Selected Answers

Selected Answers Chapter 1

1.1 Simplifying with Exponents Answers

2. $\dfrac{25x^{21}}{y^8}$ **4.** $\dfrac{b^{7/6}}{a}$ **6.** $-8m^3n^{7/6}$ **8.** $\dfrac{y^{13/6}}{x^3}$ **10.** $-6a^7bc$ **12.** $2xy^2$ **14.** $\dfrac{6y^{11/2}z}{x^{5/6}}$

16. $64y^{1/3}$ **18.** $\dfrac{16x^{17/6}}{3y^{19/6}}$ **19.** $\dfrac{x^2}{y^{3/2}}$ **20.** x^{9k+5} **21.** $\dfrac{1}{x^2}$ **22.** $\dfrac{1}{a^4b^4}$ **23.** x^3y^{3k+9} **24.** x^{3-n}

25. $4x^{3-3n}$ **26.** $c^{3n}-k^{9n}$ **27.** $\dfrac{9}{x^{2n}}$ **28.** $\dfrac{a^2}{b^4}$ **29.** $\dfrac{27}{25}a^{k-2}b^{8k-2}$ **30.** a^{3n+1}

31. $a^{3n}-a^{2n}+a^n-1$ **32.** $x^{2n}+2x^n+1$ **33.** $\dfrac{x^{n+1}}{y}$ **34.** $x^{ac+bc}y^{ac+bc}$ **35.** $m^{x^2}n^{x^2}$

36. $9x^{2a}y^{2b}$ **37.** $\dfrac{x^{6r}}{y^{18t}}$ **38.** x^4y^2 **40.** $y^{1/3}$ **41.** $x^{1/2}$ **42.** $\dfrac{y}{x}$ **43.** $\dfrac{y^2}{x^2}$ **45.** $\dfrac{y^n}{x^{3n}}$

47. $x-y$ **48.** $x+y$ **49.** $x-24x^{1/2}+16$ **50.** $x-6x^{1/2}y^{1/2}+y$

51. $x-2x^{1/2}y^{1/2}+y$ **52.** $x-8x^{1/2}y^{1/2}+4y$ **53.** x^n-y^n

1.2 Radical Expressions and Equations Answers

2. $\sqrt{7}+3\sqrt{3}$ **4.** $13x\sqrt{2x}$ **6.** $\dfrac{10\sqrt{3}}{3}$ **8.** $2a\sqrt{2a}$ **10.** $3\sqrt{3x}$ **12.** $\dfrac{16\sqrt{3}}{3}$ **14.** $7\sqrt{2}+2\sqrt{3}$

16. $11a^3\sqrt{2ab}$ **18.** $\dfrac{3\sqrt{x}}{x}$ **20.** $\sqrt{21}$ **22.** $\dfrac{17\sqrt{5}}{2}$ **24.** $-\dfrac{4\sqrt{15}}{3}$ **26.** $\dfrac{2\sqrt{3}}{3}$ **28.** $-15\sqrt{3}$

30. $-2\sqrt{3}$ **32.** $\dfrac{\sqrt{2}}{4}-2\sqrt[3]{2}$ **34.** $\dfrac{a\sqrt{ab}}{2}$ **35.** $\dfrac{2b\sqrt{a^2-b^2}}{a^2-b^2}$ **36.** $\dfrac{(2a-1)\sqrt{a^2-1}}{a(a-1)}$ **39.** $5\sqrt{3}$

41. $\dfrac{23\sqrt{3}}{6}+\dfrac{\sqrt{5}}{2}+11$ **43.** 3 **45.** 3 **47.** $1,5$ **49.** No Solution **51.** ± 2 **53.** 3 **55.** $\dfrac{1}{4}$

57. No Solution **59.** 5 **61.** 7 **63.** 6 **65.** 4 **67.** $1,5$

1.3 Quadratic Expressions and Equations Answers

1. $x^{n+1}(x^n+2)$ **2.** $(x^n+y^n)(x^n-y^n)$ **3.** $(a^nb^n+c^{2n})(a^nb^n-c^{2n})$

4. $(a^n+2)(a^n-2)$ **5.** $(x^{2n}+y^n)(x^{2n}-y^n)$ **6.** $(x^{2n}+1)(x^n+1)(x^n-1)$

7. $(4+x^{2n})(2+x^n)(2-x^n)$ **8.** $y^2(y^a+1)$ **9.** $x^2y(x^2y+2x+3)$

10. $a(2 + 3x^n)(1 - x^n)$ 11. $(a - b)(x + 4)(x - 2)$ 12. $3x^n y(x^n - 3)^2$

13. $(a + b)(2x - 7)$ 14. $(x + a + 1)(x - a - 1)$ 15. $x - 1$ 16. $\pi(R + r)(R - r)$

17. $(n + p)(n + 2)$ 18. $\frac{1}{3}\pi h(r - R)^2$ 19. $(x - 2)(2x + z)$ 20. $(3 - x^n)(x^n + 15)$

21. $2m^{2n}(3m^n + 1)^2$ 22. $(x - y)(3a - 2bx - 2by)$ 23. $(x - y - a + b)(x + y - a - b)$

24. $(a - b)(a^2 + ab + a + b^2 + b)$ 25. $-(a + b - 4)(a - b + 4)$ 26. $(7 - x^n)(8 + x^n)$

27. $(2a - 3b)(4a + 3b)$ 28. $(x^n + 3)(5 - 2x^n)$ 29. $(s - t)(s + t - 4)$

30. $3(3 - x^n)(4 + x^n)$ 31. $(ay - 1)(a - y)$ 32. $(9 - x^n)(4 - x^n)$

33. $2p^4 q^2(p - q)(5p + 3q)$ 34. $(2x^n + 3)(2x^n - 3)(x^n + 1)(x^n - 1)$

35. $(a + b)(x^2 + y)$ 36. $(x - 1)^2(x + 1)$ 37. $(5c - 1)(a + b)(a^2 - ab + b^2)$

38. $(x + 2)(x^4 - 2x^3 + 4x^2 - 8x + 16)$ 39. $(x + y)(x + 1)$ 40. $\left(\frac{3x}{a} - \frac{2a}{x}\right)\left(\frac{x}{a} + \frac{3a}{x}\right)$

41. $(a - 3)(a + y)$ 42. $(a - b)(a^2 + ab + b^2 - a + b)$ 43. $(2y - 1)(3y + p)$

44. $(a + b)(a - b)(a^2 - b^2 - 1)$ 45. $(a + b - c)(a + b + c)$

46. $(2a + 3b)(4a^2 - 6ab + 9b^2)(2a - 3b)(4a^2 + 6ab + 9b^2)$ 47. $(a - 1)(y - 1)(y + 1)$

48. $(x + y)^3$ 49. $5y(x + 1)(3x - 7)$ 50. $(a - 1)(a + 2)(a^2 - a + 2)$

51. $(a - b)(a + b - 6)$ 52. $(x - y)(x + y)(x^2 + xy + y^2)$ 53. $(c - xy)(x - c^2)$

54. $(x + 1)(4x + 3)(x - 2)$ 55. $-x(y - 1)(xy - 1)$ 56. $(2x - y + 3)(6x - 3y - 4)$

57. $(2x - 3y)(4x^2 + 6xy + 9y^2)$ 58. $(w - 1)(2w + 3)(w + 3)$ 59. $(a - b)^2(a + b)^2$

60. $r(r - 1)^2(r + 2)$ 61. $6(4x^n + 3y^n)(x^n - y^n)$ 62. $(x - 9)(2x + 9)$

63. $(x + y - 3)(x - y + 3)$ 64. $(8y + p + 2)(8y - p - 2)$ 65. $(a + b + 1)(a - b - 1)$

66. $(x - 1)(3 - 2x)$ 67. $5(p^2 + 4)(p + 2)(p - 2)$ 68. $(a + 3b - 2)(a - 8b - 2)$

69. $(2x^n + 5)(3x^n - 2)$ 70. $(5b - 4a)(b + 2a)$ 71. $(x + 1)(x + 2)(x - 2)$

72. $a(x + 2y)(3 - 4x)$ 73. $-(a - b + c)(a + b + c)(a + b - c)(a - b - c)$

74. $(3a + 4b)(3a^2 + 3ab + 7b^2)$ 75. $2(x^n - 2y^n)(x^n - y^n)$ 76. $(2ab - 3c)(3a + 4c)$

77. $(x + y)(x^2 - xy + y^2)(x - y)(x^2 + xy + y^2)$ 78. $y(2x - 3y)(8x^2 + 3)$

79. $(a - 3b)(c + 2d)$ 80. $(x^2 - 2x + 2)(x^2 + 2x + 2)$ 81. $(4x^n + 3)(5x^n - 4)$

82. $(x - y + 3z)(x + y - 3z)$ 83. $(x^2 + y^2 - 9)(x^2 - y^2 + 9)$

84. $(a - b)^2(a + b)(a^2 + ab + b^2)$ 85. $(2x + 5y)(2x - 5y + 1)$ 86. $(x + 2y + z)^2$

87. $x(2a + b)(3x + 1)(3x - 1)$ 88. $(a + 2c - 3b)^2$ 89. $(x^n + y^n)(2x^n - 3y^n)$

90. $(2k + 4m - 3l)^2$ 91. $2ax^n(x^n - 3)(x^n + 2)$ 92. $(x^2 - 3xy + 4y^2)(x^2 + 3xy + 4y^2)$

93. $(k^n - 8)(k^n + 6)$ 94. $(a + 2b - 3c)^2$ 95. $3x^n(x^n - 2y^n)(x^n + y^n)$

96. $2x^2y(2x^2y + 3y^2 - 1)$ 98. $(x^2 + 2xy + 3y^2)(x^2 - 2xy + 3y^2)$ 101. $\pm 1, \pm 2$

103. $\pm i, \pm 2\sqrt{2}$ 105. $\pm 1, \pm 7$ 107. $\pm 3, \pm 4$ 109. $\pm 2, \pm 4$ 111. $-2, 3, 1 \pm i\sqrt{3}, \frac{-3 \pm 3i\sqrt{3}}{2}$

113. $\pm \frac{2i\sqrt{3}}{3}, \pm \frac{\sqrt{6}}{2}$ 115. $-125, 343$ 117. $1, -\frac{1}{2}, \frac{1 \pm i\sqrt{3}}{4}, \frac{-1 \pm i\sqrt{3}}{2}$ 119. $\pm i, \pm \sqrt{3}$

121. $\pm \sqrt{2}, \pm \frac{\sqrt{2}}{2}$ 123. $\pm 1, \pm 2\sqrt{2}$ 125. $1, \frac{1}{2}, \frac{-1 \pm i\sqrt{3}}{4}, \frac{-1 \pm i\sqrt{3}}{2}$ 127. $\pm 1, \pm i, \pm 2, \pm 2i$

129. $-(b + 3), 7 - b$ 131. $-4, 6$ 133. $-2, 10$ 135. $-1, 11$ 137. $4, -\frac{4}{3}$ 139. $\pm 1, -\frac{1}{3}, \frac{5}{3}$

141. $\frac{511}{3}, -\frac{1339}{24}$ 143. $\pm 1, -3$ 145. $\pm 1, -\frac{1}{2}, \frac{3}{2}$ 147. $0, 5, 3 \pm i\sqrt{3}, \frac{1 \pm 3i\sqrt{3}}{2}$ 149. $-\frac{12}{5}, \frac{13}{5}$

151. $-7, 4$ 153. $3, 5$ 155. No Solution   157. $1, -3$ 159. $1, -\frac{7}{6}$ 160. $-1, -3, 2, 6$

161. $-2, 4, 3 \pm \sqrt{17}$ 162. $2, 3, 4, 6$ 163. $1, 8, 1 \pm i\sqrt{7}$ 164. $-3, -9, 4, 12$ 165. $\frac{100}{99}$

166. $\frac{1}{98}$ 167. $-\frac{6}{7}$ 168. $-\frac{5}{2}, -5$ 169. $-3, -4, 2, 6$ 170. $0, \frac{56}{5}$ 171. $-4, 10, -5, 8$

172. $-3, 15, -9, 5$ 173. $-2, \frac{3}{2}, -3, 1$ 174. $-1, 8, -2, 4$ 175. $-3, 6, -4, \frac{9}{2}$

176. $-5, 4, -10, 2$ 177. 19 179. $\frac{4}{9}, \frac{9}{4}$ 181. $\frac{-3 \pm \sqrt{39 \pm \sqrt{33}}}{2}$ 183. $\pm 1, \pm 2$

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1.4 Simplifying Rational Expressions Answers

1. $\frac{2x-2a}{3x}$ 3. $\frac{c+d}{(c-d)^2}$ 5. $\frac{3y+9}{2y-4}$ 7. $\frac{3}{2}$ 10. $\frac{xy}{x+y}$ 12. $\frac{a^2}{b}$ 14. $\frac{b+a}{b-a}$ 16. $\frac{y-x}{xy}$ 18. $\frac{x^2-xy+y^2}{y-x}$

20. $\frac{x^2+y^2}{xy}$ 22. $-\frac{x+2}{x+1}$ 24. $-\frac{1}{x}$ 26. $\frac{2x-1}{2x+1}$ 27. $\frac{1-3x}{1+3x}$ 28. $\frac{x+y}{xy}$ 29. $-\frac{1}{xy}$ 31. $\frac{m+3}{2}$ 33. 1

35. $\frac{a-1}{2a}$ 37. $\frac{a^2+b^2}{a^2-2ab-b^2}$ 39. 3   42. $-y$ 44. $-\frac{1}{\sqrt{x^2+1}}$ 49. $-\frac{1}{t^2\sqrt{t^2+1}}$ 50. $\frac{x^2-2}{x^3(1-x^2)^{1/2}}$

51. $-\frac{1}{x^2(x+1)^{3/4}}$ 52. $\frac{2x+3}{3(2x+1)^{13/6}}$ 53. $\frac{x-3}{(2x-1)^{3/2}}$ 54. $2x-1$ 58. $\frac{1}{a+2b}$ 60. $\frac{1}{x^n+2}$

62. $\frac{3(2x^a-3)}{4(x^a+3)}$ 63. $\frac{(x+3)(2-x)(1+2x)}{(x-3)(x+2)}$ 64. $-\frac{2(21x^2+2x-27)}{(x^2-3)^3(6x+1)^4}$ 65. $-\frac{3(11x^2+4x+5)}{(3x+2)^6(x^2+1)^4}$ 66. $\frac{1-10x}{6x+1}$

67. $-\frac{6(2x-3)}{(4x^2+9)^{3/2}}$ 68. $-\frac{5}{(3x+2)^{7/4}(2x+3)^{2/3}}$ 69. $\frac{4x-3}{(3x-1)^{4/3}}$ 70. $\frac{1-4x}{(x+1)^2(2x-3x^2)^{1/2}}$

1.5 Complex Numbers Answers

2. $-5-i$ 4. $6+2i$ 6. $72+18i\sqrt{5}$ 8. $15+8i$ 10. $17+20i\sqrt{2}$ 12. $15i$

14. $6+13i\sqrt{2}$ 16. 25 18. $3+3i$ 20. $\frac{-1+18i}{13}$ 22. $\frac{-7-6i}{10}$ 24. $\frac{-1+i\sqrt{5}}{2}$

1.6 Complete the Square Answers

2. $\frac{1}{\left(x-\frac{1}{2}\right)^2-1}$ 4. $\sqrt{2\left(x-\frac{1}{2}\right)^2+\frac{1}{2}}$ 6. $\frac{1}{\sqrt{25-(x+3)^2}}$ 8. $\frac{2x-1}{\sqrt{2\left(x-\frac{3}{4}\right)^2-\frac{1}{8}}}$ 10. $2\sqrt{4\left(x+\frac{1}{4}\right)^2-\frac{9}{4}}$

12. $\sqrt{\frac{29}{3}-6\left(x-\frac{1}{3}\right)^2}$ 14. $\left[\frac{1}{2}(x+3)^2-\frac{13}{2}\right]^2$ 16. $\frac{6}{4(x^3+1)^2+1}$

1.7 Solving Linear Formulas Answers

1. $x=1-\frac{y}{a}$ 3. $q=3p$ 5. $x=\frac{y}{y-2}$ 7. $x=\frac{ab}{1+b}$ 8. $x=2b$ 10. $x=b-2a$

12. $x=-2y$ 14. $x=4-y$ 16. $x=\frac{2a}{a-1}$ 17. $x=-\frac{2n}{m-n}$ 18. $n=\frac{m}{5-m}, m=\frac{5n}{n+1}$

20. $x=\frac{2p+pq}{q-2p}, p=\frac{qx}{2+2x+q}, q=\frac{2px+2p}{x-p}$ 26. $m=\frac{an-n}{a-an-1}, n=\frac{m-am}{1-a-am}$

28. $h=\frac{1}{\pi r}\sqrt{S^2-\pi^2r^4}$ 29. $Q=\pm\sqrt{Lci^2+q}$ 30. $d=\frac{2s-2an}{n(n-1)}$ 31. $r=\frac{nE-IR}{in}$

33. $c = \dfrac{2Pg}{2gH - v^2}$ 35. $C = \dfrac{C_1 C_2}{C_1 + C_2}$ 41. $2x + y = -4$

