^{-1} is a function.

51. $f^{-1}(x) = \pm\sqrt{2x}$ $x \ge 0$, domain of f: all reals, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: all reals, and f^{-1} is not a function.

52. $f^{-1}(x) = \pm\frac{1}{\sqrt{x}}$ $x > 0$, domain of f: $\{x \mid x \ne 0\}$, range of f: $\{y \mid y > 0\}$, domain of f^{-1}: $\{x \mid x > 0\}$, range of f^{-1}: $\{y \mid y \ne 0\}$, and f^{-1} is not a function.

53. $f^{-1}(x) = \pm\sqrt{x} + 4$ $x \ge 0$, domain of f: all reals, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: all reals, and f^{-1} is not a function.

54. $f^{-1}(x) = 7 \pm \sqrt{x}$ $x \ge 0$, domain of f: all reals, range of f: $\{y \mid y \ge 0\}$, domain of f^{-1}: $\{x \mid x \ge 0\}$, range of f^{-1}: all reals, and f^{-1} is not a function.

55. $f^{-1}(x) = \pm\sqrt{\frac{1}{x}} - 1$ $x > 0$, domain of f: $\{x \mid x \ne -1\}$, range of f: $\{y \mid y > 0\}$, domain of f^{-1}: $\{x \mid x > 0\}$, range of f^{-1}: $\{y \mid y \ne -1\}$, and f^{-1} is not a function.

56. $f^{-1}(x) = \left(-\frac{x-4}{2}\right)^2$ $x \le 4$, domain of f: $\{x \mid x \ge 0\}$, range of f: $\{y \mid y \le 4\}$, domain of f^{-1}: $\{x \le 4\}$, range of f^{-1}: $\{y \mid y \ge 0\}$, and f^{-1} is a function.

57. $f^{-1}(x) = \left(\frac{3}{x}\right)^2$ $x \ge 0$, domain of f: $\{x \mid x > 0\}$, range of f: $\{y \mid y > 0\}$, domain of f^{-1}: $\{x \mid x > 0\}$, range of f^{-1}: $\{y \mid y > 0\}$, and f^{-1} is a function.

58. $f^{-1}(x) = -\frac{1}{2}\left(\frac{1}{x}\right)^2$ $x > 0$, domain of f: $\{x \mid x < 0\}$, range of f: $\{y \mid y > 0\}$, domain of f^{-1}: $\{x \mid x > 0\}$, range of f^{-1}: $\{y \mid y < 0\}$, and f^{-1} is a function.

59. a–b. Answers may vary. Sample:

a.

−2	→	0
0	→	4
2	→	16
4		

b.

0	→	−4
5	→	−2
9	→	0
		4
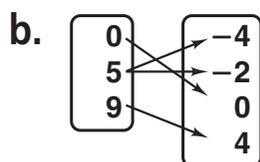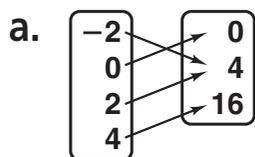
60. r is not a function because there are two y-values for one x-value. r^{-1} is a function because each of its x-values has one y-value.

61. $h = s\sqrt{2}$; $3\sqrt{2}$ in. ≈ 4.2 in. **62.** Check students' work.

63. $f^{-1}(x) = \sqrt[3]{5x}$; yes   **64.** $f^{-1}(x) = x^3 + 5$; yes

65. $f^{-1}(x) = 27x^3$; yes   **66.** $f^{-1}(x) = 2 + \sqrt[3]{x}$; yes

67. $f^{-1}(x) = x^4, x \ge 0$; yes   **68.** $f^{-1}(x) = \pm\sqrt[4]{\frac{5x}{6}}$ no

