IM2 Book 3 Selected Answers

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1. $10\sqrt{2}$
2. (a) $A = \left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$, $B = \left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
   (b) cos()
   (c) sin()
3. (a) cos(40°)
   (b) sin(40°)
4. (a) $m_{OA} = 1$, $m_{OB} = \frac{\sqrt{3}}{3}$
   (b) tan()
5. 470 ft
6. $\frac{3}{5}$
7. Length of line: 3.42 ft
   Distance to bobber: 9.40 ft
8. 23.82 ft
9. (a) π; $(-1, 0)$
   (b) $\frac{\pi}{2}$; $(0, 1)$
10. –
11. –
12. –
13. $\cos A = \frac{\sqrt{21}}{5}$, $\tan A = \frac{2}{\sqrt{21}}$, $\sin^2 A + \cos^2 A = 1$
14. (a) 79 ft
    (b) 7,873 ft^2
    (c) 135 ft
15. 67°

16. $21.6°$

17. No

18. 54.8 ft

19. $\frac{2\pi}{3}$

20. $\frac{6\pi}{5}$, $\frac{9\pi}{5}$

21. $\sin^2\theta + \cos^2\theta = 1$

22. length = 5.22; Area = 12.68

23. $\frac{ab\sin C}{2}$

24. 9.9 in^2

25. $(-1,0)$, $(-1,0)$

26. –

27. $\pi - \alpha$

28. (a) $(0,1)$
    (b) $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
    (c) $\left(\frac{-1}{2}, \frac{\sqrt{3}}{2}\right)$
    (d) $\left(\frac{-\sqrt{3}}{2}, \frac{-1}{2}\right)$

29. (a) $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$; $\cos\theta$ gives the x-coordinate; $\sin\theta$ gives the y-coordinate
    (b) $\cos\frac{3\pi}{4} = \frac{-\sqrt{2}}{2}$, $\sin\frac{3\pi}{4} = \frac{\sqrt{2}}{2}$

30. (a) $AD = b - x$, $BD = \sqrt{a^2 - x^2}$
    (b) $c^2 = a^2 + b^2 - 2bx$
    (c) $c^2 = a^2 + b^2 - 2ab\cos C$

31. 5.01 in.

32. (a) $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$, $m = \sqrt{3}$
    (b) $\tan\theta$

33. $205°$

34. (a) $\sin\frac{2\pi}{3} = \frac{\sqrt{3}}{2}$, $\cos\frac{2\pi}{3} = \frac{-1}{2}$, $\tan\frac{2\pi}{3} = -\sqrt{3}$
    (b) $\sin\frac{4\pi}{3} = \frac{-\sqrt{3}}{2}$, $\cos\frac{4\pi}{3} = \frac{-1}{2}$, $\tan\frac{4\pi}{3} = \sqrt{3}$

35. (a) $\sin 135° = \frac{\sqrt{2}}{2}$, $\cos 135° = \frac{-\sqrt{2}}{2}$, $\tan 135° = -1$

(b) $\sin 225° = -\frac{\sqrt{2}}{2}$, $\cos 225° = \frac{-\sqrt{2}}{2}$, $\tan 225° = 1$

36. (a) $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$, $m = -\frac{\sqrt{3}}{3}$

(b) $\sin\left(-\frac{\pi}{6}\right) = -\frac{1}{2}$, $\cos\left(-\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$, $\tan\left(-\frac{\pi}{6}\right) = -\frac{\sqrt{3}}{3}$

37. $\sin\left(-\frac{2\pi}{3}\right) = -\frac{\sqrt{3}}{2}$, $\cos\left(\frac{5\pi}{2}\right) = 0$, $\tan\left(\frac{2\pi}{3}\right) = -\sqrt{3}$