1.8 Solving Absolute Value Equations and Inequalities Answers

1. $-4, 1$ 2. $10, -4$ 3. $4, -\dfrac{5}{2}$ 4. $1, \dfrac{7}{3}$ 5. $-\dfrac{19}{3}, \dfrac{11}{3}$ 6. $-3, \dfrac{7}{3}$ 7. $\dfrac{12}{5}, -\dfrac{8}{5}$ 8. $\dfrac{1}{2}, -\dfrac{3}{2}$

9. $\dfrac{7}{3}, \dfrac{5}{3}$ 10. $\dfrac{10}{3}, -\dfrac{2}{3}$ 11. $-\dfrac{4}{3}, -\dfrac{2}{7}$ 12. $-6, \dfrac{2}{5}$ 13. $7, \dfrac{1}{5}$ 14. $-\dfrac{22}{5}, -\dfrac{2}{13}$ 15. $-\dfrac{19}{22}, -\dfrac{11}{38}$

16. $0, -\dfrac{12}{5}$ 19. $[-8, 8]$ 21. $\left(-\infty, -\dfrac{5}{3}\right) \cup \left(\dfrac{5}{3}, \infty\right)$ 23. $(-4, 8)$ 24. $(-\infty, -1) \cup (9, \infty)$

26. $[-7, 1]$ 29. $[-2, 2]$ 32. $(-\infty, -1) \cup (5, \infty)$ 35. $\left(-\dfrac{7}{3}, 1\right)$ 37. $\left(-1, \dfrac{5}{2}\right)$

38. $(-\infty, -3] \cup [9, \infty)$ 39. $(0, 4)$ 41. $(-5, 4)$ 42. $(-\infty, -2] \cup [7, \infty)$ 43. $[-3, 5]$

44. $(-\infty, 0) \cup (4, \infty)$ 45. $(-\infty, -1] \cup [3, \infty)$ 46. $[0, 4]$ 47. $[1, 4]$ 48. $\left[-\dfrac{4}{3}, 2\right]$

49. $[-10, 2]$ 50. $(-\infty, -1] \cup [0, \infty)$ 51. $[-1, 3]$ 52. $\left[\dfrac{8}{3}, \dfrac{31}{9}\right]$ 53. $\left(-\infty, -\dfrac{5}{3}\right] \cup [3, \infty)$

54. $\left(-\infty, -\dfrac{45}{8}\right) \cup \left(\dfrac{21}{8}, \infty\right)$

2.1 Functions Answers

1. a. all x b. all x c. all x d. $x \geq 0$ e. all x f. $x \geq 16$ g. $x \neq 3$ h. $x \neq -1, 4$

i. all x j. all x k. $x \neq -4$ l. $x \geq 4, x \neq 5$ m. $t \neq 0$ n. $x \neq \pm 5$ o. $s \neq 4, 0$ p. all t

q. $x \leq \frac{5}{4}$ r. $t \neq 0$ **2.** a. yes   b. no   **3.** a. yes   b. no   **4.** a. yes   b. no   **5.** a. $x \neq -4$

b. yes   c. no   **6.** a. $x \neq -5$ b. yes   c. no   **7.** a. $x \neq \frac{1}{4}$ b. no   c. yes   **8.** a. $x \neq a$

b. yes   c. no   **9.** a. -1 b. 1   c. 5   d. $-\frac{5}{4}$ e. $z^2 - 3z + 1$ f. $x^2 - x - 1$

g. $a^2 - a - 1$ h. $x^2 + 3x + 1$ i. 1   j. $4 - 3\sqrt{3}$ k. $1 - \sqrt{2}$ l. 2   **10.** a. $H(0)$ is larger

b. no   **11.** a. $12x^2$ b. $6x^2$ c. $3x^4$ d. $9x^4$ e. $\frac{3x^2}{4}$ f. $\frac{3x^2}{2}$ **12.** a. -2 b. -5 c. -7

d. -11 e. $4 - 6x$ f. $8 - 6x$ g. $4 - 3x^2$ h. $4 - \frac{3}{x}$ i. $9x - 8$ j. $4x^2 - 3x^3$ k. $\frac{1}{4 - 3x}$

l. $3x + 4$ m. $3x - 4$ n. $-3x - 4$ **13.** a. 1   b. -7 c. -3 d. $-\frac{7}{18}$ e. $4\sqrt{3} - 7$

f. $1 - 2x^4$ g. $-2x^2 - 4x - 1$ h. $-2x^2 - 4hx - 2h^2 + 1$ **14.** a. undefined   b. $\frac{1}{2}$ c. 0

d. 1   e. $\frac{2x^2 - 1}{x^2 - 2}$ f. $\frac{x - 2}{2x - 1}$ g. $\frac{2a - 1}{a - 2}$ h. $\frac{2x - 3}{x - 3}$ **15.** a. 2   b. 2   c. 2

16. a. 80, 108, 128, $-16t_0^2 + 96t_0$ b. $t = 0, t = 6$ c. $t = \frac{12 \pm \sqrt{143}}{4}$ **17.** 3, 0, 1   **18.** 1, $|x|$

19. a. $x \neq 0$ b. 2, 2, 20   **20.** a. 3   b. 3   **21.** $-\frac{1}{4}$ **22.** 8   **23.** b. $x - 1$ **24.** a. $h + 5$

b. $t + 3$ c. $\frac{5t}{2}$ **25.** $\frac{1 - ax}{1 + ax}$ **26.** $t^2 - 3t + 1$ **27.** $5x^3 + \frac{5}{x^3} - x - \frac{1}{x}$ **28.** $\frac{19}{(2x+1)(2x+2h+1)}$

29. $-\frac{2y^2}{(2x-y)(2x+y)}$ **30.** $\frac{2u - 4}{u + 12}$ **31.** z **32.** x **33.** $k = -1$ **34.** $k = -\frac{1}{3}$ **35.** a. $x = -1, 6$

b. $x = \frac{5 \pm \sqrt{53}}{2}$ c. undefined   **36.** a. $2x + h$ b. $2x + h$ c. $2x + h$ d. $3x^2 + 3hx + h^2$

e. $3x^2 + 3hx + h^2$ f. $3x^2 + 3hx + h^2$ g. $-\frac{1}{x(x+h)}$ h. $\frac{\sqrt{x+h}-\sqrt{x}}{h}$ i. $\frac{\sqrt{x}-\sqrt{x+h}}{h\sqrt{x}\sqrt{x+h}}$ j. -3 k. 0

l. $4x + 2h - 3$ 37. a. 1   b. $2x + h$ c. $2x - 1$ d. $-\frac{1}{x(x+h)}$ e. $\frac{1}{\sqrt{x+h}+\sqrt{x-h}}$

f. $\frac{1}{\sqrt{x^2-h^2}(\sqrt{x+h}+\sqrt{x-h})}$

2.2 Algebra of Functions Answers

1. a. 33   c. 5   e. $x^2 + 2x - 2$ h. $\frac{2x-3}{x^2+1}$ **2.** a. 0   c. 10,000   e. $\frac{x^3-2x-4}{x+1}$ h. $\frac{1}{(x+1)^2}$

3. a. 0   c. Undefined   g. $2x^3 + x^2 - 4x - 3$ **4.** a. $g(f(x)) = x$ c. $f(g(x)) = 3x^2 - 22$

e. $f(g(x)) = x^2 - 4x + 1$ g. $f(g(x)) = x + 5$ $g(f(x)) = x + 5$

h. $f(g(x)) = 64 + 8x$ $g(f(x)) = 8 + 8x$ i. $f(g(x)) = (x^2 + x)^3$ $g(f(x)) = x^6 + x^3$

j. $f(g(x)) = x$ $g(f(x)) = x$ k. $f(g(x)) = x^2 - 5x + 4$ $g(f(x)) = x^2 + 3x - 4$

l. $f(g(x)) = \sqrt{x-1}$ $g(f(x)) = \sqrt{x} - 1$ m. $f(g(x)) = \frac{1}{3}$ $g(f(x)) = 3$

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

p. $f(g(x)) = \sqrt{x}$ $g(f(x)) = \sqrt{x+1} - 1$ q. $f(g(x)) = x^2 + x$ $g(f(x)) = x^2 - x + 1$

r. $f(g(x)) = x^4 + 2x^2$ $g(f(x)) = x^4 - 2x^2 + 2$ u. $f(g(x)) = x$ $g(f(x)) = x$

v. $f(g(x)) = x + 1$ $g(f(x)) = \frac{2x-1}{x}$ w. $f(g(x)) = -x$ $g(f(x)) = \frac{1}{x}$

x. $f(g(x)) = -\frac{7x+4}{5}$ $g(f(x)) = \frac{7x}{4x-5}$ y. $f(g(x)) = \frac{4x+2}{3-x}$ $g(f(x)) = \frac{4x-1}{2x+3}$

z. $f(g(x)) = x$ $g(f(x)) = x$ **5.** a. $f\left(g(h(x))\right) = x + 1$ b. $f\left(h(g(x))\right) = (\sqrt{x} + 1)^2$

c. $g\left(h(f(x))\right) = \sqrt{x^2 + 1}$ **6.** a. $f(x) = x^2; g(x) = 2x + 1$ c. $f(x) = \sqrt[3]{x}; g(x) = x^2 - 4$

e. $f(x) = \frac{1}{x}; g(x) = x - 2$ h. $f(x) = \frac{x-1}{x+1}; g(x) = x^3$ j. $f(x) = x^6; g(x) = \frac{2+x^3}{2-x^3}$

l. $f(x) = \sqrt{1+x}; g(x) = \sqrt{1+x}$ m. $f(x) = x^2 + 2x; g(x) = x + 4$

2.3 Inverse Functions Answers

1. $p^{-1}(t) = 2 + \sqrt{t-3}$ **2.** $z^{-1}(x) = 2 + \sqrt[3]{x-3}$ **3.** $h^{-1}(x) = x^2 - 6x + 11$

4. $q^{-1}(p) = \frac{3p+2}{1-p}$ **5.** $A^{-1}(b) = \frac{2b+1}{b-2}$ **6.** $f^{-1}(x) = \frac{1}{4}x^2 - 2x + 3$ **7.** $f^{-1}(x) = \frac{2x+5}{3}$

8. $z^{-1}(r) = \frac{3+\sqrt{r+6}}{2}$ **9.** $f^{-1}(x) = \frac{2+\sqrt{x+1}}{4}$ **10.** $f^{-1}(x) = -x^3 + 24x^2 - 192x + 515$

11. $f^{-1}(x) = -\frac{3x+1}{x+1}$ or $f^{-1}(x) = \frac{2}{x+1} - 3$ **12.** $f^{-1}(x) = \frac{2x-7}{x-3}$ or $f^{-1(x)} = 2 - \frac{1}{x-3}$

13.

f(x)   f⁻¹(x)   f(x)   f⁻¹(x)
Domain restricted to x ≥ 0

14.

f(x)   f⁻¹(x)

15.

f(x)   f⁻¹(x)

16.

f(x)   f⁻¹(x)   f(x)   f⁻¹(x)
Domain of f restricted to x ≥ 1
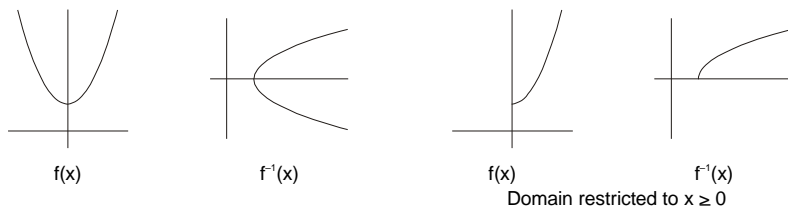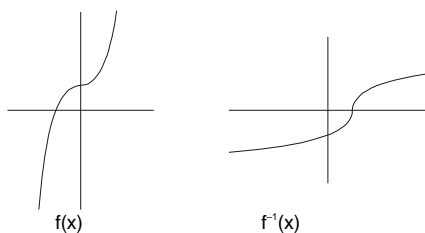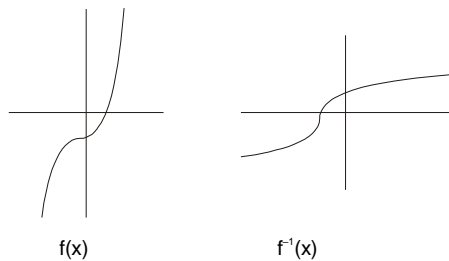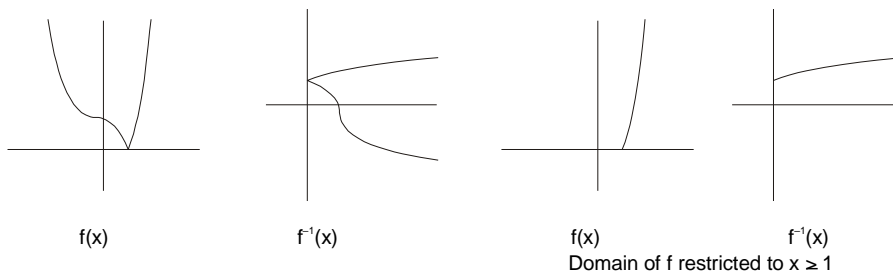
17. a. $x - 4$ b. $\frac{1}{2}x$ c. $\frac{4-7x}{x}$ d. $\frac{3x+4}{x-1}$ e. $\sqrt[3]{x+1}$ f. $\sqrt[4]{x+1}$ g. $2 + \sqrt{x-1}$ h. x^2

i. x^3 j. $\frac{1}{2}(x^2 - 3)$ k. $\frac{1}{2}(x^3 - 3)$ l. undefined   m. $1 + \sqrt{x-1}$ n. $1 + \sqrt{\dfrac{x+2}{3}}$

19. $d = -a$

20.

a)

(7, 5)

(7, –3)

(0,4)

(–7, 1)

$x \geq -7$

b)

(3, 5)

(0, 2)

(–3.5, 0)

(–4, –1)

c)

(–7, 4)

(0, 3)

(4, 1)

d)

(–7, 7)

(0, 6)

(7, 2)

e)

(–2, 7)

(4, –2)

(9, –7)

f)

(–4, 11)

(4, 4)

(9, –2)

10

g)

(−9, 8)

(−4, 3)

(2, −7)

h)

(−6, 11)

(3, 4)

(8, −2)

l)

(0, 4)

(-2,2)

j)

(0, 6)

(−4, 7)

(6, 4)

k)

(−8, 7)

(0, 6)

(4, 4)

l)

(−4, 5)

(0, 1)

(0, −1)