Answers for Lesson 7-8 Exercises
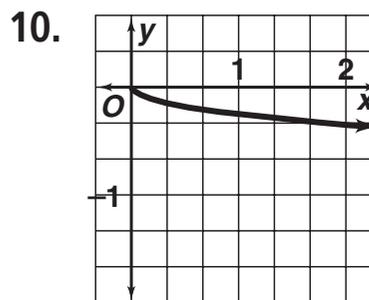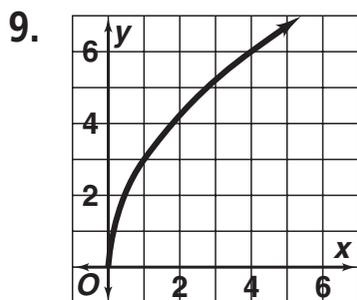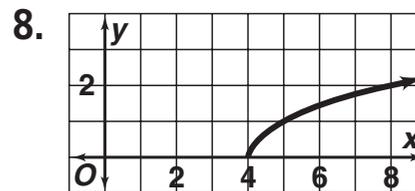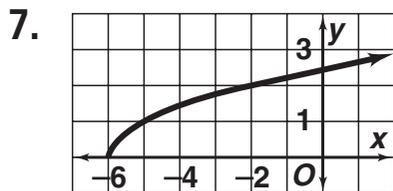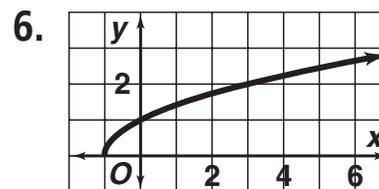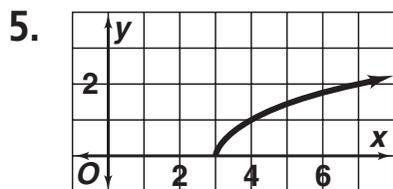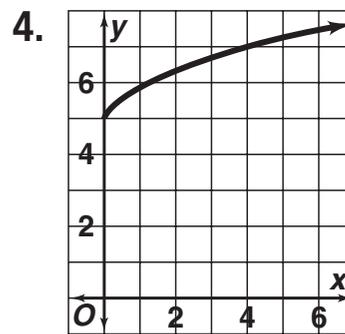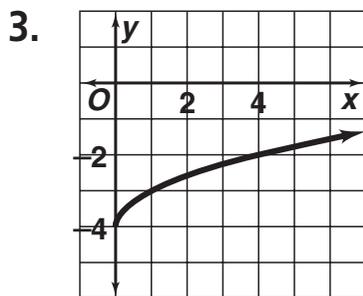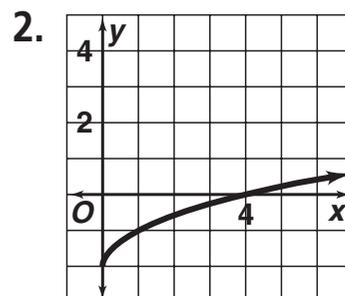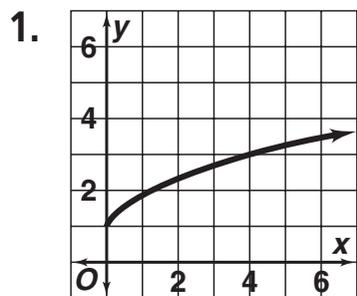
1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Answers for Lesson 7-8   Exercises (cont.)

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

Answers for Lesson 7-8 Exercises (cont.)

21.

22.

23.

