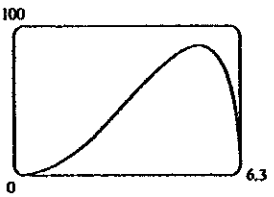
# Chapter 5 Solutions

## Section 5.1 ■ page 474

**1.** $2\pi/5 \approx 1.257$ rad **2.** $3\pi/10 \approx 0.942$ rad
**3.** $-\pi/4 \approx -0.785$ rad
**4.** $-\pi/3 \approx -1.047$ rad
**5.** $-5\pi/12 \approx -1.309$ rad **6.** $-5\pi/3 \approx -5.236$ rad
**7.** $6\pi \approx 18.850$ rad **8.** $22\pi \approx 69.115$ rad
**9.** $8\pi/15 \approx 1.676$ rad **10.** $\pi/12 \approx 0.262$ rad
**11.** $\pi/24 \approx 0.131$ rad **12.** $9\pi/8 \approx 3.534$ rad
**13.** 210° **14.** 660° **15.** −225° **16.** −270°
**17.** $540/\pi \approx 171.9°$ **18.** $-360/\pi \approx 114.6°$
**19.** $-216/\pi \approx 68.8°$ **20.** $612/\pi \approx 194.8°$
**21.** 18° **22.** 50° **23.** −24° **24.** −195°
**25.** 410°, 770°, −310°, −670° **26.** 495°, 855°, −225°, −585°
**27.** $11\pi/4$, $19\pi/4$, $-5\pi/4$, $-13\pi/4$ **28.** $23\pi/6$, $35\pi/6$, $-\pi/6$, $-13\pi/6$ **29.** $7\pi/4$, $15\pi/4$, $-9\pi/4$, $-17\pi/4$
**30.** 315°, 675°, −405°, −765° **31.** Yes **32.** Yes **33.** Yes
**34.** No **35.** Yes **36.** No **37.** 13° **38.** 1° **39.** 30°
**40.** 260° **41.** 280° **42.** 190° **43.** $5\pi/6$ **44.** $5\pi/3$
**45.** $\pi$ **46.** $10 - 2\pi \approx 3.717$ rad **47.** $\pi/4$ **48.** $3\pi/2$
**49.** $55\pi/9 \approx 19.2$ **50.** $360/\pi \approx 114.6°$ **51.** 4
**52.** $5\pi/2 \approx 7.85$ m **53.** 4 mi **54.** $216/\pi \approx 68.8°$, 1.2 rad
**55.** 2 rad ≈ 114.6° **56.** 6.88 ft **57.** $36/\pi \approx 11.459$ m
**58.** $16/(3\pi) \approx 1.698$ ft **59.** (a) 35.45 (b) 25 **60.** (a) 5.855 (b) 3.028 **61.** 50 m² **62.** 4.7 mi² **63.** 4 m **64.** 57.3°
**65.** 6 cm² **66.** $\pi/4$ ft² **67.** 13.9 mi **68.** 672
**69.** $330\pi$ mi ≈ 1037 mi **70.** $110\pi$ mi ≈ 346 mi
**71.** 1.6 million mi **72.** 3979 mi, 25,000 mi **73.** 1.15 mi
**74.** $70{,}000\pi \approx 219{,}911$ ft² **75.** $360\pi$ in² ≈ 1130.97 in²
**76.** $3750\pi$ ft² ≈ 11,781 ft² **77.** $32\pi/15$ ft/s ≈ 6.7 ft/s
**78.** (a) $90\pi$ rad/min (b) $1440\pi$ in./min ≈ 4523.9 in./min
**79.** (a) $2000\pi$ rad/min (b) $50\pi/3$ ft/s ≈ 52.4 ft/s
**80.** 1039.6 mi/h **81.** 39.3 mi/h **82.** (a) 1100 rad/min (b) 175 **83.** 2.1 m/s **84.** (a) 160 rad/min (b) $2080\pi$ ft/min ≈ 74.26 mi/h **85.** (a) $10\pi$ cm ≈ 31.4 cm (b) 5 cm (c) 3.32 cm (d) 86.8 cm³
**86.** (b)