(4, −5)
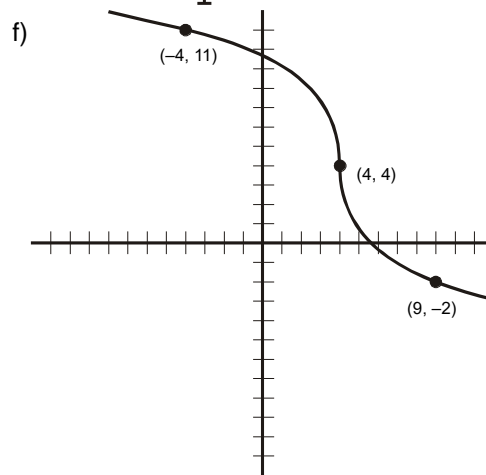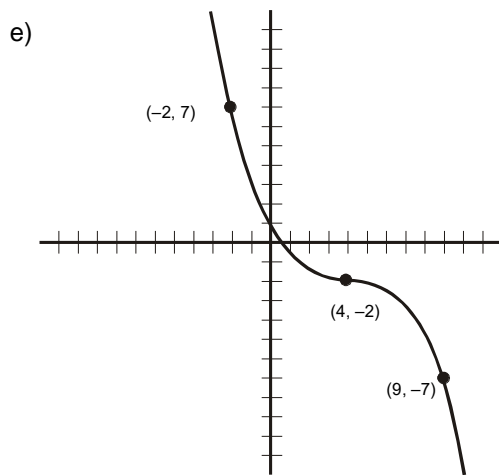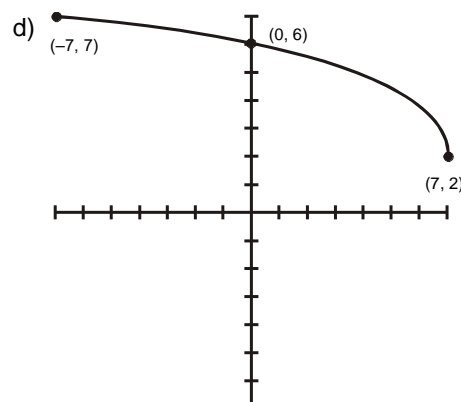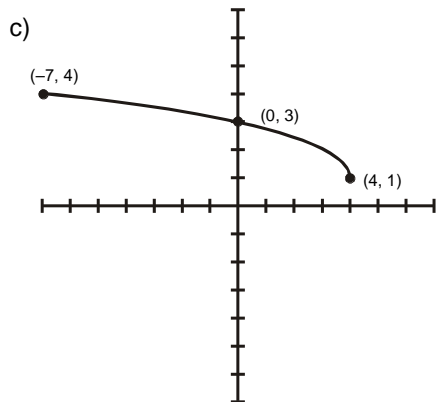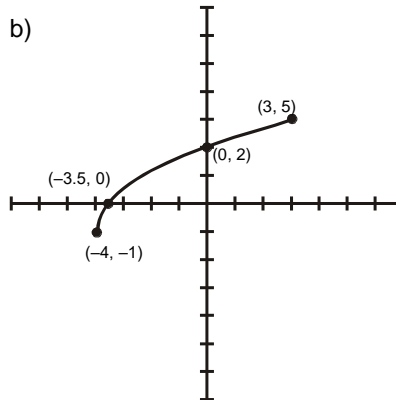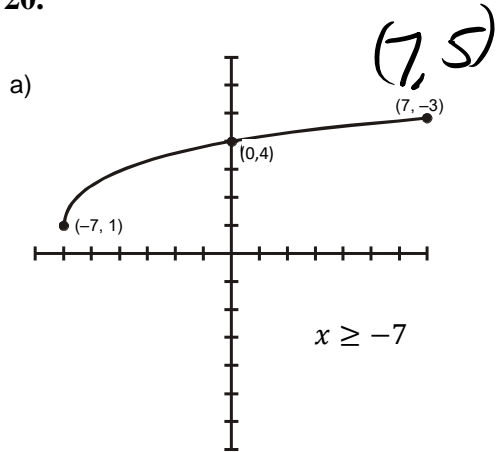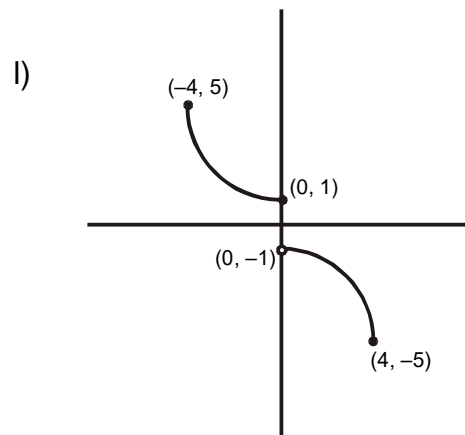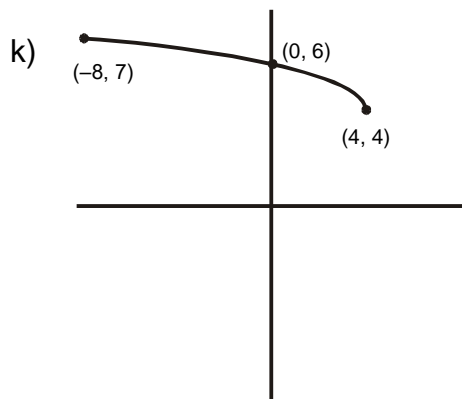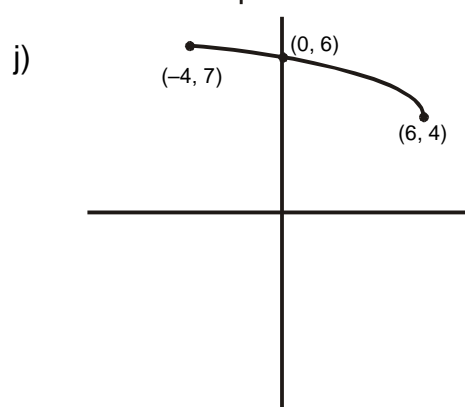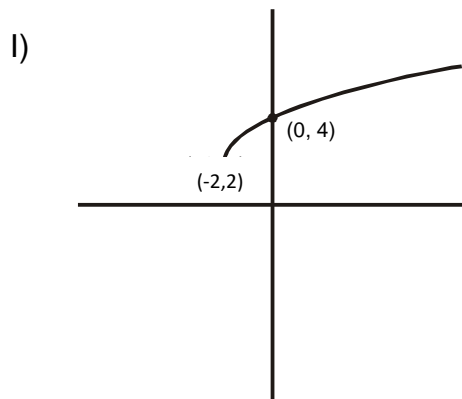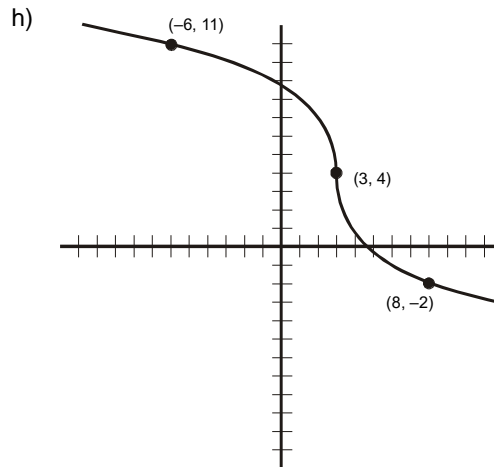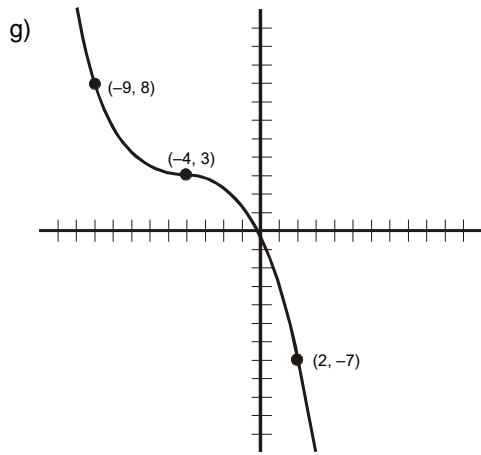
2.4 Applications of Functions Answers

1. 6.25　　**3.** $\frac{1}{2}$　　**5.** 6.25 by 6.25　　**7.** 1250 in^2　　**9.** a. $x = 6, y = 7, S = 377$

b. $x = 84, y = -70, S = 12{,}152$　　c. $x = 9, y = -1, S = 196$　　d. $x = -13, y = 5, S = 356$

11

e. $x = 13, y = 7, S = -310$ f. $x = 8, y = -9, S = 210$ g. $x = -3, y = -24, S = -198$

h. $x = 2, y = -11, S = 276$ i. $x = 3, y = 3, S = 27$ j. $x = 10, y = 6, S = 8$ **10**. a. 18

b. $\frac{23}{4}$ c. $\frac{47}{8}$ d. $\frac{95}{16}$ **12.** a. 16 ft, 12 ft   b. 16ft at 1 sec   c. $\frac{1}{4}$ sec, 7/4 sec   **13**. a. $\frac{1}{2}$ b. $\frac{1}{4}$

15. 125 (2 sides) by 250 ft   **17**. 40   **19**. 60, $900, $15

21. Approximately 16.95   **23**. 3 PM, no   **25**. a. $\frac{36}{13}$ **27**. a. $\frac{225}{2}$ **29**. $\frac{1}{2}$ **31**. 100 by 150

33. 2   **35**. $\frac{49}{12}$ square units   **36.** $2R^2$ **38**. 9 square units   **40**. a. $(\pm\sqrt{2}, -17)$

b. min at (0,0) and (4,0); max at (2,2)   **42**. 56 trees   **44**. $26   **46**. $6.50   **48**. $R^2 \left(\frac{\pi-2}{2}\right)$

2.5 Reading Graphs of Functions Answers

1. a. all real numbers   b. $y \le 3$ c. 3   d. 2   e. 1   f. 3   g. $x \le 0$ h. $x \le 2$ i. $f \to 0$

j. $f \to -\infty$ **2.** a. all real numbers   b. $y \ge -5$ c. -5 d. $-4, 2$ e. -5 f. $x \le 0$

g. $-4 < x < 2$ h. . $f \to \infty$ i. . $f \to \infty$ **3**. a. all real numbers   b. $y \ge -6$ c. -6

d. 2   e. -4 f. $x \ge 0$ g. $x > 2$ h. -3 i. ∞ **4.** a. $x \ne 4$ b. $y \ne -2$ c. -1.5 d. 3

e. -3 f. undefined   g. $x \ne 4$ h. $3 < x < 4$ i. -2 j. $x \to 4^-, f \to \infty; x \to 4^+, f \to -\infty$

5. a. $x \ne -4,5$ b. $y \ne 4$ c. 2   d. $-3, 5.5, 2$ e. -3 f. -5 g. undefined

h. $x < -4; -3 < x < 2; x > 5.5$ i. 2   j. 4   k. $-\infty$

l. $x \to -4^-, f \to \infty; x \to -4^+, f \to -\infty$ **6**. a. $x \ne -2$ b. all real numbers   c. 3

d. $-3, -1$ e. 0   f. $-4, -1.5$ g. $x \ne -2$ h. $-3 < x < -2; x > -1$

i. $x \to -\infty, f \to -4; x \to \infty, f \to 5$ j. $x \to -2^-, f \to \infty; x \to -2^+, f \to -\infty$

7. a. all real numbers   b. all real numbers   c. -1 d. $-4, -1, 1$ e. $x = -2, x \ge 4$ f. -3

g. $-4 < x < -1, x \ge 1$ h. $x < -4, -1 < x < 1$ i. $-2, 4$ j. $f \to \infty$ k. $f \to -\infty$

8. a. $x \ne -3$ b. all real numbers   c. -1 d. ± 2 e. $-2.9, 3$ f. 3   g. $x = -4$ h. 0

i. 3   j. $x \to -3^-, f \to -\infty$; $x \to -3^+, f \to \infty$ **9**. a. $x \neq \pm 3$ b. $y > 3$ or $y \leq 1$ c. $\pm 1, 5$

d. 1   e. 1   f. -4 g. undefined   h. $x \to -3^-, f \to \infty$; $x \to -3^+, f \to \infty$ i. $-\infty$

j. $x \to \infty, f \to 0$; $x \to -\infty, f \to 3$ **10**. a. $x \neq 2$ b. $y < 2$ c. -3 d. -2 e. -2 f. 1, 3

g. $x < 2$ h. $x > 2$ i. $x \leq -2$ j. $-\infty$ k. $x \to \infty, f \to 0$; $x \to -\infty, f \to 2$

11. a. $-5 \leq x \leq 5$ b. $-5 \leq y \leq 5$ c. ± 5 d. ± 5 e. ± 3 f. ± 3 g. $-3 \leq x \leq 3$

h. undefined   i. undefined   j. no   **12**. a. $x \neq 2$ b. $y \geq 1, y < -1$ c. 2   d. 1   e. 1

f. none   g. 1   h. $-1 < x < 2$; $x > 2$ i. $x > 2$ j. $x \to \infty, g \to -1$; $x \to -\infty, g \to 4$

k. $x \to 2^-, g \to \infty$; $x \to 2^+, g \to -\infty$ **13**. a. $x \neq -5, 4$ b. all real numbers   c. undefined

d. 1   e. $-5.5, -4, 5$ f. 3   g. $-2 < x < 4$; $x \geq 6$ h. $x < -5$ i. $x \to -5, q \to -\infty$

j. $x \to 4^-, q \to \infty$; $x \to 4^+, q \to -\infty$ k. $x \to -\infty, q \to 0$; $x \to \infty, q \to 2$ **14**. a. $y \neq 2$

b. all real numbers   c. -1 d. 2   e. $-4, 1$ f. $-2, 3$ g. -2 h. -1

i. $x < -4$; $1 < x < 2$ j. $x < -2$; $x > 4$ k. $x \to \infty, z \to -2$; $x \to -\infty, z \to \infty$

l. $x \to 2^-, z \to \infty$; $x \to 2^+, z \to -\infty$ **15**. A. $x \neq -2, 4$ b. $y > -6$ c. -1 d. undefined

e. $-3, -1, 2, 5$ f. $-4, 6$ g. none   h. -1 i. $x < -3$; $-1 < x < 2$; $x > 5$

j. $x < -2$; $0 < x < 4$ k. $x \to 4, Q \to \infty$ l. $x \to \pm \infty, Q \to -6$

2.6 Transformations of Graphs Answers

1.

$y = f(x)$

$y = f(x + 4)$

$y = f(x) + 4$

$y = 2f(x)$

$y = f(2x)$

$y = 2f(2x + 4) + 4$

2.

(−5, 3)   (3, 3)
(−4, 0)
(−8, 0)
(−3, −3)

y = g(x)

(−3, 3)
(−8, 0)   (−4, 0)
(−5, −3)   (3, −3)

y = − g(x)

(−3, 3)   (5, 3)
(4, 0)   (8, 0)
(3, −3)

y = g(−x)

(−3, 5)
(−8, 2) (−4, 2)
(−5, −1)   (3, −1)

y = −g(x) + 2

(−1, 3)
(−6, 0) (−2, 0)
(−3, −3)   (5, −3)

y = −g(x − 2)

(−5, 3)   (3, 3)
(2, 0)   (6, 0)
(1, −3)

y = g(−x − 2)

15

3.

(−5, 2)   (0, 3)

(−7, 0)   (−3, 0)   (3, 0)   (7, 0)

(5, −2)

y = h(x)

$\left(-\frac{5}{2}, 2\right)$ (0, 3)

(−5, 1) $\left(0, \frac{3}{2}\right)$ $\left(\frac{3}{2}, 0\right)$ $\left(\frac{7}{2}, 0\right)$

(−7, 0)   (−3, 0)   (3, 0)   (7, 0)

$\left(-\frac{7}{2}, 0\right)$ $\left(\frac{-3}{2}, 0\right)$ (5, −1)

$\left(\frac{5}{2}, -2\right)$

y = ½h(x)

(−10, 2)   (0, 3)

(6, 0)   (14, 0)

(−14, 0)   (−6, 0)

(10, −2)

y = h(½x)

(−10, 1) $\left(0, \frac{3}{2}\right)$

(6, 0)   (14, 0)

(−14, 0)   (−6, 0)

(10, −1)

~~y = ½h(½x)~~

$y = \frac{1}{2}h(-2x)$

$\left(-\frac{7}{2}, 0\right)$ $\left(-\frac{3}{2}, 0\right)$ $\left(\frac{5}{2}, 1\right)$ $\left(\frac{7}{2}, 0\right)$

$\left(-\frac{5}{2}, -1\right)$ $\left(\frac{3}{2}, 0\right)$ $\left(0, -\frac{3}{2}\right)$

~~y = ½h(−2x)~~

$y = \frac{1}{2}h\left(\frac{1}{2}x\right)$

(2, 3)

(7, 1)

(−5, −3)   (5, −3)   (9, −3)

(−3, −7)

y = 2h(−x + 2) − 3

16

4.

$(-\frac{\pi}{2}, 1)$

$(-\pi, 0)$ $(0, 0)$

$(-\frac{\pi}{2}, -1)$ $(\pi, 0)$

y = S(x)

$(-\pi, 1)$ $(\frac{\pi}{2}, 2)$

$(-\frac{\pi}{2}, 0)$ $(0, 1)$ $(\pi, 1)$

y = S(x) + 1

$(\frac{\pi}{2}, 2)$

$(-\pi, 0)$ $(0, 0)$

$(\pi, 0)$

$(-\frac{\pi}{2}, -2)$ y = 2S(x)

$(\frac{3\pi}{4}, 1)$

$(0, 0)$ $(\frac{\pi}{2}, 0)$

$(\pi, 0)$

$(\frac{\pi}{4}, -1)$

y = S(2x − π)

$(-\frac{\pi}{2}, 0)$ $(-\frac{\pi}{6}, 0)$ $(0, \frac{1}{2})$

$(\frac{\pi}{6}, 0)$

$(-\frac{\pi}{3}, -\frac{1}{2})$

y = $\frac{1}{2}$S(3x + $\frac{\pi}{2}$)

$(-3\pi, 2)$

$(-6\pi, 0)$ $(-2\pi, 0)$

$(-4\pi, 0)$

$(-5\pi, -2)$ y = 2S($\frac{1}{2}$x + 2π)

17

5.

