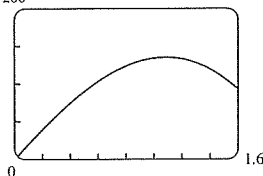## SECTION 6.3 ■ PAGE 459

1. $y/r, x/r, y/x$ **2.** quadrant, positive, negative, negative
3. (a) 30° (b) 30° (c) 30° **4.** (a) 60° (b) 30° (c) 60°
5. (a) 45° (b) 90° (c) 75° **6.** (a) 81° (b) 19° (c) 1°
7. (a) $\pi/4$ (b) $\pi/6$ (c) $\pi/3$ **8.** (a) $\pi/3$ (b) $\pi/4$
(c) $\pi/6$ **9.** (a) $2\pi/7$ (b) 0.4π (c) 1.4 **10.** (a) 0.3π
(b) 0.84 (c) 0 **11.** $\frac{1}{2}$ **12.** $-\sqrt{2}/2$ **13.** $-\sqrt{3}/2$
14. $\frac{1}{2}$ **15.** $-\sqrt{3}$ **16.** 2 **17.** 1 **18.** $\sqrt{3}$ **19.** $-\sqrt{3}/2$
20. -2 **21.** $\sqrt{3}/3$ **22.** $\frac{1}{2}$ **23.** $\sqrt{3}/2$ **24.** $-\sqrt{3}/2$
25. -1 **26.** $\frac{1}{2}$ **27.** $\frac{1}{2}$ **28.** $-\sqrt{3}/3$ **29.** 2 **30.** $-\sqrt{2}$
31. -1 **32.** $\sqrt{2}/2$ **33.** Undefined **34.** $-\frac{1}{2}$
35. III **36.** IV **37.** IV **38.** II
39. $\tan\theta = -\sqrt{1-\cos^2\theta}/\cos\theta$
40. $\cot\theta = -\sqrt{1-\sin^2\theta}/\sin\theta$
41. $\cos\theta = \sqrt{1-\sin^2\theta}$ **42.** $\sec\theta = \dfrac{1}{\sqrt{1-\sin^2\theta}}$
43. $\sec\theta = -\sqrt{1+\tan^2\theta}$ **44.** $\csc\theta = -\sqrt{1+\cot^2\theta}$
45. $\cos\theta = -\frac{4}{5}, \tan\theta = -\frac{3}{4}, \csc\theta = \frac{5}{3}, \sec\theta = -\frac{5}{4}, \cot\theta = -\frac{4}{3}$
46. $\sin\theta = -\sqrt{95}/12, \tan\theta = \sqrt{95}/7, \csc\theta = -12\sqrt{95}/95,$
$\sec\theta = -12/7, \cot\theta = 7\sqrt{95}/95$
47. $\sin\theta = -\frac{3}{5}, \cos\theta = \frac{4}{5}, \csc\theta = -\frac{5}{3}, \sec\theta = \frac{5}{4}, \cot\theta = -\frac{4}{3}$
48. $\sin\theta = -2\sqrt{6}/5, \cos\theta = \frac{1}{5}, \tan\theta = -2\sqrt{6},$
$\csc\theta = -5\sqrt{6}/12, \cot\theta = -\sqrt{6}/12$
49. $\sin\theta = \frac{1}{2}, \cos\theta = \sqrt{3}/2, \tan\theta = \sqrt{3}/3,$
$\sec\theta = 2\sqrt{3}/3, \cot\theta = \sqrt{3}$
50. $\sin\theta = -4\sqrt{17}/17, \cos\theta = -\sqrt{17}/17, \tan\theta = 4,$
$\csc\theta = -\sqrt{17}/4, \sec\theta = -\sqrt{17}$
51. $\sin\theta = 3\sqrt{5}/7, \tan\theta = -3\sqrt{5}/2, \csc\theta = 7\sqrt{5}/15,$
$\sec\theta = -\frac{7}{2}, \cot\theta = -2\sqrt{5}/15$
52. $\sin\theta = 4\sqrt{17}/17, \cos\theta = -\sqrt{17}/17, \csc\theta = \sqrt{17}/4,$
$\sec\theta = -\sqrt{17}, \cot\theta = -\frac{1}{4}$ **53.** (a) $\sqrt{3}/2, \sqrt{3}$
(b) $\frac{1}{2}, \sqrt{3}/4$ (c) $\frac{3}{4}, 0.88967$ **54.** 30.0 **55.** 19.1 **56.** 43.3
57. 66.1° **58.** $\sqrt{96}$ cm ≈ 9.8 cm **59.** $(4\pi/3) - \sqrt{3} \approx 2.46$
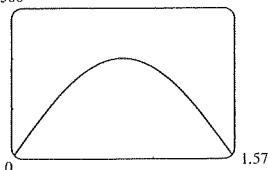**60.** $120\pi + 36\sqrt{3} \approx 439.3$
63. (b)