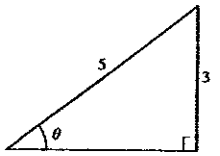



(c) 5.13 rad **88.** $11.5\pi \approx 36.128$ rad, $\dfrac{23\pi}{24} \approx 3.011$ rad

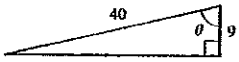
## Section 5.2 ■ page 484

**1.** $\sin\theta = \frac{4}{5}$, $\cos\theta = \frac{3}{5}$, $\tan\theta = \frac{4}{3}$, $\csc\theta = \frac{5}{4}$, $\sec\theta = \frac{5}{3}$, $\cot\theta = \frac{3}{4}$ **2.** $\sin\theta = \frac{7}{25}$, $\cos\theta = \frac{24}{25}$, $\tan\theta = \frac{7}{24}$, $\csc\theta = \frac{25}{7}$, $\sec\theta = \frac{25}{24}$, $\cot\theta = \frac{24}{7}$ **3.** $\sin\theta = \frac{40}{41}$, $\cos\theta = \frac{9}{41}$, $\tan\theta = \frac{40}{9}$, $\csc\theta = \frac{41}{40}$, $\sec\theta = \frac{41}{9}$, $\cot\theta = \frac{9}{40}$ **4.** $\sin\theta = \frac{15}{17}$, $\cos\theta = \frac{8}{17}$, $\tan\theta = \frac{15}{8}$, $\csc\theta = \frac{17}{15}$, $\sec\theta = \frac{17}{8}$, $\cot\theta = \frac{8}{15}$

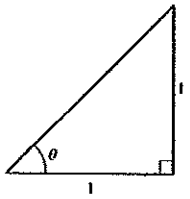
5. $\sin\theta = 2\sqrt{13}/13, \cos\theta = 3\sqrt{13}/13, \tan\theta = \frac{2}{3}$, $\csc\theta = \sqrt{13}/2, \sec\theta = \sqrt{13}/3, \cot\theta = \frac{3}{2}$
6. $\sin\theta = \frac{7}{8}, \cos\theta = \sqrt{15}/8, \tan\theta = 7\sqrt{15}/15$, $\csc\theta = \frac{8}{7}, \sec\theta = 8\sqrt{15}/15, \cot\theta = \sqrt{15}/7$
7. (a) $3\sqrt{34}/34, 3\sqrt{34}/34$ (b) $\frac{3}{5}, \frac{3}{5}$ (c) $\sqrt{34}/5, \sqrt{34}/5$
8. (a) $\frac{4}{7}, \frac{4}{7}$ (b) $4\sqrt{33}/33, 4\sqrt{33}/33$ (c) $7\sqrt{33}/33, 7\sqrt{33}/33$
9. $\frac{25}{2}$ 10. $12\sqrt{2}$ 11. $13\sqrt{3}/2$ 12. $4\sqrt{3}$ 13. 16.51658
14. 31.30339 15. $x = 28\cos\theta, y = 28\sin\theta$
16. $x = 4\tan\theta, y = 4\sec\theta$
17. $\cos\theta = \frac{4}{5}, \tan\theta = \frac{3}{4}, \csc\theta = \frac{5}{3}, \sec\theta = \frac{5}{4}, \cot\theta = \frac{4}{3}$



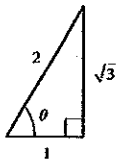

18. $\sin\theta = 7\sqrt{31}/40, \tan\theta = 7\sqrt{31}/9, \csc\theta = 40\sqrt{31}/217$, $\sec\theta = \frac{40}{9}, \cot\theta = 9\sqrt{31}/217$