(0, 2)
(−2, 0)
(2, 0)
(0, −2)
y = R(x)

(0, 3)
(−2, 1)
(2, 1)
(0, −1)
y = R(x) + 1

(2, 2)
(0, 0)
(4, 0)
(2, −2)
y = R(x − 2)

(2, 3)
(0, 1)
(4, 1)
(2, −1)
y = R(x − 2) + 1

(0, 4)
(−2, 0)
(2, 0)
(0, −4)
y = 2R(x)

(0, 2)
$(-\frac{2}{3}, 0)$
$(\quad, 0)$ $\frac{2}{3}$
(0, −2)
y = R(3x)

(1, 6)
$(\frac{1}{3}, 2)$
$(\frac{5}{3}, 2)$
(1, −2)
y = 2R(3x − 3) + 2

18

6.

	a	b	c	d
$(-2, 1)$	$(0, 2)$	$(-5, 0)$	$\left(-\frac{2}{3}, \frac{9}{2}\right)$	$\left(0, -\frac{1}{2}\right)$
$(0, 2)$	$(-2, 3)$	$(-3, 2)$	$\left(\frac{2}{3}, 6\right)$	$\left(-\frac{4}{3}, 0\right)$
$(1, 3)$	$(-3, 4)$	$(-2, 4)$	$\left(\frac{4}{3}, \frac{15}{2}\right)$	$\left(-2, \frac{1}{2}\right)$
$(2, 4)$	$(-4, 5)$	$(-1, 6)$	$(2, 9)$	$\left(-\frac{8}{3}, 1\right)$
$(4, 0)$	$(-6, 1)$	$(1, -2)$	$\left(\frac{10}{3}, 3\right)$	$(-4, -1)$

7.

	a	b	c	d
$(-3, -1)$	$(-1, 4)$	$\left(5, -\frac{7}{2}\right)$	$(-2, 1)$	$\left(-\frac{7}{3}, -1\right)$
$(-1, 2)$	$(0, -5)$	$(3, -2)$	$(2, -5)$	$(-1, 1)$
$(0, 3)$	$\left(\frac{1}{2}, -8\right)$	$\left(2, -\frac{3}{2}\right)$	$(4, -7)$	$\left(-\frac{1}{3}, \frac{5}{3}\right)$
$(2, -2)$	$\left(\frac{3}{2}, 7\right)$	$(0, -4)$	$(8, 3)$	$\left(1, -\frac{5}{3}\right)$
$(4, 1)$	$\left(\frac{5}{2}, -2\right)$	$\left(-2, -\frac{5}{2}\right)$	$(12, -3)$	$\left(\frac{7}{3}, \frac{1}{3}\right)$

8.

	a	b	c	d
$(-4, 3)$	$\left(-\frac{1}{2}, -5\right)$	$(-1, 3)$	$(5, -2)$	$(-2, 11)$
$(-3, 3)$	$(0, -5)$	$\left(-\frac{2}{3}, 3\right)$	$(4, -2)$	$(0, 11)$
$(0, -2)$	$\left(\frac{3}{2}, 5\right)$	$\left(\frac{1}{3}, \frac{1}{2}\right)$	$(1, 3)$	$(6, -4)$
$(2, 1)$	$\left(\frac{5}{2}, -1\right)$	$(1, 2)$	$(-1, 0)$	$(10, 5)$
$(4, -1)$	$\left(\frac{7}{2}, 3\right)$	$\left(\frac{5}{3}, 1\right)$	$(-3, 2)$	$(14, -1)$

2.7 Transformations of Basic Functions Answers

1.

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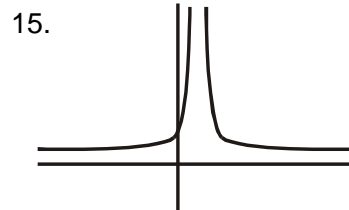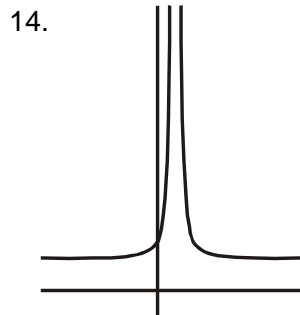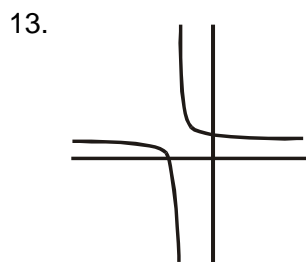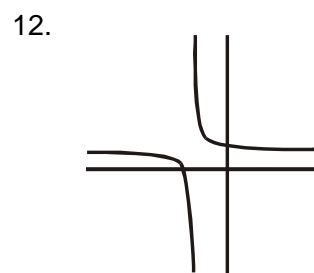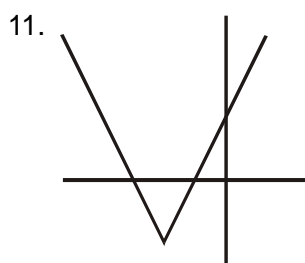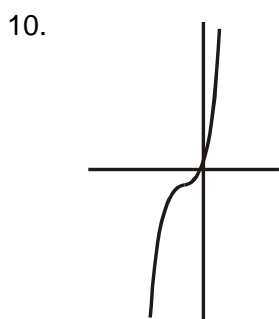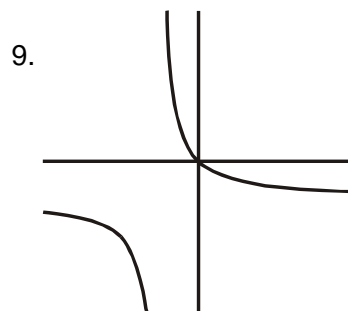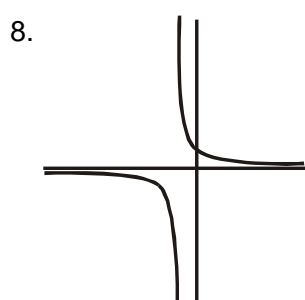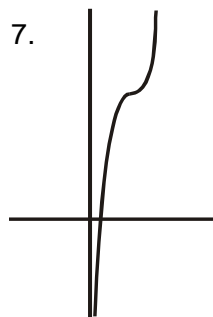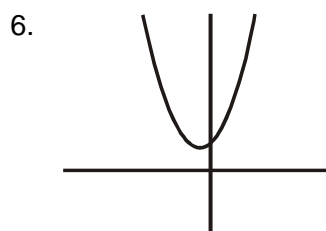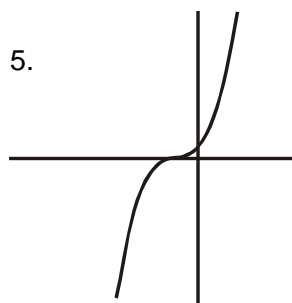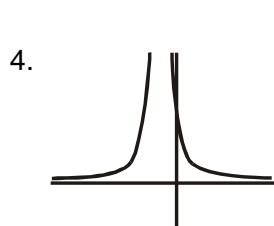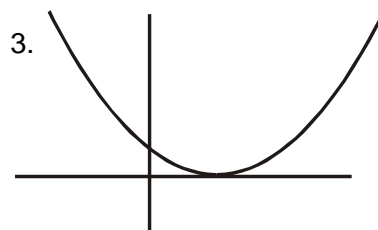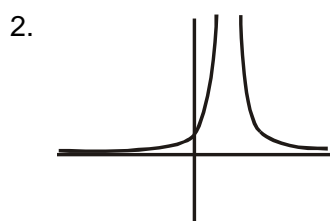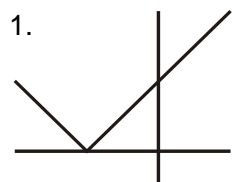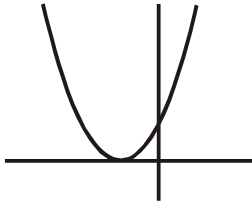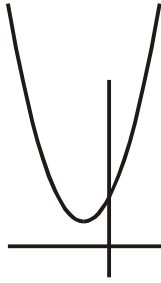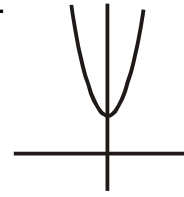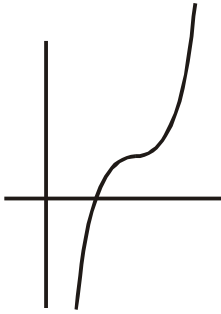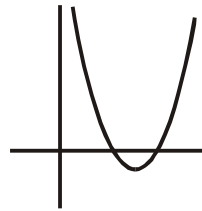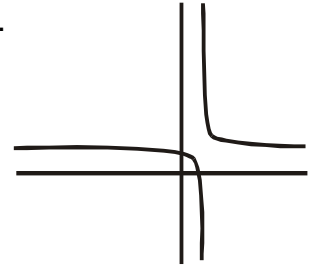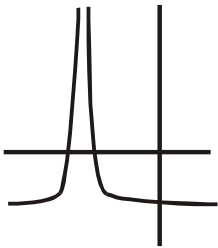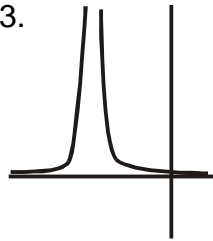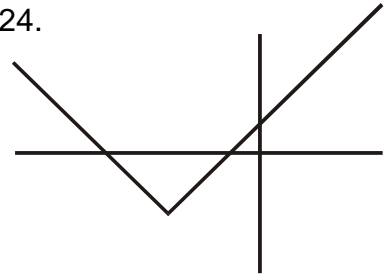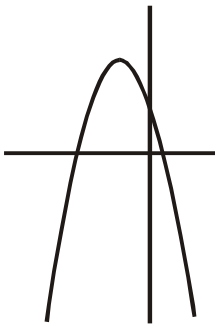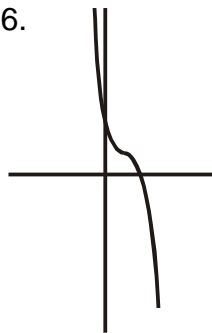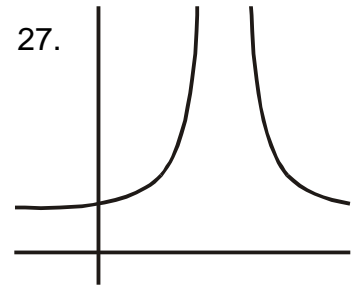
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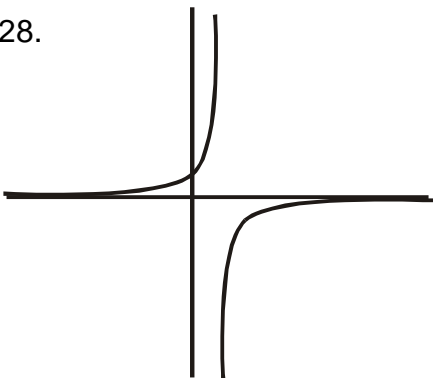
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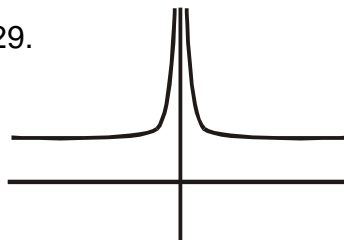
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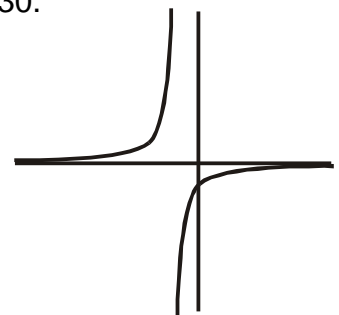
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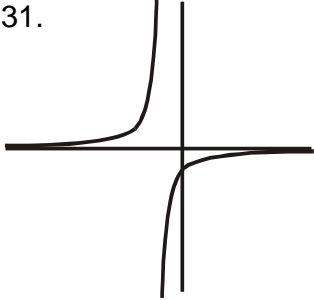
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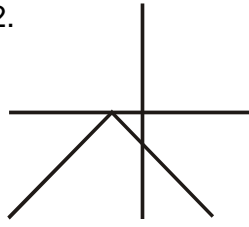
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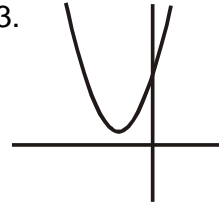
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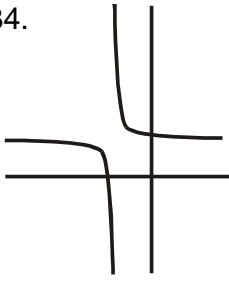
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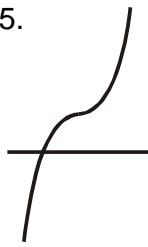
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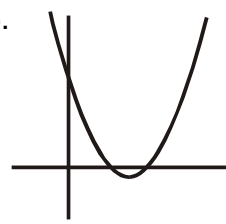
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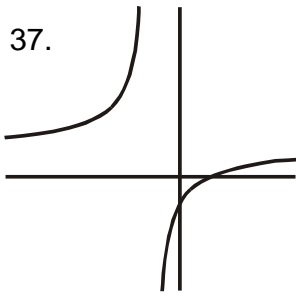
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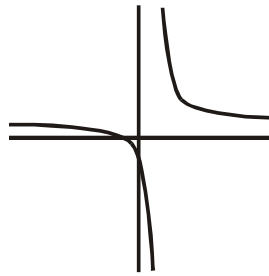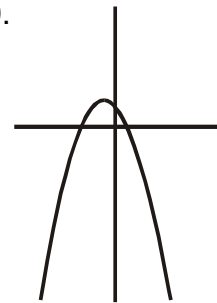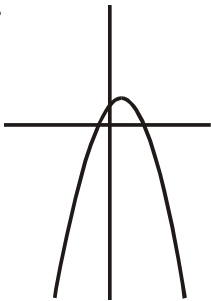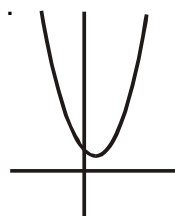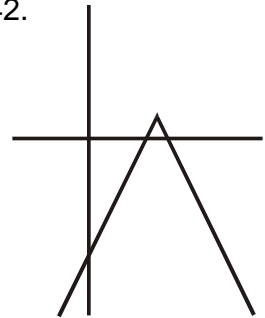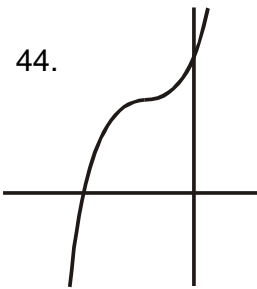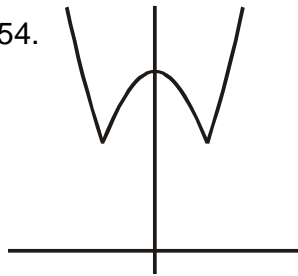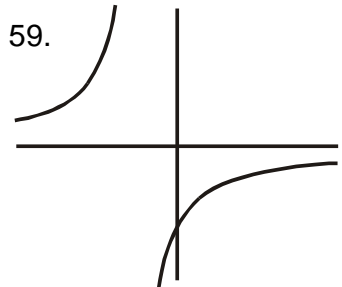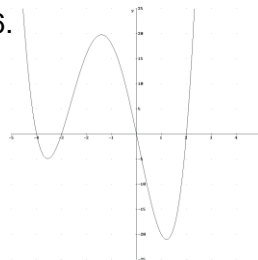
3.1 Graphs of Polynomial Functions Answers