θ	20°	60°	80°	85°
h	1922	9145	29,944	60,351

64. (b)

(c) 60°

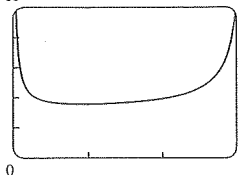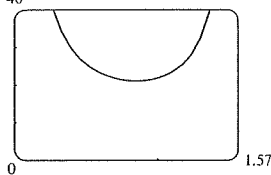**65.** (a) $A(\theta) = 400\sin\theta\cos\theta$
(b)

(c) width = depth ≈ 14.14 in.
66. $S(\theta) = 8000\,k\cos\theta\sin^2\theta$
67. (a) $9\sqrt{3}/4$ ft ≈ 3.897 ft, $\frac{9}{16}$ ft $= 0.5625$ ft
(b) 23.982 ft, 3.462 ft **68.** 15.8 s

69. (a)

(b) 0.946 rad or 54°
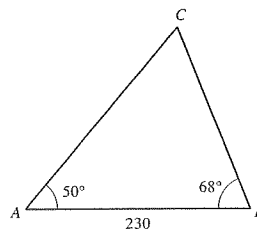
70. (b)
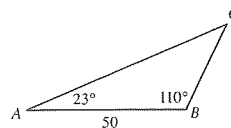

(c) 21.07 **71.** 42°

SECTION 6.4 ■ PAGE 467

1. (a) $[-1, 1], [-\pi/2, \pi/2]$ (b) $[-1, 1], [0, \pi]$
(c) $\mathbb{R}, (-\pi/2, \pi/2)$ **2.** (a) $\frac{8}{10}$ (b) $\frac{6}{10}$ (c) $\frac{8}{6}$ **3.** (a) $\pi/6$
(b) $5\pi/6$ (c) $-\pi/4$ **4.** (a) $-\pi/3$ (b) $3\pi/4$ (c) $-\pi/3$
5. (a) $-\pi/6$ (b) $\pi/3$ (c) $\pi/6$ **6.** (a) $-\pi/2$ (b) 0 (c) 0
7. 0.46677 **8.** 2.41886 **9.** 1.82348 **10.** 0.33984
11. 1.24905 **12.** -1.32582 **13.** Undefined **14.** Undefined
15. 36.9° **16.** 21.3° **17.** 34.7° **18.** 25.4° **19.** 34.9°
20. 27.3° **21.** 30°, 150° **22.** 60°, 120° **23.** 44.4°, 135.6°
24. 14.5°, 165.5° **25.** 45.6° **26.** 83.6° **27.** $\frac{4}{5}$ **28.** $\frac{4}{3}$ **29.** $\frac{13}{5}$
30. $\frac{25}{24}$ **31.** $\frac{12}{5}$ **32.** $\sqrt{5}/2$ **33.** $\sqrt{1-x^2}$ **34.** $x/\sqrt{x^2+1}$
35. $x/\sqrt{1-x^2}$ **36.** $1/\sqrt{x^2+1}$ **37.** 72.5°, 19 ft **38.** 38.7°
39. (a) $h = 2\tan\theta$ (b) $\theta = \tan^{-1}(h/2)$
40. (a) $\theta = \tan^{-1}(50/s)$ (b) $\theta = 68.2°$
41. (a) $\theta = \sin^{-1}(h/680)$ (b) $\theta = 0.826$ rad
42. (a) $\theta = \cos^{-1}\left(\dfrac{3960}{h+3960}\right)$ (b) $s = 7920\theta$
(c) $s = 7920\cos^{-1}\left(\dfrac{3960}{h+3960}\right)$ (d) 1761.5 mi (e) 197.3 mi
43. (a) 54.1° (b) 48.3°, 32.2°, 24.5°. The function $\sin^{-1}$ is
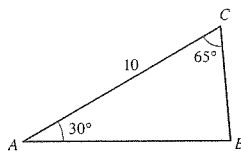undefined for values outside the interval $[-1, 1]$.