24. a.
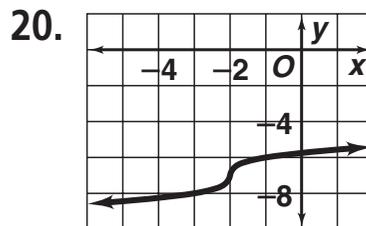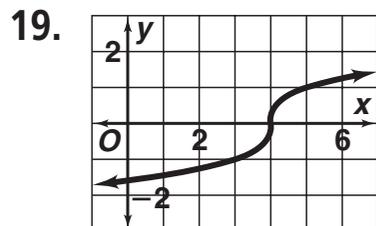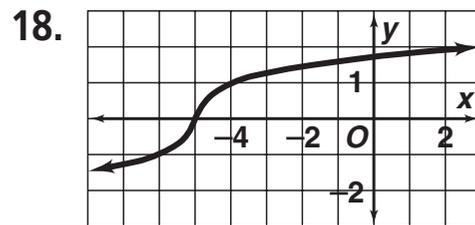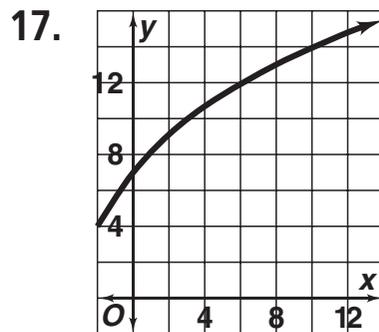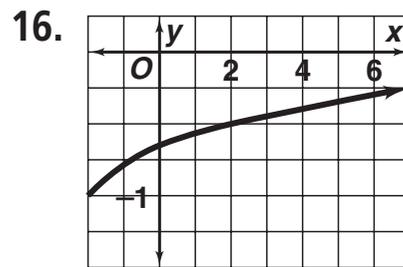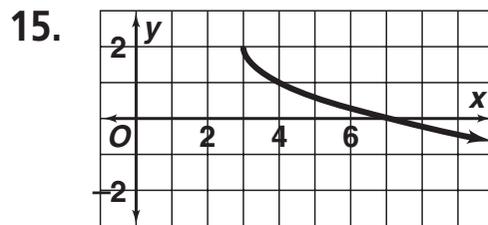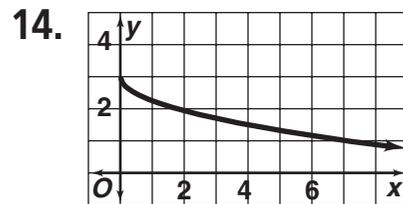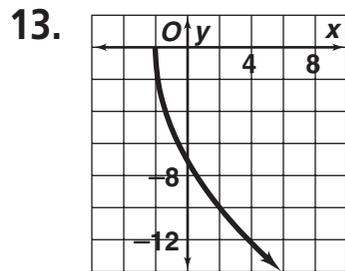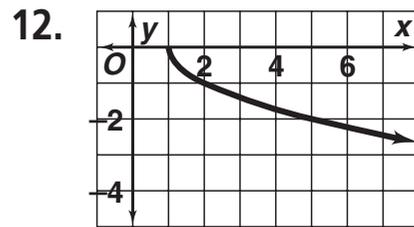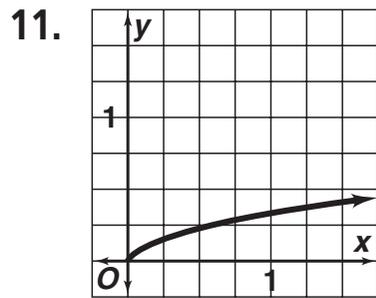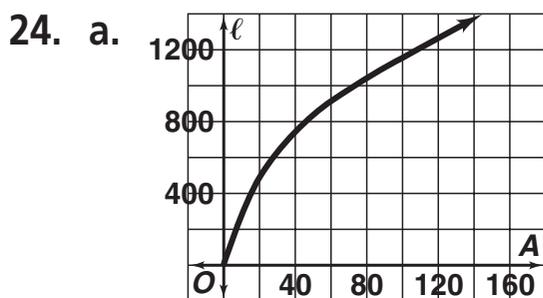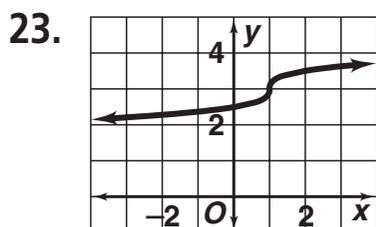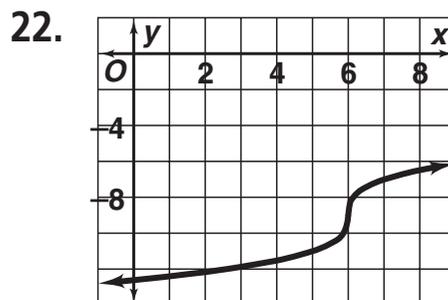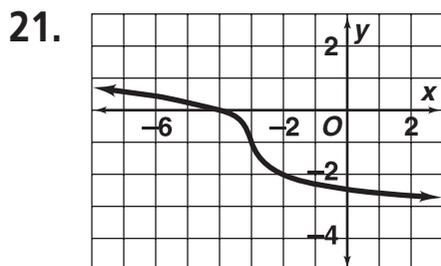
b. ≈745 ft, ≈1053 ft, ≈1343 ft