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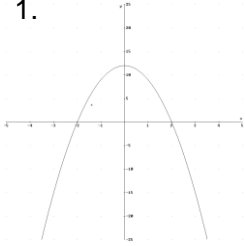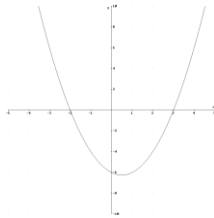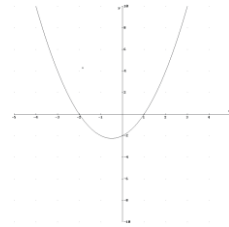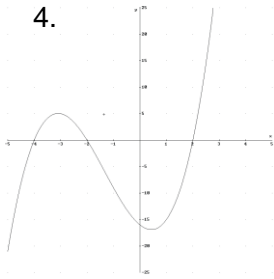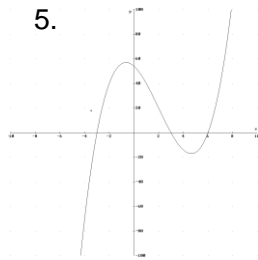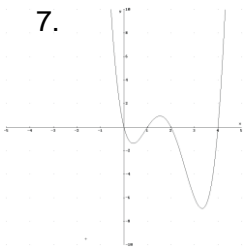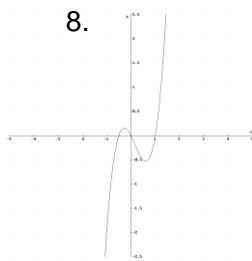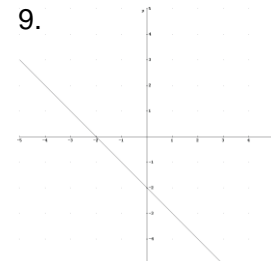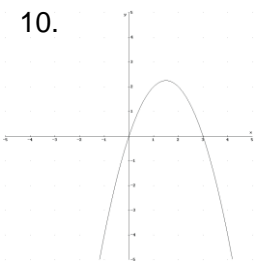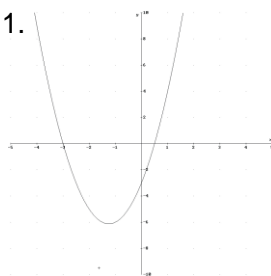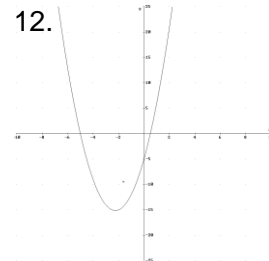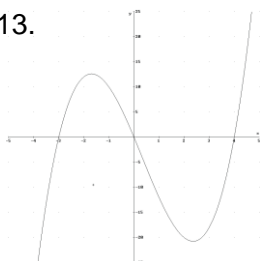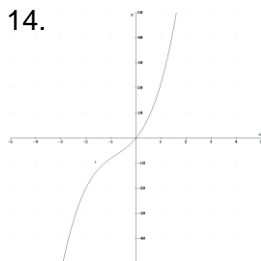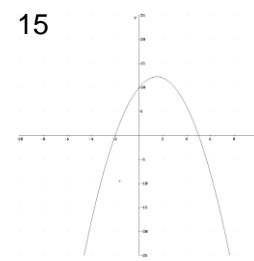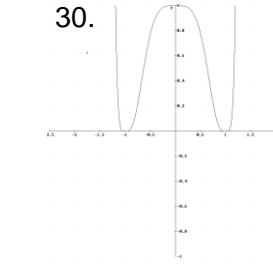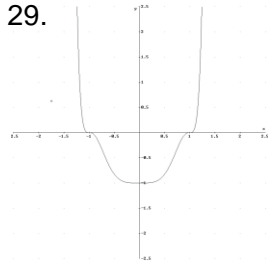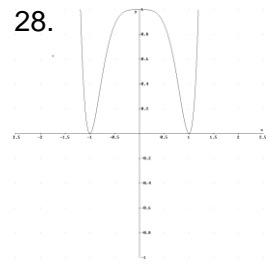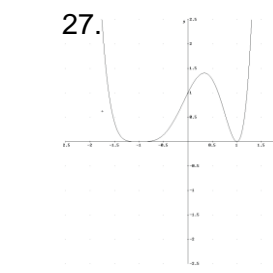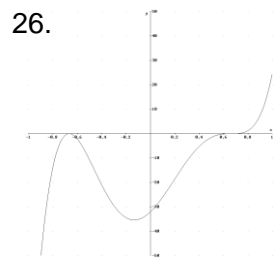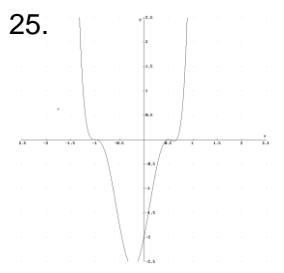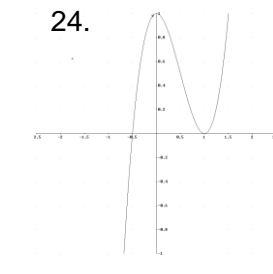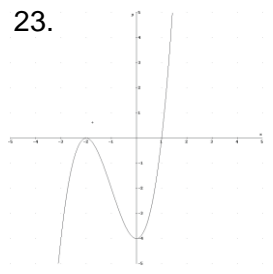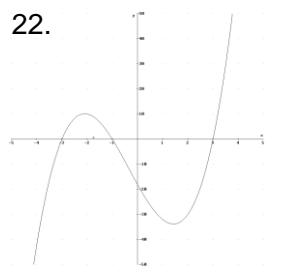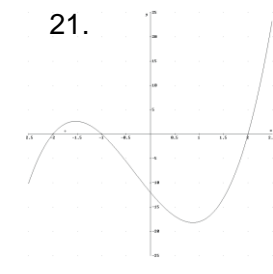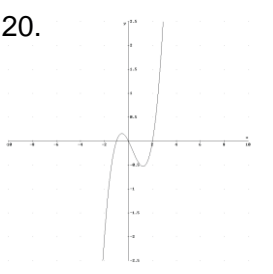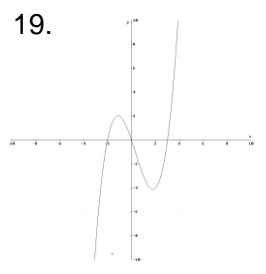
31. $y = \frac{1}{96}(x+4)^3(x+1)^2(x-3)$ **32.** $y = \frac{3}{256}(x+4)^3(x-2)^2$

33. $y = -\frac{3}{640}(x+5)(x+2)^3(x-4)^2$ **34.** $y = -x(x+3)^3(x-3)^2(x-5)$

3.2 Synthetic Division Answers

1. $3x^2 + 7x + 25$ **2.** $3x^2 - 4x + 4$ **3.** $x^3 - 7x^2 + 8x - 8$ **4.** $x^3 - x^2 - 2x - 3$

5. $2x^3 - 6x^2 + 3x - 1$ **6.** $3x^3 + 6x^2 + 12x + 9 + R(16)$

7. $4x^4 - 5x^2 - 5x - 5 + R(-1)$ **8.** $4x^2 + 5x + 5 + R(12)$ **9.** $3x^2 + 4x + 12$

10. $3x^2 - 4x + 12$ **11.** 2 **12.** 5 **13.** -15 **14.** 3 **15.** -8 **16.** -11 **17.** 25

18. -77 **19.** -4 **20.** -4 **21.** 6 **22.** 5 **23.** -69 **24.** -5 **25.** -2 or 4 **26.** -3 or 1

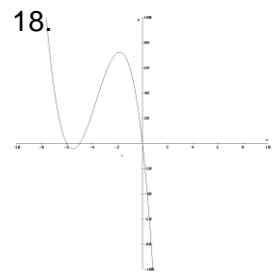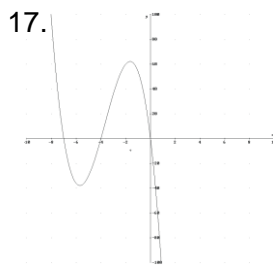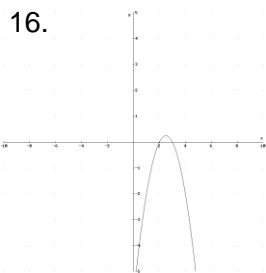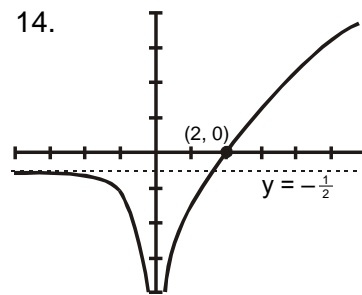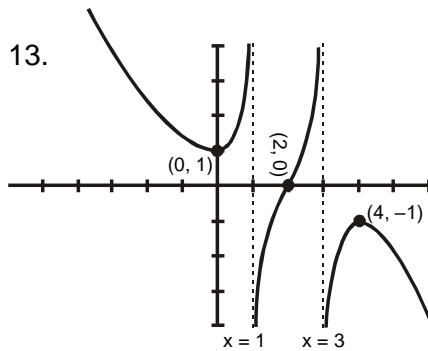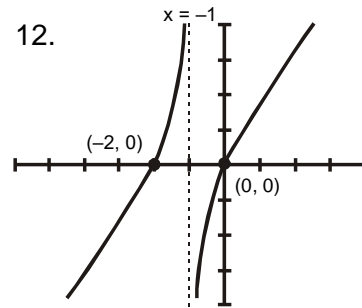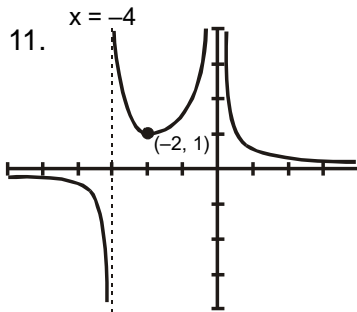**27.** -5 or 1

3.3 Rational Root Theorem Answers

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

4. $(x - 4)(3x + 4)(9x + 1)$ **5.** $(2x - 1)(3x - 4)(3x + 1)$ **6.** $(x - 6)(x + 4)(8x + 3)$

7. $(x + 3)(6x + 1)(7x - 2)$ **8.** $(x - 2)(2x + 7)(5x - 1)$ **9.** $(x + 1)(3x + 5)(5x - 3)$

10. $(2x + 3)(3x - 2)^2$ **11.** $(2x - 3)(2x + 3)^2$ **12.** $(x - 3)(x - 2)(x + 2)(x + 3)$

13. $(x - 1)(x + 1)(x^2 - 2)$ **14.** $(x^2 - 3)(4x^2 + 1)$ **15.** $(x - 3)(x + 1)(2x + 1)(3x - 2)$

16. $(x + 1)(x + 2)(2x + 3)(3x + 4)$ **17.** $(x + 2)(2x - 3)(2x + 1)(3x + 2)$

18. $(x - 2)(x + 2)(2x - 1)^2$ **19.** $(x - 4)(2x - 1)^3$ **20.** $(x + 1)^2(2x - 3)(3x - 2)$

21. $(x - 3)(x + 2)(2x - 1)(3x + 1)$ **22.** $(2x - 1)(2x + 1)(x^2 + 1)$

23. $(2x + 3)(3x - 2)(4x^2 + 1)$ **24.** $(x - 2)(x + 1)(x^2 + 4)$

25. $(x + 1)(2x - 1)(x^2 - 12)$ **26.** $(x + 1)(x + 2)(4x^2 + 9)$

27. $(x - 1)(x + 2)(2x - 43)(3x + 4)$ **28.** $(x - 2)(x + 1)(2x + 3)(3x - 4)$

29. $(x - 2)(x + 3)(2x + 1)(3x - 1)$ **30.** $(x - 2)(x + 1)(2x + 1)(2x + 3)(3x - 1)$

31. $(x - 2)(x + 3)(2x + 1)(3x - 4)^2$ **32.** $2(x - 3)(x + 2)(2x - 1)^2(4x + 5)$

33. $(x - 2)(x - 1)(x + 3)(2x - 5)(3x + 2)$ **34.** $(x - 3)(x + 2)(2x + 1)^2(2x + 3)(3x + 2)$

35. $(x - 3)(2x - 3)(2x + 1)^2(3x - 2)(3x - 1)$

3.4 Graphs of Reciprocal Functions Answers

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3.

4.

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6.

7.

8.

9.

10.

11. $x = -4$

$(-2, 1)$

12. $x = -1$

$(-2, 0)$

$(0, 0)$

13.

$(0, 1)$

$(2, 0)$

$(4, -1)$

$x = 1$ $x = 3$

14.

$(2, 0)$

$y = -\frac{1}{2}$

26
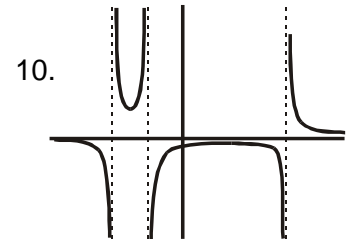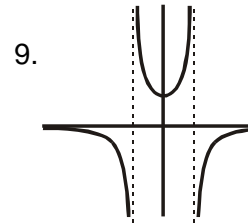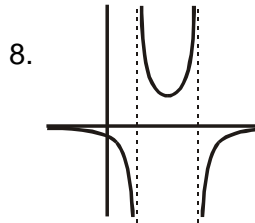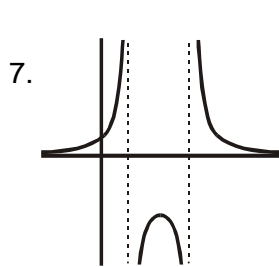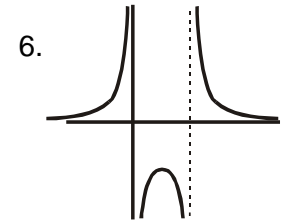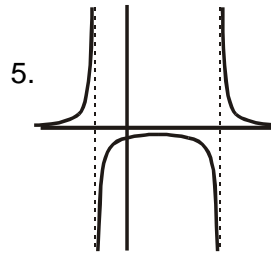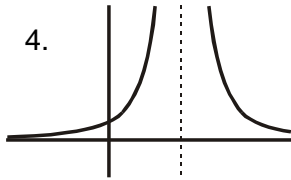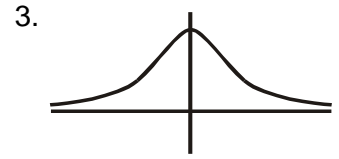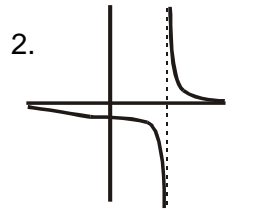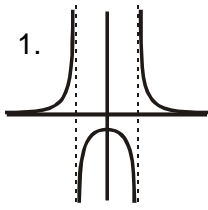
3.5 Graphs of Rational Functions Answers

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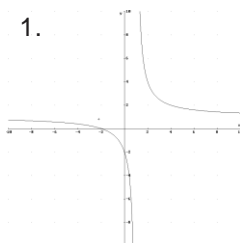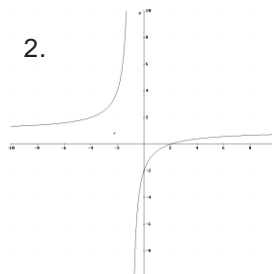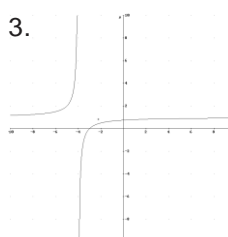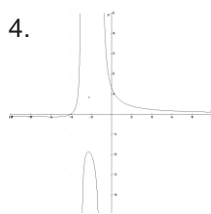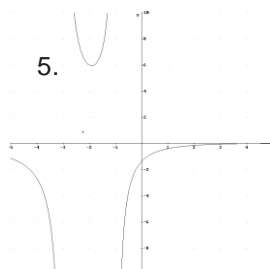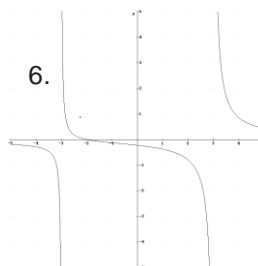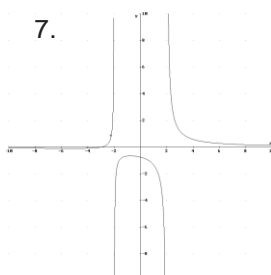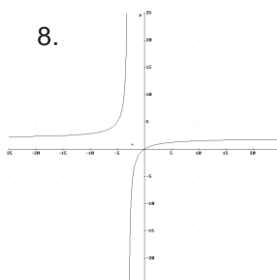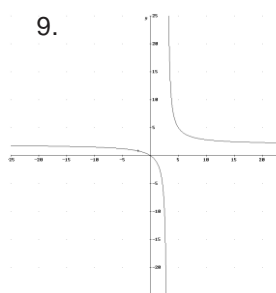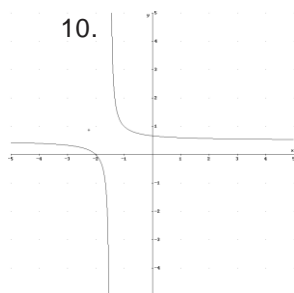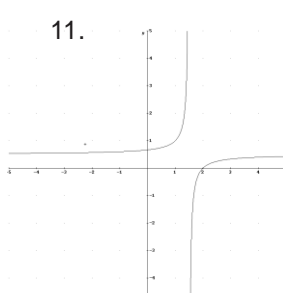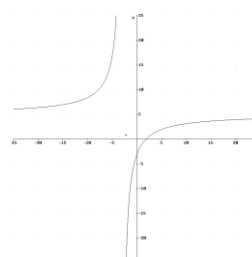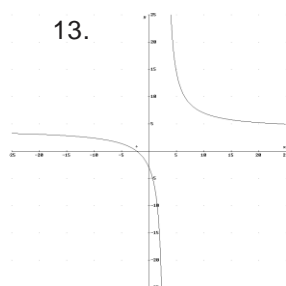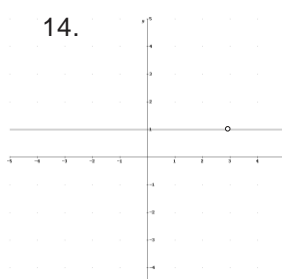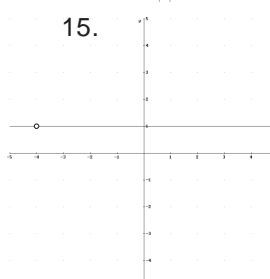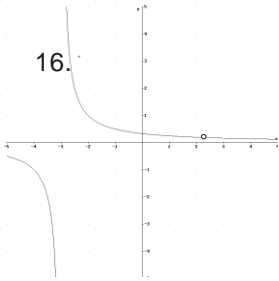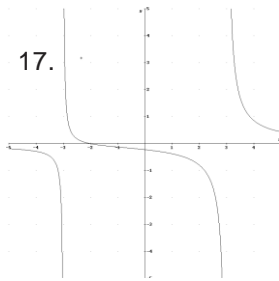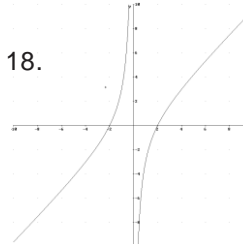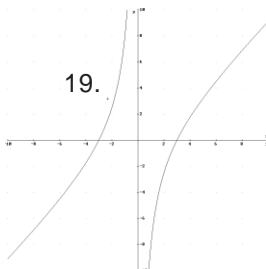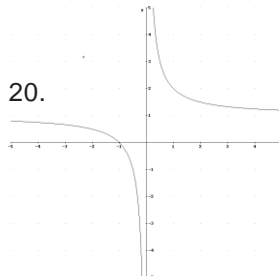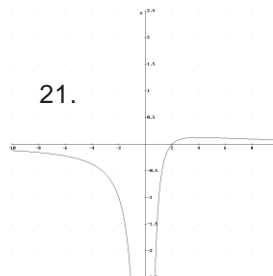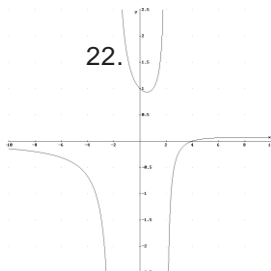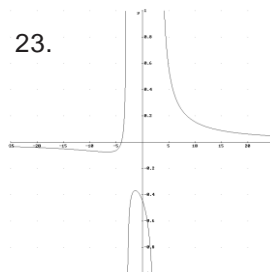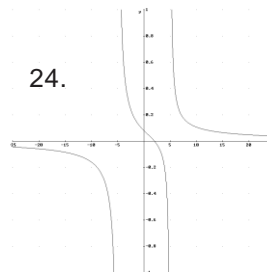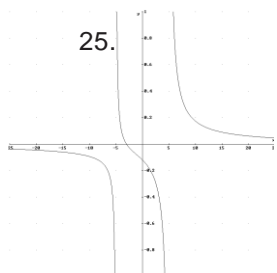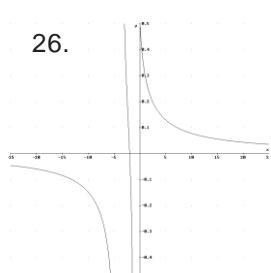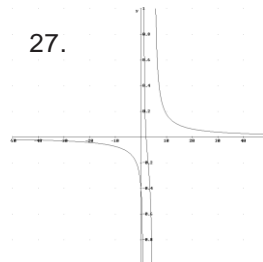
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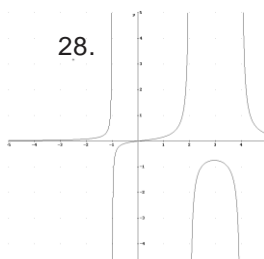
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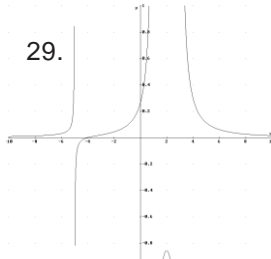
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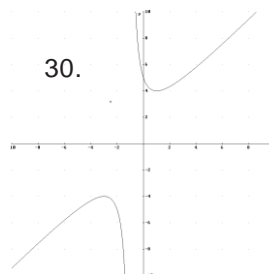
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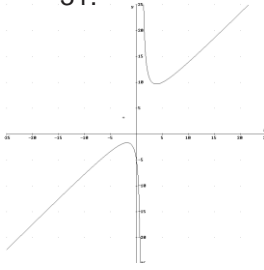
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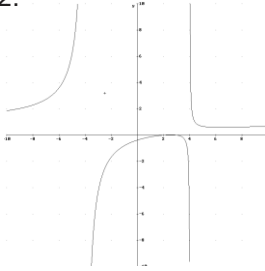
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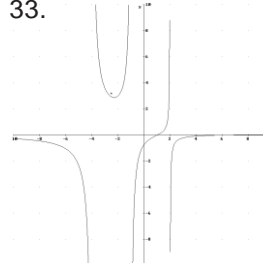
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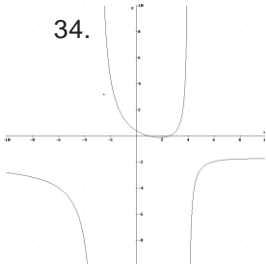
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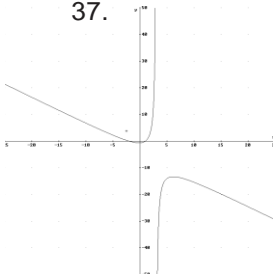
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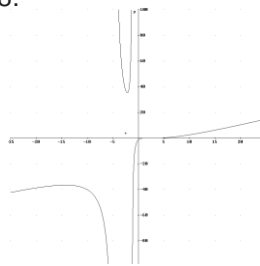
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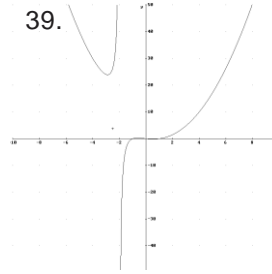
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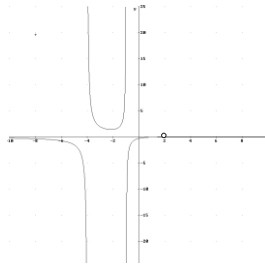
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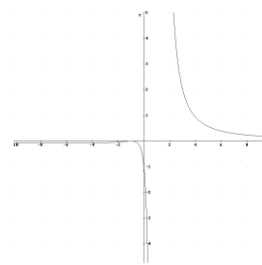
3.6 Midpoint, Distance, and Circles Answers