38. $\cos A = -\frac{\sqrt{91}}{10}$, $\tan A = -\frac{3}{\sqrt{91}}$

39. 2.52 km

40. side length = 16.8 cm, Area = 91.3 cm^2

41. 78.5°, 57.1°, 44.4°

42. (a) $c = p + q$

(b) $c = |p - q|$

(c) $c = \sqrt{p^2 + q^2}$

43. (a) $\sin 60° = \sin 120° = \frac{\sqrt{3}}{2}$

(b) $\sin 30° = \sin 150° = \frac{1}{2}$

(c) –

44. $\sin\theta = \sin(\pi - \theta)$

45. $\cos\theta = -\cos(\pi - \theta)$

46. $\tan\theta = \tan(\theta + \pi)$

47. $\cos x = -\frac{\sqrt{4-a^2}}{2}$, $\tan x = -\frac{a}{\sqrt{4-a^2}}$

48. (a) $\frac{\pi}{6}$, $\frac{5\pi}{6}$

(b) $\sin(x) = \frac{1}{2}$

49. $\frac{\pi}{3}$, $\pi - \frac{\pi}{3}$

50. $\cos 280° \approx 0.174$, $\cos 100° = \cos 260° \approx -0.174$, $\sin 190° \approx -0.174$

51. (a) $\cos 310° < \cos 311°$

(b) $\sin 76° > \sin 106°$

(c) $\sin 81° = \sin 99°$

(d) $\tan 89° > \tan 71°$

52. $BC = 4.01$

53. (a) 1

(b) 1

(c) $\frac{\sqrt{3}}{2}$

(d) $\frac{\sqrt{2}}{2}$

54. (a) $\frac{\sqrt{3}}{2}$

(b) $\frac{\sqrt{3}}{2}$

(c) $-\sqrt{3}$

(d) $\frac{\sqrt{2}}{2}$

55. (a) $\theta = \frac{5\pi}{6}, \frac{7\pi}{6}$

(b) $\theta = 0, \pi$

(c) $\theta = \frac{3\pi}{2}$

56. (a) $\theta = 0°, 180°$

(b) $\theta = 135°, 225°$

(c) $\theta = 45°, 225°$

57. –

58. (a) $\cos B = \frac{106 - x^2}{90}$

(b) $\cos D = \frac{58 - x^2}{42}$

(c) $\cos B = -\cos D$

(d) $x = 8.56$

59. (a) $\sin(-\alpha) = -\sin(\alpha)$

(b) $\sin(180 - \alpha) = \sin(\alpha)$

(c) $\sin(360 + \alpha) = \sin(\alpha)$

(d) $\cos(-\alpha) = \cos(\alpha)$

(e) $\cos(180 - \alpha) = -\cos(\alpha)$

(f) $\cos(90 - \alpha) = \sin(\alpha)$

60. (a) $A = 109°$

(b) $A = 230°, 310°$

(c) No solutions

(d) $A = 110°, 250°$

61. (a) $\frac{\sqrt{2}}{2}$

(b) 0

(c) $\frac{-\sqrt{3}}{2}$

(d) -1

(e) $\frac{-\sqrt{3}}{2}$

(f) 0

62. $\theta = 60°, 300°$

63. (a) $h = b\sin A,\ h = a\sin B$
    (b) $\frac{\sin A}{a} = \frac{\sin B}{b}$
    (c) $\frac{b}{\sin B} = \frac{a}{\sin A}$

64. $NC = 8.08$ in., $CY = 3.19$ in.

65. (a) $3.42 \text{ ft} < l < 10 \text{ ft}$
    (b) $l = 3.42$ ft or $l \geq 10$ ft
    (c) $0 \text{ ft} \leq l < 3.42 \text{ ft}$

66. (a) $\theta = 140°$
    (b) $\theta = 300°$
    (c) $\theta = 50°, 310°$

67. (a) $\tan\theta = \frac{\sqrt{b^2-a^2}}{a}$
    (b) $\cos(\pi+\theta) = \frac{-a}{b}$
    (c) $\sin(\pi+\theta) = \frac{-\sqrt{b^2-a^2}}{b}$
    (d) $\cos(\pi-\theta) = \frac{-a}{b}$

68. (a) $\frac{\pi}{6} < t < \frac{11\pi}{6}$
    (b) $\frac{7\pi}{6} < w < \frac{11\pi}{6}$