25. 147 **26.** 9.5 **27.** −8.11

28. no solution; the left-hand side is never negative, but the right is always negative.

29. 5 **30.** −1

31. $y = 3\sqrt{x - 1}$; the graph is the graph of $y = 3\sqrt{x}$ translated 1 unit to the right.

32. $y = -4\sqrt{x + 2}$; the graph is the graph of $y = -4\sqrt{x}$ translated 2 units to the left.

33. $y = -14\sqrt{x + 1}$; the graph is the graph of $y = -14\sqrt{x}$ translated 1 unit to the left.

34. $y = 4\sqrt[3]{x + 2}$; the graph is the graph of $y = 4\sqrt[3]{x}$ translated 2 units to the left.

Answers for Lesson 7-8   Exercises (cont.)

35. $y = 8\sqrt{x-2} - 3$; the graph is the graph of $y = 8\sqrt{x}$ translated 2 units to the right and 3 units down.

36. $y = 3\sqrt[3]{x-2} + 1$; the graph is the graph of $y = 3\sqrt[3]{x}$ translated 2 units to the right and 1 unit up.

37.

D: $x \geq 0$, R: $y \geq 7$

38.

D: $x \geq 0$, R: $y \geq -6$

39.

D: $x \geq 6$, R: $y \geq 0$

40.

D: $x \geq 0$, R: $y \leq 2$

41.

D: $x \geq 0$, R: $y \leq 0$

42.
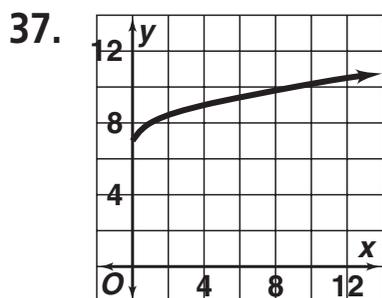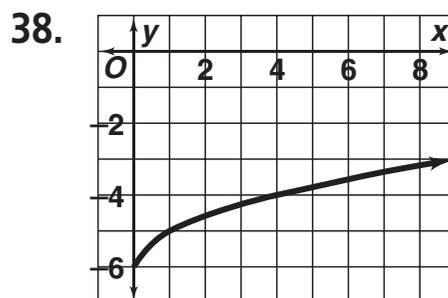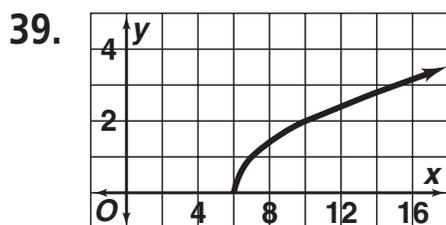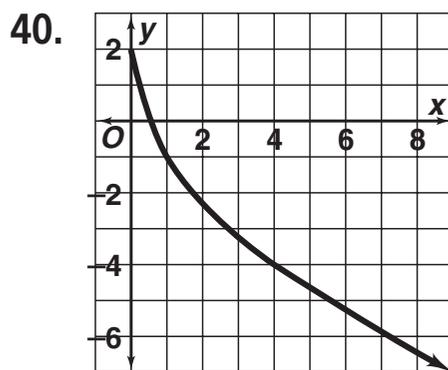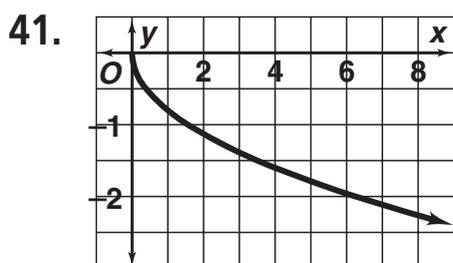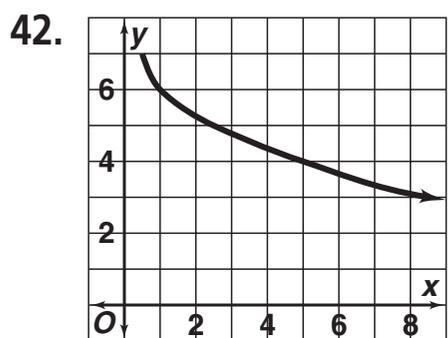
D: $x \geq \frac{1}{2}$, R: $y \leq 7$