1. $10; (5,4)$ 2. $13; \left(\frac{7}{2}, 6\right)$ 3. $17; \left(0, \frac{5}{2}\right)$ 4. $15; \left(-\frac{5}{2}, 2\right)$ 5. $2\sqrt{10}; (2, 3)$ 6. $8\sqrt{2}; (6,6)$

7. $\frac{\sqrt{82}}{3}; \left(-1, \frac{7}{6}\right)$ 8. $\frac{\sqrt{2}}{6}; \left(-\frac{1}{4}, -\frac{5}{12}\right)$ 9. $6\sqrt{277}; (6, -45)$ 11. $\left(\frac{7}{2}, \frac{2+\sqrt{6}}{2}\right)$ 13. a. $-4, 6$

b. $4, -20$

14. a. ± 15 b. $-4, 12$ 15. a. $3x - 2y = 1$ b. $80x + 12y = -139$ 16. a. $y = x + 2$

b. $3x + y = -5$ 17. $x^2 + y^2 = 9$ 18. $x^2 + y^2 = 25$ 19. $(x - 2)^2 + (y + 1)^2 = 16$

20. $x^2 + \left(y - \frac{1}{3}\right)^2 = \frac{1}{9}$ 21. $(x + 1)^2 + (y - 2)^2 = 5$ 22. $(x - 3)^2 + (y + 2)^2 = 25$

23. $(x - 3)^2 + (y - 4)^2 = 25$ 24. $x^2 + y^2 = 17$ 25. $(1, -3); r = 2$ 26. $(1, -3); r = 5$

27. Not a circle   28. $(0,1); r = \frac{2}{3}\sqrt{3}$ 29. $\left(\frac{1}{2}, \frac{1}{2}\right); r = \sqrt{2}$ 30. $\left(\frac{1}{2}, -\frac{1}{4}\right); r = \frac{3}{4}$

31. $\left(-\frac{1}{2}, -\frac{5}{4}\right); r = \frac{3}{2}$ 32. $(2, -1); r = \sqrt{2}$

4.1 Exponential Equations with Common Base Answers

1. 3   2. 3   3. 3   4. 5   5. $\frac{3}{2}$ 6. $\frac{1}{3}$ 7. 3   8. 4   9. $\frac{2}{3}$ 10. $\frac{2}{3}$ 11. $\frac{3}{4}$ 12. $\frac{2}{3}$ 13. 7

14. 2   15. 11   16. 5   17. $-\frac{1}{2}$ 18. $-\frac{1}{3}$ 19. $\frac{1}{3}$ 20. $\frac{1}{6}$ 21. -3 22. -2 23. $-\frac{1}{2}$ 24. $\frac{1}{2}$

25. $\frac{1}{4}$ 26. $\frac{18}{13}$ 27. -5 28. -3 29. 2   30. $\frac{12}{5}$ 31. $-1, -3$ 32. $\frac{1}{2}, -3$ 33. $\frac{1}{2}, -1$ 34.

$-3, 2$ 35. $-3, -1$ 36. $-\frac{3}{2}, 1$ 37. $\frac{1}{3}, 1$ 38. 1, 2   39. $\frac{1}{3}, 2$ 40. $-\frac{1}{3}, \frac{2}{3}$ 41. $\frac{4\pm3\sqrt{2}}{2}$ 42.

$0, -1$ 43. $\frac{4\pm3\sqrt{2}}{2}$ 44. DNE   45. ±1

4.2 Properties of Logarithms Answers

1. $4^t = 7$ 2. $5^1 = 5$ 3. $10^{0.845} = 7$ 4. $a^{2.3036} = 10$ 5. $a^{-0.9676} = 0.38$ 6. $a^{-2} = W$

7. $6^h = 29$ 8. $10^{-1} = 0.1$ 9. $\log_{10} 3 = 0.4771$ 10. $\log_t Q = k$

11. $\log_a 0.906 = -0.0987$ 12. $\log_2 32 = 5$ 13. $\log_{10} 0.01 = -2$ 14. $\log_m P = a$

15. $\log_r M = -x$ 16. 1000   17. -2 18. 4   19. $\frac{1}{9}$ 20. 4   21. 9   22. 4   23. 2   24. 1

25. 64   26. $\frac{1}{2}$ 27. 2   28. $27, \frac{1}{27}$ 29. $\frac{1}{\sqrt{125}}$ 30. 5   31. $0, \frac{1}{2}$ 32. 1296   33. 4   34. 6

35. $1, -3$ 36. 3   37. 3   38. -8 39. 1   40. -2 41. $\log_b P + \log_b Q$

42. $\log_b P - \log_b Q$ 43. $\frac{1}{2}(3 \log_a z - \log_a x - \log_a y)$ 44. $2 \log_a x - 3 \log_a y - 1$

45. $3 \log_m a + 4 \log_m b - 9 \log_m n - 5$ 46. $3 \log_a p + 2 \log_a q - 4 \log_a z$

47. $\frac{1}{4}(\log_a b - 3 \log_a c + 1)$ 48. $\log_b a - 3 \log_b m - 4 \log_b n + 5$

49. $\frac{1}{2}[\log_a(2 + x) + \log_a(2 - x)]$ 50. $-\frac{1}{2}\log_a(x + y) + \frac{1}{2}\log_a(x - y)$

51. $\ln(x+1) + \ln(x-1) - 3\ln x$ 52. $\ln x + \frac{1}{2}\ln(x+2)$ 53. $\log CABIN$ 54. $\log_2 \frac{x}{25}$

55. $\log_a \frac{x^5 \sqrt[4]{z}}{y}$ 56. $\log_a \left(\frac{z\sqrt{x}}{y^7}\right)$ 57. $-\log_a b^{3/2}$ 58. $\log_a b^{3/2}$ 59. $\log_a \frac{x^{2/3}}{y^{1/3}}$

60. $\log_a \left(\frac{y^4}{x^{5/2}}\right)$ 61. $\log_a \frac{2x^4}{y^3}$ 62. $\log_a x^{3/2}$ 63. $\log_a \left(\frac{\sqrt{a}}{x}\right)$ 64. $\log_a(x+2)$

65. $\ln \left(\frac{x(x+1)}{x-1}\right)^{1/3}$ 66. $-\ln(x^2-1)$ 67. $\frac{\log 5}{\log 3}$ 68. $\frac{\ln 3}{\ln 5}$ 69. $\frac{\log x}{\log 2}$ 70. $\frac{1}{\log_y x}$ 71. $\frac{3}{2}$

72. $-1 - \log_5 2$ 73. 0.9208 74. 0.2084 75. 1.6542 76. 0.1781 77. -0.7124

78. 0.9136 79. 2.0367 80. 1.3917 81. 0.2625 82. 1.4854 83. 0.7730 84. 0.7396

85. 2.5646 86. 0

4.3 Solving Exponential Equations with Different Bases Answers

1. 1.465 2. 1.585 3. 3.045 4. 1.204 5. -2.138 6. 7.279 7. 0.648 8. 1.3253 9. 0

10. 0 11. -2.7677 12. -2.713 13. 4.419 14. -0.461 15. $0, 0.6931$ 16. $-1, 2.59$

17. $-1.0156, 3.4806$ 18. $0.0616, -1.3399$

4.4 Solving Equations with Logarithms Answers

1. 1 2. No solution   3. 1 4. $11\frac{3}{8}$ 5. 5 6. $1/3$ 7. $1, 100$ 8. $27, \frac{1}{3}$ 9. $1, 10^4$

10. 10^{100} 11. $\pm 2\sqrt{6}$ 12. $\frac{1}{2\sqrt{2}}$ 13. 2 14. $\frac{1}{2}$ 15. 0 16. 3 17. 1 18. $2\frac{5}{99}$ 19. $\pm\sqrt{14}$

20. 7 21. 5 22. $1, e^2, e^{-2}$ 23. $\frac{2}{3}$ 24. $1, 100, 0.01$ 25. $5 \pm \sqrt{15}$ 26. $10, 100$ 27. 18

28. 4 29. 20 30. 10^3 31. -1 32. 1 33. 1 34. -1 35. 2 36. 2 37. 3

38. -11 39. 0 40. 27 41. 8 42. $2, 3$ 43. $3 + \sqrt{2}, 3$ 44. No solution   45. -17

46. $\frac{1}{10}, \sqrt{10}$ 47. $3, 3^9$ 48. $5, \frac{1}{625}$ 49. $8, 4$ 50. $81, 3$ 51. $\frac{1}{3}, 27$ 52. $64, 4096$ 53. $8, 2$

54. $729, 3$ 55. 10 56. 2 57. $8, \frac{1}{\sqrt[3]{4}}$ 58. $100, \frac{1}{10}$ 59. $10, 100$ 60. $99, -\frac{9}{10}$

61. $22.53, 0.444$

62. $\frac{1}{\sqrt{3}}$ 70. $\frac{5+\sqrt{131}}{6}$ 71. $\frac{1}{3}, \frac{15}{17}$ 72. $0.505, \frac{1}{2}(10^5 + 1)$ 73. 4   74. 3   75. $-11, -1, -6 \pm \sqrt{7}$

76. 1

77. 2   78. $-\frac{1}{4}$ 79. $1, 4, \frac{1}{\sqrt{2}}$

4.5 Applications of Logarithms and Exponents Answers

1. 97.29   2. 15.47   3. 9.7   4. 1.14   5. .354   6. .886   7. 30   8. 28.17

9. 10.81   10. 626469   11. 275006   12. 174470   13. 156859   14. 14050712

15. 17161578   16. 9742443   17. 22076019   18. 2963039; 3394700; 3889246

19. 576410; 1050288; 1913750   20. 220.84   21. 960.79   22. 11.6   23. 5.33

24. -5.33×10^{-10} 25. 69;138.6   26. -0.000124 27. 11180   28. 10266   29. 17099

30. 1311   31. 8700   32. 57%   33. 15300   34. 5430   35. 11994   36. 2616   37. 186

38. 4.4   39. 9922   40. 19932   41. a. 10.004   b. 15.066   42. 7   43. 78.56   44. 77

45. 37   46. $k = \frac{1}{t}\ln\left(\frac{T-T_a}{T_0-T_a}\right)$ 47. 76.6°   48. 100.32 °   49. 90.7 °   50. a. 41.44 °   b. never

c. 4.34 min   51. $k = 0.225; t = 9.77$ 52. $k = 0.0788, t = 57.79$

53. $k = 0.1136, t = 87.2$ 54. $k = 0.267, t = 12.34$ 55. $k = 0.516, t = 6.5$

56. $k = 0.199, t = 6.5$ 57. $k = 0.166, t = 19.125$ 58. $k = 0.1533, t = 34.63$

59. $k = 0.249, t = 8.58$ 60. $k = 0.11168, t = 30$ 61. 10^{-7} 62. 1.26×10^{-3}

63. 2.51×10^{-13} 64. 200,000,000   65. 42.6067   66. \$7459.12   67. \$3823.98

68. \$12183.77   69. \$101.68   70. 8.66   71. 34.66   72. 3.92   73. 4186.1   74. 49th   75. 2

76. 1.4983

5.1 Angles Answers
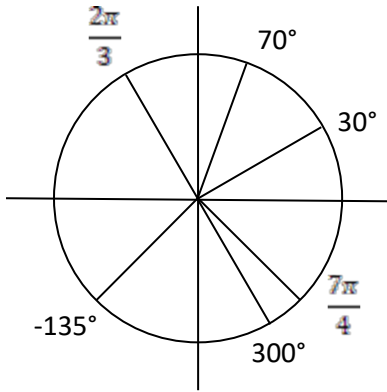
1.   **3.** π **5.** 150°   **7.** 325°   **9.** 54°   **11.** $\frac{8\pi}{9}$ **13.** $\frac{\pi}{2}$

15. 35 mi   **17**. 8π cm   **19**. 5.7596 mi   **21**. 28.6479°   **23**. 3960 rad/min, 630.254 RPM

25. 2.094 in/sec, $\frac{\pi}{12}$ rad/sec, 2.5 RPM

27. 75398.22 mm/min = 1.257 m/sec

29. Angular speed: $\frac{\pi}{12}$ rad/hr   Linear speed: 1036.73 mi/hr   **31**. a. 114° 35' 30"

b. 286° 28' 44"   c. 229° 10'59"   32. a. 63° 10' 8"   b. 310° 37' 17"   c. 81° 43' 26"

5.2 Right Triangle Trigonometry Answers

1. $\sin(A) = \frac{\sqrt{65}}{65}, \cos(A) = \frac{8\sqrt{65}}{65}, \tan(A) = \frac{1}{8}$ 3. $c = 14, b = 7\sqrt{3}, B = 60°$

5. $a = 5.3171, c = 11.3257, A = 28°$ 7. $a = 9.0631, b = 4.2262, B = 25°$ 9. 32.4987 ft

11. 836.2698 ft   13. 460.4069 ft   15. 660.35 ft   17. 28.025 ft   19. 143.0427   21. 86.6685

5.3 Non-Right Triangle: Laws of Sines and Cosines Answers

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3.