SECTION 6.5 ■ PAGE 473

1. $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$ **2.** ASA, SSA **3.** 318.8 **4.** 25.4
5. 24.8 **6.** 40.3° **7.** 44° **8.** 144.9 **9.** $\angle C = 114°, a \approx 51,$
$b \approx 24$ **10.** $\angle B = 50°, a \approx 1.31, c \approx 2.57$
11. $\angle A = 44°, \angle B = 68°, a \approx 8.99$
12. $\angle B \approx 31.0°, \angle C \approx 69°, c \approx 6.2$
13. $\angle C = 62°, a \approx 200, b \approx 242$

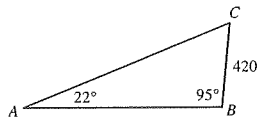**14.** $\angle C = 47°, a \approx 26.7, b \approx 64.2$

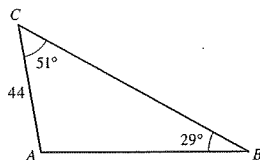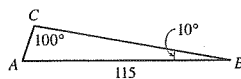**15.** $\angle B = 85°$, $a \approx 5$, $c \approx 9$

16. $\angle C = 63°$, $b \approx 1116.9$, $c \approx 999.0$

17. $\angle A = 100°$, $a \approx 89$, $c \approx 71$

18. $\angle A = 70°$, $a \approx 109.7$, $b \approx 20.3$

19. $\angle B \approx 30°$, $\angle C \approx 40°$, $c \approx 19$
20. $\angle B_1 \approx 89.6°$, $\angle C_1 \approx 53.4°$, $b_1 \approx 49.8$;
$\angle B_2 \approx 16.4°$, $\angle C_2 \approx 126.6°$, $b_2 \approx 14.1$ **21.** No solution
22. $\angle A_1 \approx 100.7°$, $\angle B_1 \approx 41.3°$, $a_1 \approx 67.0$;
$\angle A_2 \approx 3.3°$, $\angle B_2 \approx 138.7°$, $a_2 \approx 3.9$
23. $\angle A_1 \approx 125°$, $\angle C_1 \approx 30°$, $a_1 \approx 49$;
$\angle A_2 \approx 5°$, $\angle C_2 \approx 150°$, $a_2 \approx 5.6$
24. $\angle B_1 \approx 41.8°$, $\angle C_1 \approx 108.2°$, $c_1 \approx 142.5$;
$\angle B_2 \approx 138.2°$, $\angle C_2 \approx 11.8°$, $c_2 \approx 30.7$ **25.** No solution
26. $\angle B \approx 34.4°$, $\angle C = 10.6°$, $c \approx 25.9$
27. $\angle A_1 \approx 57.2°$, $\angle B_1 \approx 93.8°$, $b_1 \approx 30.9$;
$\angle A_2 \approx 122.8°$, $\angle B_2 \approx 28.2°$, $b_2 \approx 14.6$
28. $\angle A_1 \approx 49.7°$, $\angle C_1 \approx 72.3°$, $a_1 \approx 65.7$;
$\angle A_2 \approx 14.3°$, $\angle C_2 \approx 107.7°$, $a_2 \approx 21.3$
29. (a) $91.146°$ (b) $14.427°$ **30.** 5.25 **33.** (a) 1018 mi
(b) 1017 mi   **34.** (a) 3.77 mi   (b) 2.00 mi   **35.** 219 ft
36. 678.5 ft   **37.** 55.9 m   **38.** 161.1 ft   **39.** 175 ft
40. 155 m   **41.** 192 m   **42.** $48.2°$ **43.** 0.427 AU, 1.119 AU
44. (b) 12 cm   (c) A plane