Answers for Lesson 7-8   Exercises (cont.)
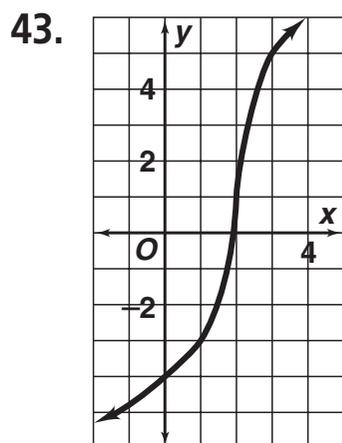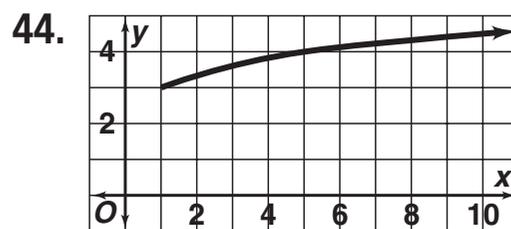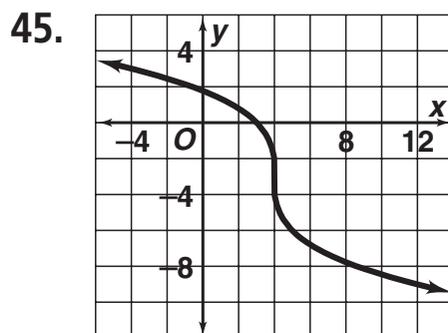
43.

D: all real numbers,
R: all real numbers

44.

D: $x \geq 1$, R: $y \geq 3$

45.


D: all real numbers,
R: all real numbers

46.

D: $x \geq -\frac{1}{2}$, R: $y \leq 0$

47.

D: all real numbers,
R: all real numbers

48.
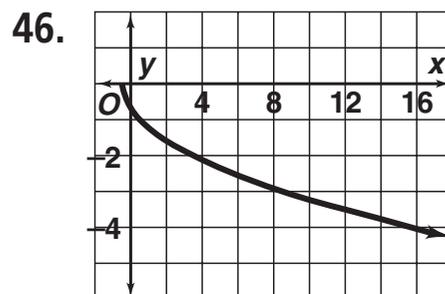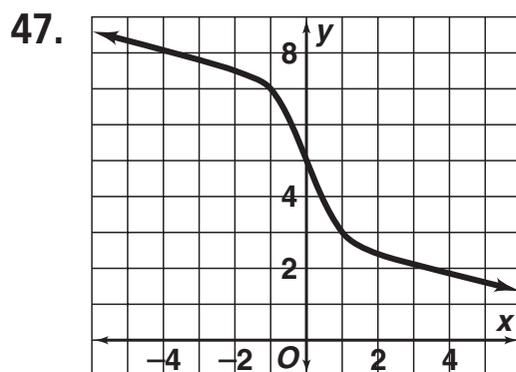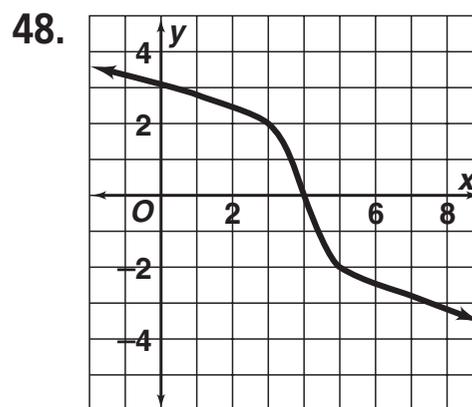
D: all real numbers,
R: all real numbers