5.

7.
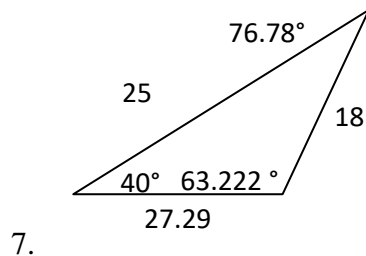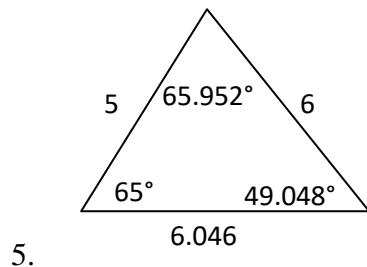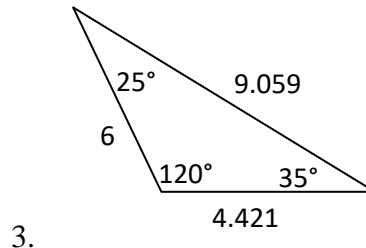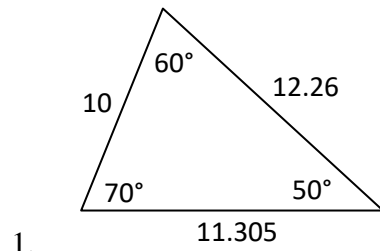
9. $\beta = 68°, a = 14.711, c = 20.138$ 11. $\beta = 28.096°, \gamma = 32.904°, c = 16.149$

13. Not possible

15. $\beta = 64.243°, \gamma = 72.687°, c = 257.328$ or $\beta = 115.757°, \gamma = 21.143°, c = 97.238$

17.

19.
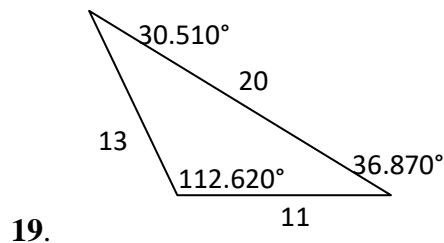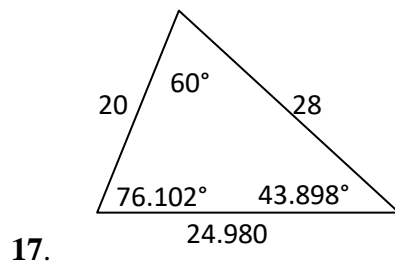
21. $c = 2.066, \ \alpha = 52.545°, \beta = 86.255°$ 23. $a = 11.269, \beta = 27.457°, \gamma = 32.543°$

25. 177.562   27. 978.515 ft   29. To A: 565.258 ft, to shore: 531.169 ft   31. 529.014 m

33. 173.877 ft   35. 4.02 km, 2.794 km,   37. 757.963 ft   39. 2371.129 mi

5.4 Points on a Circle Answers

1. a. III   b. II   3. $-\frac{4}{5}$ 5. $-\frac{4\sqrt{3}}{7}$ 7. $-\frac{\sqrt{55}}{8}$

9. a. reference: 45°, quadrant III, $\sin(225°) = -\frac{\sqrt{2}}{2}$, $\cos(225°) = -\frac{\sqrt{2}}{2}$

b. reference: 60°, quadrant IV, $\sin(300°) = -\frac{\sqrt{3}}{2}$, $\cos(300°) = \frac{1}{2}$

c. reference: 45°, quadrant II, $\sin(135°) = \frac{\sqrt{2}}{2}$, $\cos(135°) = -\frac{\sqrt{2}}{2}$

d. reference: 30°, quadrant III, $\sin(210°) = -\frac{1}{2}$, $\cos(210°) = -\frac{\sqrt{3}}{2}$

11. a. reference: $\frac{\pi}{4}$, quadrant III, $\sin\left(\frac{5\pi}{4}\right) = -\frac{\sqrt{2}}{2}$, $\cos\left(\frac{5\pi}{4}\right) = -\frac{\sqrt{2}}{2}$

b. reference: $\frac{\pi}{6}$, quadrant III, $\sin\left(\frac{7\pi}{6}\right) = -\frac{1}{2}$, $\cos\left(\frac{7\pi}{6}\right) = -\frac{\sqrt{3}}{2}$

c. reference: $\frac{\pi}{3}$, quadrant IV, $\sin\left(\frac{5\pi}{3}\right) = -\frac{\sqrt{3}}{2}$, $\cos\left(\frac{5\pi}{3}\right) = \frac{1}{2}$,

d. reference: $\frac{\pi}{4}$, quadrant II, $\sin\left(\frac{3\pi}{4}\right) = \frac{\sqrt{2}}{2}$, $\cos\left(\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$

13. a. $\sin\left(-\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$, $\cos\left(-\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$ b. $\sin\left(\frac{23\pi}{6}\right) = -\frac{1}{2}$, $\cos\left(\frac{23\pi}{6}\right) = \frac{\sqrt{3}}{2}$

c. $\sin\left(-\frac{\pi}{2}\right) = -1$, $\cos\left(-\frac{\pi}{2}\right) = 0$ d. $\sin(5\pi) = 0$, $\cos(5\pi) = -1$ 15. a. $\frac{2\pi}{3}$ b. 100°

c. 40°   d. $\frac{5\pi}{3}$ e. 235°   17. a. $\frac{5\pi}{3}$ b. 280°   c. 220°   d. $\frac{2\pi}{3}$ e. 55°

19. $(-11.491, -9.642)$

5.5 Other Trigonometric Functions Answers

1. $\sec(\theta) = \sqrt{2}$, $\csc(\theta) = \sqrt{2}$, $\tan(\theta) = 1$, $\cot(\theta) = 1$

3. $\sec(\theta) = -\frac{2\sqrt{3}}{3}$, $\csc(\theta) = 2$, $\tan(\theta) = -\frac{\sqrt{3}}{3}$, $\cot(\theta) = -\sqrt{3}$

5. $\sec(\theta) = -2$, $\csc(\theta) = \frac{2\sqrt{3}}{3}$, $\tan(\theta) = -\sqrt{3}$, $\cot(\theta) = -\frac{\sqrt{3}}{3}$ 7. a. $-\sqrt{2}$ b. -2 c. $\sqrt{3}$

d. 1   9. $\cos(\theta) = -\frac{\sqrt{7}}{4}, \sec(\theta) = -\frac{4\sqrt{7}}{7}, \csc(\theta) = \frac{4}{3}, \tan(\theta) = -\frac{3\sqrt{7}}{7}, \cot(\theta) = -\frac{\sqrt{7}}{3}$

11. $\sin(\theta) = -\frac{2\sqrt{2}}{3}, \csc(\theta) = -\frac{3\sqrt{2}}{4}, \sec(\theta) = -3, \tan(\theta) = 2\sqrt{2}, \cot(\theta) = \frac{\sqrt{2}}{4}$

13. $\sin(\theta) = \frac{12}{13}, \cos(\theta) = \frac{5}{13}, \sec(\theta) = \frac{13}{5}, \csc(\theta) = \frac{13}{12}, \cot(\theta) = \frac{5}{12}$

15. a. $\sin(0.15) = 0.1494, \cos(0.15) = 0.9888, \tan(0.15) = 0.1511$

b. $\sin(4) = -0.7568, \cos(4) = -0.6536, \tan(4) = 1.1578$

c. $\sin(70°) = 0.9397, \cos(70°) = 0.3420, \tan(70°) = 2.7475$

d. $\sin(283°) = -0.9744, \cos(283°) = 0.2250, \tan(283°) = -4.3315$ 17. $\sec(t)$

19. $\tan(t)$ 21. $\tan(t)$ 23. $\cot(t)$ 25. $(\sec(t))^2$ or $\sec^2(t)$

5.6 Graphs of Trig Functions Answers

1.

2.

3.

4.
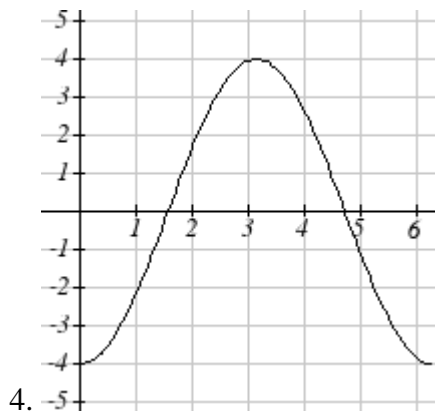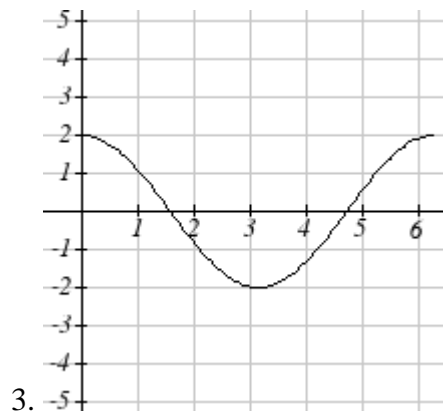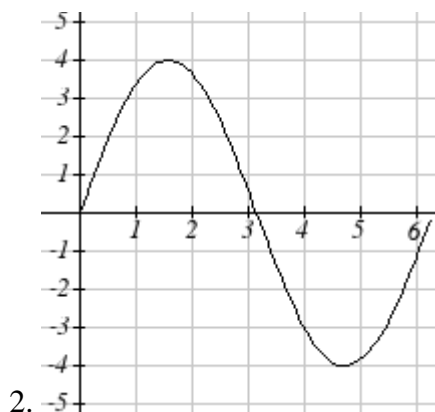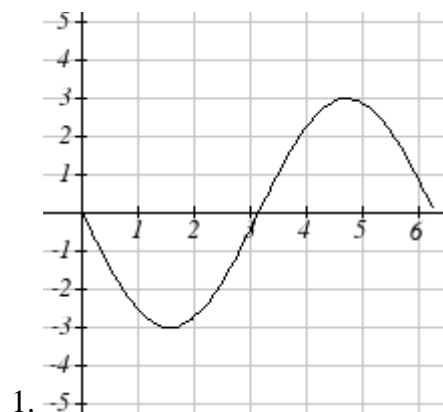
Prob	Amp	Per	V. Shift	$f(t)$
5.	3	2	Down 4	$3\sin(\pi t) - 4$
6.	2	4	Down 3	$2\sin\left(\frac{\pi}{2}t\right) - 3$
7.	2	4π	Up 1	$2\cos\left(\frac{1}{2}t\right) + 1$
8.	3	π	Down 1	$3\cos(2t) - 1$
9.	2	5	Up 3	$-2\cos\left(\frac{2\pi}{5}t\right) + 3$
10.	1	3	Down 1	$-\sin\left(\frac{2\pi}{3}t\right) - 1$

Prob	Amp	Per	H. Shift	V. Shift
11.	3	$\frac{\pi}{4}$	Left 4	Up 8
12.	4	4	Right 3	Up 7
13.	2	$\frac{2\pi}{3}$	Right 7	Up 4
14.	5	$\frac{2\pi}{5}$	Left 4	Down 2
15.	1	12	Left 6	0
16.	8	$\frac{12}{7}$	Left 3	Up 6

17. $f(x) = 4\sin\left(\frac{\pi}{5}(x+1)\right)$ 18. $f(x) = 3\sin\left(\frac{\pi}{3}(x+1)\right)$ 19. $f(x) = \cos\left(\frac{\pi}{5}(x+2)\right)$

20. $f(x) = -2\cos\left(\frac{\pi}{3}(x-1)\right)$ 21. $D(t) = 50 - 7\sin\left(\frac{\pi}{12}t\right)$ 22. $D(t) = 68 - 12\sin\left(\frac{\pi}{12}t\right)$

23. a. Amp: 12.5, vertical shift 13.5 up, period: 10   b. $h(t) = -12.5\cos\left(\frac{\pi}{5}t\right) + 13.5$

c. $h(5) = 26$ m   24. a. amp: 17.5, vertical shift 20.5 up, period: 8

b. $h(t) = -17.5 \cos\left(\frac{\pi}{4}t\right) + 20.5$ c. 38 m   25. II   27. I   29. Period: $\frac{\pi}{4}$, H. shift: 8 right

31. Period: 8, H. shift: 1 left   33. Period: 6, H. shift 3 left
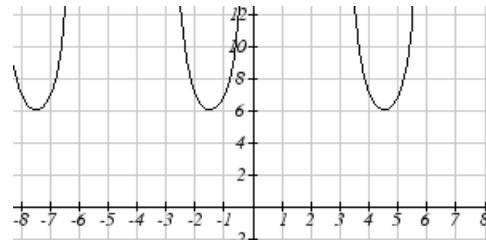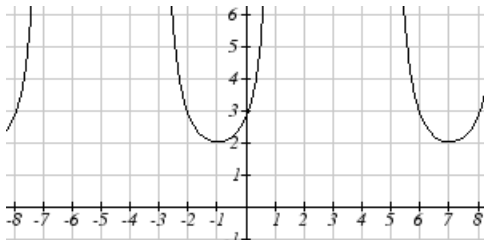
35.

37.
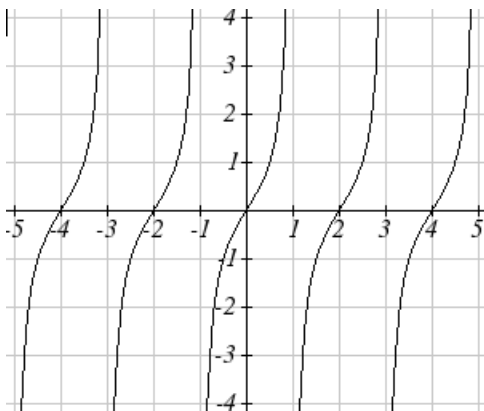
39.

41. $f(x) = 2\sec\left(\frac{\pi}{2}x\right) - 1$

43. $f(x) = 2\csc\left(\frac{\pi}{4}x\right) + 1$ 45. 1.5   47. 2   49. 5   51. $-\csc(x)$

5.7 Inverse Trig Functions Answers

1. $\frac{\pi}{4}$ 3. $-\frac{\pi}{6}$ 5. $\frac{\pi}{3}$ 7. $\frac{3\pi}{4}$ 9. $\frac{\pi}{4}$ 11. $-\frac{\pi}{3}$ 13. 1.9823   15. -0.9273 17. 44.427°   19. $\frac{\pi}{4}$

21. $-\frac{\pi}{6}$ 23. $\frac{2\sqrt{10}}{7}$ 25. $\frac{\sqrt{17}}{17}$ 27. $\frac{\sqrt{25-x^2}}{5}$ 29. $\frac{3x\sqrt{9x^2+1}}{9x^2+1}$

6.1 Solving Trigonometric Equations Answers

1. $\frac{5\pi}{4}, \frac{7\pi}{4}$ 3. $\frac{\pi}{3}, \frac{5\pi}{3}$ 5. $\frac{\pi}{2}$ 7. $\frac{\pi}{2}, \frac{3\pi}{2}$ 9. $\frac{\pi}{4} + 2\pi k, \frac{7\pi}{4} + 2\pi k$ 11. $\frac{7\pi}{6} + 2\pi k, \frac{11\pi}{6} + 2\pi k$

13. $\frac{\pi}{18} + \frac{2\pi}{3}k, \frac{5\pi}{18} + \frac{2\pi}{3}k$ 15. $\frac{5\pi}{12} + \frac{2\pi}{3}k, \frac{7\pi}{12} + \frac{2\pi}{3}k$ 17. $\frac{\pi}{6} + \pi k, \frac{5\pi}{6} + \pi k$

19. $\frac{\pi}{4} + \frac{2\pi}{3}k, \frac{5\pi}{12} + \frac{2\pi}{3}k$ 21. $4 + 8k$ 23. $\frac{1}{6} + 2k, \frac{5}{6} + 2k$ 25. $0.2734, 2.8682$

27. $3.7603, 5.6645$ 29. $2.1532, 4.1300$ 31. $0.7813, 5.5019$ 33. $0.04829, 0.47531$

35. $0.7381, 1.3563$ 37. $0.9291, 3.0709$ 39. $1.3077, 4.6923$

6.2 Modeling with Trigonometric Functions Answers

1. $c = \sqrt{89}, A = 57.9946°, B = 32.0054°$ 3. $b = \sqrt{176}, A = 27.8181°, B = 62.1819$

5. $y(x) = 6\sin\left(\frac{\pi}{2}(x-1)\right) + 4$ 7. $D(t) = 50 - 13\cos\left(\frac{\pi}{12}(t-5)\right)$

9. a. $P(t) = 129 - 25\cos\left(\frac{\pi}{6}t\right)$ b. $P(t) = 129 - 25\cos\left(\frac{\pi}{6}(t-3)\right)$ 11. $75°$ 13. 8