SECTION 6.6 ■ PAGE 480

1. $a^2 + b^2 - 2ab \cos C$ **2.** SSS, SAS   **3.** 28.9 **4.** 26.8
5. 47 **6.** 8.2 **7.** $29.89°$ **8.** $111°$ **9.** 15 **10.** $130.54°$
11. $\angle A \approx 39.4°$, $\angle B \approx 20.6°$, $c \approx 24.6$
12. $\angle A \approx 63.0°$, $\angle B \approx 15.5°$, $\angle C \approx 101.5°$
13. $\angle A \approx 48°$, $\angle B \approx 79°$, $c \approx 3.2$
14. $\angle B \approx 80.5°$, $\angle C \approx 29.5°$, $a \approx 57.2$
15. $\angle A \approx 50°$, $\angle B \approx 73°$, $\angle C \approx 57°$
16. $\angle A \approx 38.6°$, $\angle B \approx 48.5°$, $\angle C \approx 92.9°$
17. $\angle A_1 \approx 83.6°$, $\angle C_1 \approx 56.4°$, $a_1 \approx 193$;
$\angle A_2 \approx 16.4°$, $\angle C_2 \approx 123.6$, $a_2 \approx 54.9$ **18.** No such triangle
19. No such triangle   **20.** $\angle A = 36°$, $b \approx 109.4$, $c \approx 124.1$
21. 2 **22.** 12.2 **23.** 25.4 **24.** $21.3°$ **25.** $89.2°$
26. $126.5°$ **27.** 24.3 **28.** 1180.8 **29.** 54 **30.** 0.97
31. 26.83 **32.** 549.6 **33.** 5.33 **34.** 9.798 **35.** 40.77
36. 2.46 **37.** 3.85 cm^2 **39.** 2.30 mi   **40.** 7.3, 3.8
41. 23.1 mi   **42.** 56.0 mi   **43.** 2179 mi   **44.** 28 mi

45. (a) 62.6 mi   (b) S $18.2°$ E   **46.** (a) 232.5 mi
(b) N $50°$ E   **47.** $96°$ **48.** $31°$ **49.** 211 ft   **50.** 161 ft
51. 3835 ft   **52.** 1679 ft   **53.** \$165,554