69. (a) $\frac{\pi}{2}, y = 1$
    (b) π
    (c) $\frac{3\pi}{2}, y = -1$
    (d) 2π
    (e) –

70. (a) $\frac{\pi}{2}$
    (b) π
    (c) $\frac{3\pi}{2}$
    (d) 2π
    (e) –

71. (a) –
    (b) –
    (c) –
    (d) Domain: $(-\infty, \infty)$, Range: $[-1, 1]$

72. –

73. 232.1

74. Triangle 1: $B = 34.8°, C = 125.2°, AB = 14.3$
Triangle 2: $B = 145.2°, C = 14.8°, AB = 4.5$

75. (a) $BC = 3.42$
(b) –

76. 63.1 miles

77. $\frac{\pi}{4} < \theta < \frac{\pi}{2} \cup \frac{5\pi}{4} < \theta < \frac{3\pi}{2}$

78. (a) $x = \frac{\pi}{6}, \frac{5\pi}{6}$
(b) $x = \frac{7\pi}{6}, \frac{11\pi}{6}$
(c) $x = 0.927, 5.356$ (radians)

79. (a) 2π seconds, 10π seconds
(b) –
(c) 2π

80. (a) $x = \pi$
(b) $x = -3\pi, -\pi, \pi, 3\pi$
(c) $x = \pi + 2\pi n$

81. (a) $x = \frac{\pi}{6}, \frac{5\pi}{6}$
(b) $x = ..., -3\pi, -\pi, \pi, 3\pi, ...$
(c) $x = \pi + 2\pi n$

82. $x = \frac{5\pi}{6}, \frac{7\pi}{6}$
$x = \frac{5\pi}{6} + 2\pi n, \frac{7\pi}{6} + 2\pi n$

83. 22.2 ft

84. Smallest angle = 0.48996, $D = 21.25$ in.

85. Triangle 1: $P = 53.1°, R = 120.5°, Q = 6.4°, p = 13, r = 14, q = 1.8$
Triangle 2: $P = 53.1°, R = 59.5°, Q = 67.4°, p = 13, r = 14, q = 15$

86. (a) $x = 30°, 150°$
(b) $B = 30°, 150°$; No

87. B has no solutions

88. There are a bunch of typos here. The second sentence should say "The ride starts at $(1,2)$ with a starting height of 2 feet."

(a) $\frac{\pi}{2}, 3$

(b) π

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

(d) 2π

(e) –

(f) –

(g) $y = \sin x + 2$

89. (a) –

(b) –

(c) $y = -3$

90. Midline: $y = 4$. Maximum value: 5. Minimum value: 3.

91. (a) $x = \frac{2\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n$

(b) $x = \frac{\pi}{4} + 2\pi n, \frac{3\pi}{4} + 2\pi n$

(c) $x = \pi n$

92. (a) $x = 45° + 360° \cdot n,\ 135° + 360° \cdot n$

(b) $180° + 360° \cdot n$

(c) $30° + 360° \cdot n,\ 330° + 360° \cdot n$

93. $d = 21.28$

94. $A = 84$ in.^{2}

95. 30.8 km

96. 289 ft^2 or 111 ft^2

97. –

98. –

99. (a) Translate up 3

(b) Translate up 2

100. $P = (-42°, 0.7431),\ R = (318°, 0.7431),\ S = (402, 0.7431)$

101. 15.71

102. The Law of Sines!

103. (a) $\frac{\pi}{2},\ 3$

(b) π

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

(d) 2π

(e) –

(f) $y = 4\sin x$

104. (a)

x	$\cos x$	$4\cos x$
0	1	4
$\frac{\pi}{2}$	0	0
π	-1	-4
$\frac{3\pi}{2}$	0	0
2π	1	4

(b) –

(c) 4

105. Midline: x-axis
Amplitude: 2
Max value: 2
Min value: -2
Period: 2π

106. –

107. $(67°, 0.39073),\ (293°, 0.39073),\ (427°, 0.39073)$

108. –

109. $Q = (\pi - \theta, k),\ R = (\theta + 2\pi, k),\ S = (3\pi - \theta, k)$