15. 2.80869431742 17. 5.035 months

6.3 Solving Trigonometric Equations with Identities Answers

1. $\frac{7\pi}{6}, \frac{11\pi}{6}$ 3. $\frac{\pi}{3}, \frac{5\pi}{3}$ 5. $\frac{2}{3} + 8k, \frac{10}{3} + 8k$ 7. $\frac{5\pi}{12} + k\pi, \frac{7\pi}{12} + k\pi$

9. $1.339 + 10k, 8.6614 + 10k$ 11. $1.438 + \frac{2\pi}{3}k, 1.9978 + \frac{2\pi}{3}k$ 13. $\frac{\pi}{2}, \frac{3\pi}{2}, 0.644, 2.498$

15. $0.056, 1.515, 3.197, 4.647$ 17. $0, \pi, \frac{\pi}{3}, \frac{5\pi}{3}$ 19. No solution

21. $1.183, 1.958, 4.325, 5.100$ 23. $\frac{3\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$ 25. $\pi, \frac{\pi}{3}, \frac{5\pi}{3}$ 27. $1.823, 4.46$

29. 2.301, 3.983, 0.723, 5.560   31. 3.305, 6.120   33. $0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{5\pi}{3}$ 35. $0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{7\pi}{4}$

37. $\frac{\pi}{6}, \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{4\pi}{3}$ 39. $0, \pi, 1.231, 5.052$ 41. $\frac{\pi}{3}, \frac{5\pi}{3}$

6.4 Addition and Subtraction Identities Answers

1. $\frac{\sqrt{2}+\sqrt{6}}{4}$ 3. $\frac{-\sqrt{2}-\sqrt{6}}{4}$ 5. $\frac{\sqrt{2}-\sqrt{6}}{4}$ 7. $\frac{\sqrt{2}+\sqrt{6}}{4}$ 9. $\frac{\sqrt{3}}{2}\sin(x) - \frac{1}{2}\cos(x)$

11. $-\frac{\sqrt{3}}{2}\cos(x) + \frac{1}{2}\sin(x)$ 13. $\sec(t)$ 15. $\tan(x)$ 17. $8(\cos(5x) - \cos(27x))$

19. $\sin(8x) + \sin(2x)$ 21. $2\cos(5t)\cos(t)$ 23. $2\sin(5x)\cos(2x)$ 25. a. $\frac{-2-5\sqrt{3}}{12}$

b. $\frac{\sqrt{5}+2\sqrt{15}}{12}$ 27. $0.373 + \frac{2\pi}{3}k, 0.674 + \frac{2\pi}{3}k$ 29. $2\pi k$

31. $\frac{\pi}{7} + \frac{4\pi}{7}k, \frac{3\pi}{7} + \frac{4\pi}{7}k, \frac{\pi}{3} + \frac{4\pi}{3}k, \pi + \frac{4\pi}{3}k$ 33. $\frac{k\pi}{2}, \frac{\pi}{4} + \frac{\pi k}{2}, \frac{7\pi}{12} + k\pi, \frac{11\pi}{12} + k\pi$

35. $2\sqrt{13}\sin(x + 5.3004)$ or $2\sqrt{13}\sin(x - 0.9828)$ 37. $\sqrt{29}\sin(3x + 0.3805)$

39. $0.3681, 3.8544$ 41. $0.7854, 1.8158$ 43. $\tan(6t)$

6.5 Double Angle Identities Answers

1. a. $\frac{3\sqrt{7}}{32}$ b. $\frac{31}{32}$ c. $\frac{3\sqrt{7}}{31}$ 3. $\cos(56°)$ 5. $\cos(34°)$ 7. $\cos(18x)$ 9. $2\sin(16x)$

11. $0, \pi, 2.4189, 3.8643$ 13. $0.7297, 2.4119, 3.8713, 5.5535$ 15. $\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}$

17. $\frac{2\pi}{9}, \frac{4\pi}{9}, \frac{8\pi}{9}, \frac{10\pi}{9}, \frac{14\pi}{9}, \frac{16\pi}{9}, 0, \frac{2\pi}{3}, \frac{4\pi}{3}$ 19. $\frac{1+\cos(10x)}{2}$ 21. $\frac{3}{8} - \frac{1}{2}\cos(16x) + \frac{1}{8}\cos(32x)$

23. $\frac{1}{16} - \frac{1}{16}\cos(2x) - \frac{1}{16}\cos(4x) + \frac{1}{16}\cos(2x)\cos(4x)$ 25. a. $\sqrt{\frac{1}{2} + \frac{2\sqrt{3}}{7}}$ b. $\sqrt{\frac{1}{2} - \frac{2\sqrt{3}}{7}}$ c. $7 + 4\sqrt{3}$

6.6 Review Trig Identities and Trig Equations Answers

1. $\frac{\pi}{2}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{3\pi}{2}$ 3. $\frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$ 5. $0, \frac{\pi}{4}, \frac{5\pi}{4}$ 7. $\frac{\pi}{2}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{3\pi}{2}$ 9. π 11. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

13. $\frac{\pi}{4}, \frac{5\pi}{4}$ 15. $0, \frac{\pi}{3}, \pi, \frac{5\pi}{3}$ 17. $\frac{\pi}{2}, \frac{3\pi}{2}$ 19. $0, \frac{2\pi}{3}, \frac{4\pi}{3}$ 21. $0, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}$

23. $0, \dfrac{\pi}{5}, \dfrac{2\pi}{5}, \dfrac{3\pi}{5}, \dfrac{4\pi}{5}, \pi, \dfrac{6\pi}{5}, \dfrac{7\pi}{5}, \dfrac{8\pi}{5}, \dfrac{9\pi}{5}$ 25. $\dfrac{\pi}{6}, \dfrac{5\pi}{6}, \dfrac{3\pi}{2}$ 27. $\dfrac{\pi}{2}$ 29. 0 31. $\dfrac{\pi}{3}, \dfrac{5\pi}{3}$

33. No real solutions   35. No real solutions   37. $\dfrac{\pi}{2}, \dfrac{7\pi}{6}$ 39. $0, \dfrac{\pi}{3}, \pi, \dfrac{5\pi}{3}$ 41. $\dfrac{\pi}{4}$

7.1 Polar Coordinates Answers
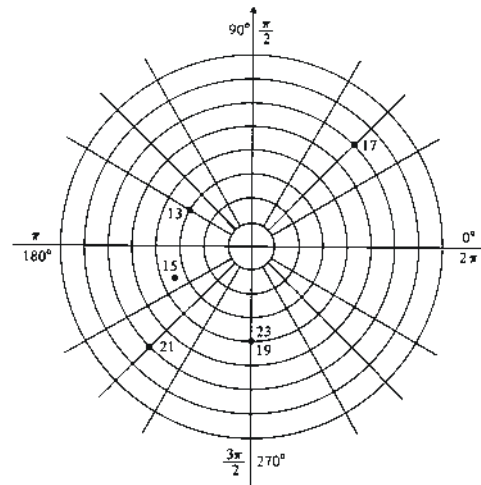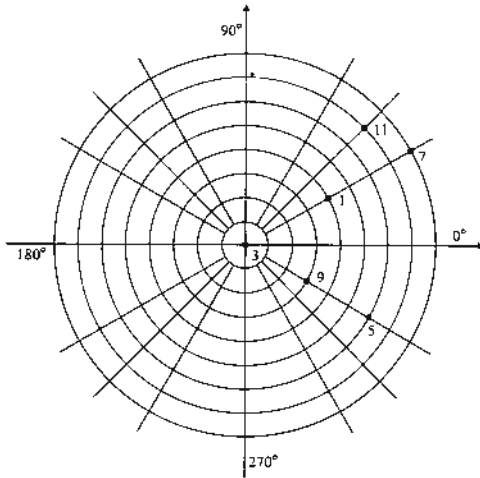
25. $(4\sqrt{2}, 45°)$ 27. $(5, 90°)$ 29. $(4, 0°)$ 31. $(6, 60°)$ 33. $(2, 30°)$ 35. $(6, 30°)$

37. $(2\sqrt{2}, 2\sqrt{2})$ 39. $(0,0)$ 41. $\left(-\frac{3\sqrt{2}}{2}, -\frac{3\sqrt{2}}{2}\right)$ 43. $(3, -3\sqrt{3})$ 45. $(5\sqrt{3}, 5)$

47. $(4.33, -2.5)$ 49. $3r\cos(\theta) + 4r\sin(\theta) = 5$ 51. $r\cos(\theta) = 5$ 53. $r^2 = 36$

55. $r^2(\cos^2(\theta) - 4\sin^2(\theta)) = 4$ 57. $x^2 + y^2 = 25$ 59. $y = x$ 61. $y = 2$

63. $x^2 - 4x + y^2 = 0$ 65. $x^2 - 4y = 4$ 67. $x^2 - 2x + y^2 - 3y = 0$

7.2 Polar Form of Complex Numbers Answers
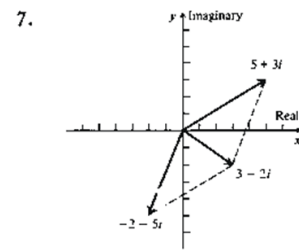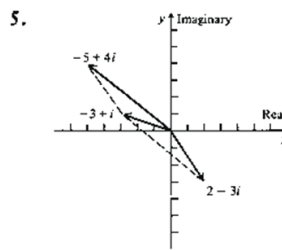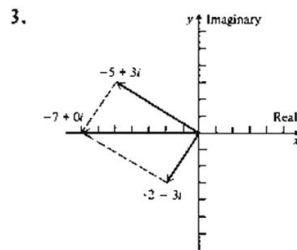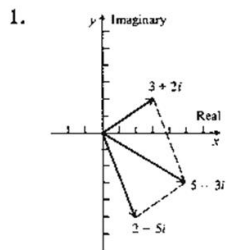
9. $\frac{3\sqrt{3}}{2}+\frac{3}{2}i$ 11. $-10i$ 13. $2+2i$ 15. $-2-2i$ 17. $\sqrt{2}cis(315°)$ 19. $20cis(330°)$

21. $5cis(180°)$ 23. $4cis(0°)$ 25. $8cis(120°)$ 27. $cis\frac{3\pi}{2}$ or $cis(270°)$

29. $2cis\frac{3\pi}{2}$ or $2cis(270°)$

7.3 DeMoivre's Theorem Answers

1. $8cis(\pi)$ 3. $64cis(\pi)$ 5. $8cis(270°)$ 7. $-8-8i\sqrt{3}$ 9. $-8-8i\sqrt{3}$ 11. i 13. 1

15. $cis(45°), cis(225°)$ or $\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}i, -\frac{\sqrt{2}}{2}-\frac{\sqrt{2}}{2}i$ 17. $2cis(157.5°), 2cis(337.5°)$

19. $\sqrt{2}cis(60°), \sqrt{2}cis(240°)$ or $\frac{\sqrt{2}}{2}+\frac{\sqrt{6}}{2}i, -\frac{\sqrt{2}}{2}-\frac{\sqrt{6}}{2}i$

21. $cis(30°), cis(150°), cis(270°)$ or $\frac{\sqrt{3}}{2}+\frac{1}{2}i, -\frac{\sqrt{3}}{2}+\frac{1}{2}i, -i$

23. $2cis(0°), 2cis(90°), 2cis(180°), 2cis(270°)$ or $2, 2i, -2, -2i$

25. $cis(36°), cis(108°), cis(180°), cis(252°), cis(324°)$

27. $2cis(30°), 2cis(120°), 2cis(210°), 2cis(300°)$ or $\sqrt{3}+i, -1+i\sqrt{3}, -\sqrt{3}-i, 1-i\sqrt{3}$

29. $\sqrt[3]{4}cis(110°), \sqrt[3]{4}cis(230°), \sqrt[3]{4}cis(350°)$

31. $cis(0°), cis(120°), cis(240°)$ or $1, -\frac{1}{2}+\frac{\sqrt{3}}{2}i, -\frac{1}{2}-\frac{\sqrt{3}}{2}i$

33. $cis(36°), cis(108°), cis(180°), cis(252°), cis(324°)$

35. $\sqrt[5]{2}cis(42°), \sqrt[5]{2}cis(114°), \sqrt[5]{2}cis(186°), \sqrt[5]{2}cis(258°), \sqrt[5]{2}cis(330°)$

8.1 Sequences Answers

1. 3, 5, 7, 9, 11   2. 1, 5, 9, 13, 17   3. 2, 4, 8, 16, 32   4. $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$ 5. $-2, 4, -8, 16, -32$

6. $-\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}, \frac{1}{16}, -\frac{1}{32}$ 7. $0, 1, 0, \frac{1}{2}, 0$ 8. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$ 9. $\frac{5}{2}, \frac{11}{4}, \frac{23}{8}, \frac{47}{16}, \frac{95}{32}$

10. $\frac{3}{4}, \frac{9}{16}, \frac{27}{64}, \frac{81}{256}, \frac{243}{1024}$ 11. $1, \frac{1}{2^{3/2}}, \frac{1}{3^{3/2}}, \frac{1}{8}, \frac{1}{5^{3/2}}$ 12. $2, \frac{14}{9}, \frac{28}{19}, \frac{48}{33}, \frac{74}{51}$ 13. $3, \frac{9}{2}, \frac{9}{2}, \frac{27}{8}, \frac{81}{40}$

14. 1, 1, 2, 6, 24   15. $-1, \frac{1}{4}, -\frac{1}{9}, \frac{1}{16}, -\frac{1}{25}$ 16. $-\frac{1}{2}, \frac{2}{3}, -\frac{3}{4}, \frac{4}{5}, -\frac{5}{6}$ 17. 3, 4, 6, 10, 18

18. 4, 6, 12, 30, 90   19. $a_n = 3n - 2$ 20. $a_n = 4n - 1$ 21. $a_n = n^2 - 1$ 22. $a_n = \frac{1}{n^2}$

23. $a_n = \frac{(-1)^{n-1}}{2^n}$ 24. $a_n = \frac{2^{n-1}}{3^n}$ 25. $a_n = 1 + \frac{1}{n}$ 26. $a_n = 1 + \frac{2^n - 1}{2^n}$ 27. $a_n = \frac{1}{n!}$ 28.

$a_n = (-1)^{n-1} 2n$ 29. $a_n = (-1)^{n-1}$ 30. $a_n = \frac{2^n}{n!}$ 31. $\frac{1}{30}$ 32. 600

33. $n^2 + 3n + 2$ 34. $n + 1$ 35. $\frac{1}{4n^2 + 2n}$ 36. $4n^2 + 6n + 2$

8.2 Series Answers

1. 35   2. 57   3. 40   4. 30   5. 30   6. 90   7. $\frac{9}{5}$ 8. $\frac{47}{60}$ 9. 238   10. 14   11. 65   12. 11

13. $\frac{47}{60}$ 14. $\frac{3}{8}$ 15. $\sum_{i=1}^{9} \frac{1}{3i}$ 16. $\sum_{i=1}^{15} \frac{5}{1+i}$ 17. $\sum_{i=1}^{6} (-1)^{i+1} 3^i$ 18. $\sum_{i=0}^{7} \frac{(-1)^i}{2^i}$

19. $\sum_{i=1}^{20} \frac{(-1)^{i+1}}{i^2}$ 20. $\sum_{i=1}^{10} \frac{1}{i(i+2)}$ 21. $\sum_{i=1}^{5} \frac{2^n - 1}{2^{n+1}}$ 22. $\sum_{i=1}^{6} \frac{i!}{2^i}$ 23. $\sum_{i=1}^{8} \left[2\left(\frac{i}{8}\right) + 3 \right]$

24. $\sum_{i=1}^{6} \left[1 - \left(\frac{i}{6}\right)^2 \right]$

8.3 Arithmetic Series Answers

1. $d = 2, a_n = 100, S_n = 2550$ 3. $d = 2, a_n = 19, S_n = 100$

5. $d = -3, a_n = -14, S_n = -5$ 7. $d = \frac{1}{6}, a_n = 2, S_n = 13$

9. $d = -0.05, a_n = -0.2, S_n = 5.5$ 11. $a_1 = -4, S_{12} = -378$ 13. $a_1 = -3, d = 4$

15. $n = 8, a_8 = 25$ 17. $d = -3, S_8 = 12$ 19. $a_1 = 9, a_{10} = 54$ 20. $d = \frac{2}{3}, S_7 = 28$

21. $d = 5, a_5 = 20$ 22. $d = 3, a_1 = -4$

8.4 Geometric Series Answers

1. 1536 3. -8192 5. 3069 7. -6554 9. $S_{20} = 0$ 11. 4.16666665

13. $r = \frac{1}{3}, S_5 = 53\frac{7}{9}$ or $r = -\frac{1}{3}, S_5 = 27\frac{1}{9}$ 16. $r = 3, S_6 = 728$

17. $a_1 = \frac{1}{2}, a_8 = 64$ 18. $a_6 = \frac{1}{2}, S_\infty = 32$ 19. $r = -0.6, S_\infty = 6.25$ 20. $r = \frac{3}{4}, a_3 = 13.5$

21. 40 inches, 30 inches

8.5 Mathematical Induction Answers

Induction proofs do not have "answers". Prove the base case, assume with $n = k$, then show $n = k + 1$ is true.