CHAPTER 6 REVIEW ■ PAGE 483

1. (a) $\pi/3$ (b) $11\pi/6$ (c) $-3\pi/4$ (d) $-\pi/2$
2. (a) $2\pi/15$ (b) $-11\pi/6$ (c) $25\pi/6$ (d) $\pi/36$
3. (a) $450°$ (b) $-30°$ (c) $405°$ (d) $(558/\pi)° \approx 177.6°$
4. (a) $(1440/\pi)° \approx 458.37°$ (b) $(450/\pi)° \approx 143.24°$
(c) $330°$ (d) $108°$ **5.** 8 m   **6.** 1.4 rad $\approx 80.2°$
7. 82 ft   **8.** $21,609$ **9.** 0.619 rad $\approx 35.4°$ **10.** 25 m^2
11. $18,151$ ft^2 **12.** 0.4 rad $\approx 22.9°$
13. 300π rad/min ≈ 942.5 rad/min,
7539.8 in./min $= 628.3$ ft/min
14. (a) 7000π rad/min $\approx 21,991$ rad/min
(b) 7777.8π rad/min $\approx 24,434.6$ rad/min
(c) $268,780$ in./min ≈ 255 mi/h
15. $\sin\theta = 5/\sqrt{74}$, $\cos\theta = 7/\sqrt{74}$, $\tan\theta = \frac{5}{7}$,
$\csc\theta = \sqrt{74}/5$, $\sec\theta = \sqrt{74}/7$, $\cot\theta = \frac{7}{5}$
16. $\sin\theta = \frac{3}{10}$, $\cos\theta = \sqrt{91}/10$, $\tan\theta = 3\sqrt{91}/91$,
$\csc\theta = \frac{10}{3}$, $\sec\theta = 10\sqrt{91}/91$, $\cot\theta = \sqrt{91}/3$
17. $x \approx 3.83$, $y \approx 3.21$ **18.** $x \approx 2.44$, $y \approx 1.40$
19. $x \approx 2.92$, $y \approx 3.11$ **20.** $x \approx 3.46$, $y \approx 1.73$
21. $A = 70°$, $a = 2.819$, $b = 1.026$
22. $C = 30°$, $a = 40$, $b = 34.64$
23. $A \approx 16.3°$, $C \approx 73.7°$, $c = 24$
24. $A \approx 22.6°$, $C \approx 67.4°$, $b = 13$
25. $a = \cot\theta$, $b = \csc\theta$ **26.** 550 m   **27.** 48 m
28. $h = \sqrt{64 - 4\cos^2\theta} + 2\sin\theta$
29. 1076 mi   **30.** $14,400$ ft   **31.** $-\sqrt{2}/2$ **32.** $\sqrt{2}$
33. 1 **34.** $-\sqrt{3}/2$ **35.** $-\sqrt{3}/3$ **36.** $\sqrt{2}/2$ **37.** $-\sqrt{2}/2$
38. -2 **39.** $2\sqrt{3}/3$ **40.** $2\sqrt{3}/3$ **41.** $-\sqrt{3}$ **42.** -1
43. $\sin\theta = \frac{12}{13}$, $\cos\theta = -\frac{5}{13}$, $\tan\theta = -\frac{12}{5}$,
$\csc\theta = \frac{13}{12}$, $\sec\theta = -\frac{13}{5}$, $\cot\theta = -\frac{5}{12}$ **44.** $\frac{1}{2}$ **45.** $60°$
46. $\sin\theta = -\sqrt{5}/5$, $\cos\theta = -2\sqrt{5}/5$, $\tan\theta = \frac{1}{2}$,
$\csc\theta = -\sqrt{5}$, $\sec\theta = -\sqrt{5}/2$, $\cot\theta = 2$
47. $\tan\theta = -\sqrt{1 - \cos^2\theta}/\cos\theta$
48. $\sec\theta = -1/\sqrt{1 - \sin^2\theta}$ **49.** $\tan^2\theta = \sin^2\theta/(1 - \sin^2\theta)$
50. $\csc^2\theta \cos^2\theta = \dfrac{1}{\sin^2\theta} - 1$
51. $\sin\theta = \sqrt{7}/4$, $\cos\theta = \frac{3}{4}$, $\csc\theta = 4\sqrt{7}/7$, $\cot\theta = 3\sqrt{7}/7$
52. $\sin\theta = -\frac{9}{41}$, $\cos\theta = \frac{40}{41}$, $\tan\theta = -\frac{9}{40}$, $\cot\theta = -\frac{40}{9}$
53. $\cos\theta = -\frac{4}{5}$, $\tan\theta = -\frac{3}{4}$, $\csc\theta = \frac{5}{3}$, $\sec\theta = -\frac{5}{4}$, $\cot\theta = -\frac{4}{3}$
54. $\sin\theta = -\frac{12}{13}$, $\cos\theta = -\frac{5}{13}$, $\tan\theta = \frac{12}{5}$, $\csc\theta = -\frac{13}{12}$, $\cot\theta = \frac{5}{12}$
55. $-\sqrt{5}/5$ **56.** $\sqrt{3}$ **57.** 1 **58.** $-\sqrt{3}/2$
59. $\pi/3$ **60.** $\pi/6$ **61.** $2/\sqrt{21}$ **62.** $\sqrt{55}/8$ **63.** $x/\sqrt{1 + x^2}$
64. $1/\sqrt{1 - x^2}$ **65.** $\theta = \cos^{-1}(x/3)$ **66.** $\theta = \tan^{-1}(x/2)$
67. 5.32 **68.** 1.46 **69.** 148.07 **70.** 77.82 **71.** 9.17 **72.** 3.3
73. $54.1°$ or $125.9°$ **74.** $52.0°$ **75.** $80.4°$ **76.** $153.2°$
77. 77.3 mi   **78.** 1160 ft   **79.** 3.9 mi   **80.** 80.8 mi
81. 32.12 **82.** 14.98

CHAPTER 6 TEST ■ PAGE 487

1. $11\pi/6$, $-3\pi/4$ **2.** $240°$, $-74.5°$
3. (a) 240π rad/min ≈ 753.98 rad/min
(b) $12,063.7$ ft/min $= 137$ mi/h   **4.** (a) $\sqrt{2}/2$
(b) $\sqrt{3}/3$ (c) 2 (d) 1 **5.** $(26 + 6\sqrt{13})/39$
6. $a = 24\sin\theta$, $b = 24\cos\theta$ **7.** $(4 - 3\sqrt{2})/4$