Answers for Lesson 7-8   Exercises (cont.)

**49.**

$$D: x \geq -5, R: y \leq -1$$

50.

D: all real numbers,
R: all real numbers

51.

$$D: x \geq \tfrac{3}{4}, R: y \leq 7$$

52. a.

b. ≈ 4.3 s; ≈ 6.1 s

53. a.
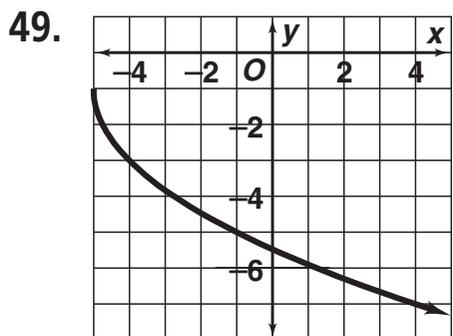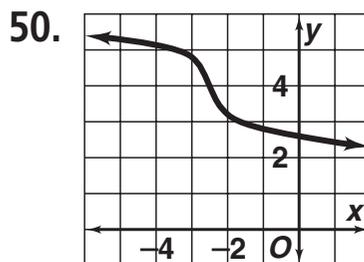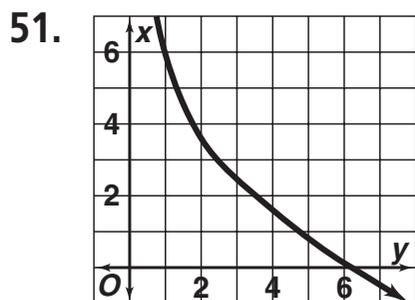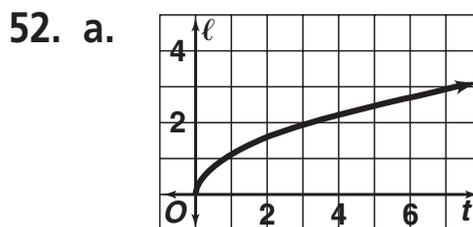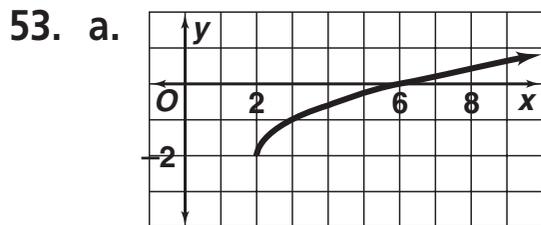

b. D: $x \geq 2$, R: $y \geq -2$

c. $(2, -2)$

d. The domain is based on the x-coordinate of that point, and the range is based on the y-coordinate.

54. a. $y = \sqrt{x - 5} - 2$

    b. $y = \sqrt{x - 1} - 5$

Answers for Lesson 7-8   Exercises (cont.)

55. a.
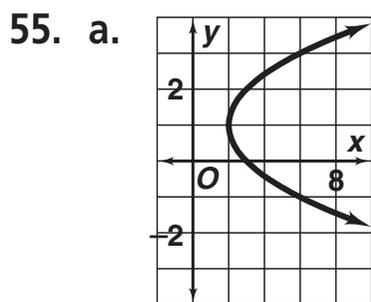
b. Both domains are $x \geq 2$. The range of $y = \sqrt{x - 2} + 1$ is $y \geq 1$. The range of $y = -\sqrt{x - 2} + 1$ is $y \leq 1$.

56. $y = 5\sqrt{x - 4} - 1$; the graph is the same as $y = 5\sqrt{x}$, translated 4 units to the right and 1 down.

57. $y = 6\sqrt{x + 3} + 4$; the graph is the graph of $y = 6\sqrt{x}$ translated 3 units to the left and 4 up.

58. $y = -2\sqrt[3]{x - \frac{1}{4}}$; the graph is the graph of $y = -2\sqrt[3]{x}$ translated $\frac{1}{4}$ unit to the right.

59. $y = \frac{1}{2}\sqrt{x - 1} - 2$; the graph is the same as $y = \frac{1}{2}\sqrt{x}$ translated 1 unit right and 2 down.

60. $y = 10 - \frac{1}{3}\sqrt[3]{x + 3}$; the graph is the same as $y = -\frac{1}{3}\sqrt[3]{x}$ translated 3 units to the left and 10 up.

61. $y = \frac{1}{3}\sqrt{x + 9} + 5$; the graph is the same as $y = \frac{1}{3}\sqrt{x}$, translated 9 units to the left and 5 up.

62. Answers may vary. Sample: $y = \sqrt[3]{x - 2} + 4$

63. a.
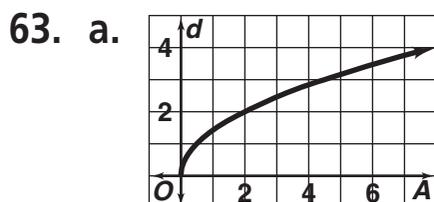
b. 20 in.

64. If $a > 0$, the graph is stretched vertically by a factor of a. If $a < 0$, the graph is reflected over the x-axis and stretched vertically by a factor of $|a|$.

Answers for Lesson 7-8   Exercises (cont.)

65. $y = -\sqrt{2}\sqrt{x + 4}$; the graph is the graph of $y = -\sqrt{2x}$ translated 4 units to the left; domain: $x \geq -4$, range: $y \leq 0$.

66. $y = -\sqrt{8}\sqrt{x - \frac{3}{4}}$; the graph is the graph of $y = -\sqrt{8x}$ translated $\frac{3}{4}$ units to the right; domain: $x \geq \frac{3}{4}$, range: $y \leq 0$.

67. $y = \sqrt{3} \cdot \sqrt{x - \frac{5}{3}} + 6$; the graph is the graph of $y = \sqrt{3x}$ translated $\frac{5}{3}$ units to the right and 6 units up; domain: $x \geq \frac{5}{3}$, range: $y \geq 6$.

68. $y = -\sqrt{12} \cdot \sqrt{x + \frac{3}{2}} - 3$; the graph is the graph of $y = -\sqrt{12x}$ translated $\frac{3}{2}$ units to the left and 3 units down; domain: $x \geq -\frac{3}{2}$, range: $y \leq -3$.

69. a.
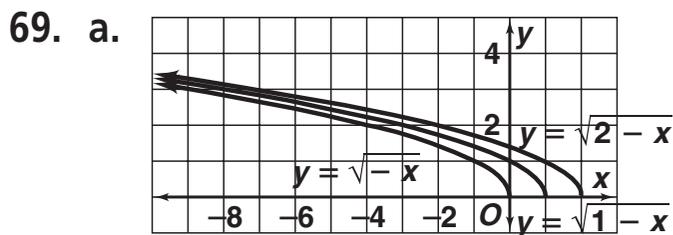
b. The graph of $y = \sqrt{h - x}$ is a reflection of the graph of $y = \sqrt{x - h}$ in the line $x = h$.

70. for all odd positive integers