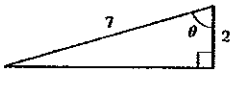

19. $\sin\theta = \sqrt{2}/2, \cos\theta = \sqrt{2}/2, \tan\theta = 1$, $\csc\theta = \sqrt{2}, \sec\theta = \sqrt{2}$



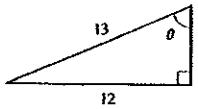

20. $\sin\theta = \sqrt{3}/2, \cos\theta = \frac{1}{2}, \csc\theta = 2\sqrt{3}/3$, $\sec\theta = 2, \cot\theta = \sqrt{3}/3$




21. $\sin\theta = 3\sqrt{5}/7, \cos\theta = \frac{2}{7}, \tan\theta = 3\sqrt{5}/2$, $\csc\theta = 7\sqrt{5}/15, \cot\theta = 2\sqrt{5}/15$

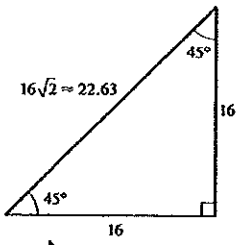



22. $\sin\theta = \frac{12}{13}, \cos\theta = \frac{5}{13}, \tan\theta = \frac{12}{5}, \sec\theta = \frac{13}{5}, \cot\theta = \frac{5}{12}$

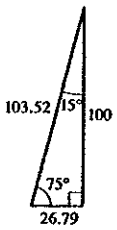



23. $(1 + \sqrt{3})/2$ 24. 1 25. 1 26. 1 27. $\frac{1}{2}$
28. $\frac{1}{4}(2 - \sqrt{3})$

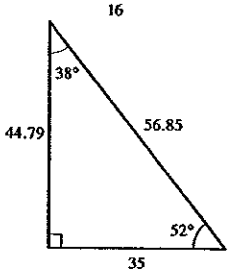
29.




30.




31.

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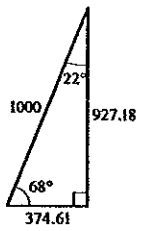
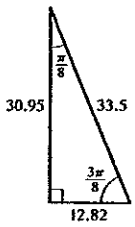
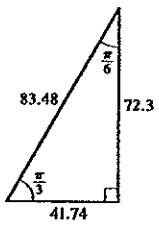


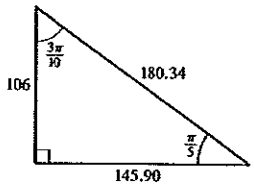

33.




34.




35.

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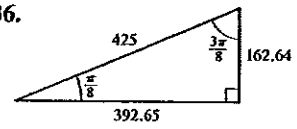



37. $\sin\theta \approx 0.45, \cos\theta \approx 0.89, \tan\theta = 0.50, \csc\theta \approx 2.24$, $\sec\theta \approx 1.12, \cot\theta = 2.00$ 38. $\sin 40° \approx 0.64$, $\cos 40° \approx 0.77, \tan 40° \approx 0.83, \csc 40° \approx 1.56$, $\sec 40° \approx 1.39, \cot 40° \approx 1.20$ 39. 230.9 40. 98.1
41. 63.7 42. 5.8 43. $x = 10\tan\theta\sin\theta$ 44. $a = \sin\theta$, $b = \tan\theta, c = \sec\theta, d = \cos\theta$ 45. 1026 ft
46. (a) 93,431 ft (b) 86,628 ft 47. (a) 2100 mi (b) No
48. 471 ft 49. 19 ft 50. 72.5°, 19 ft 51. 38.7° 52. 544 ft
53. 345 ft 54. 104.5 ft 55. 415 ft, 152 ft 56. 11,379 ft
57. 2570 ft 58. 3.7 mi 59. 5808 ft 60. 473 m
61. 91.7 million mi 62. (a) 89.05° (b) 236,000 mi
63. 3960 mi 64. $2.53 \times 10^{13}$ mi 65. 0.723 AU

## Section 5.3

1. (a) 30° (b) 30° (c) 30° 2. (a) 60° (b) 30° (c) 60°
3. (a) 45° (b) 90° (c) 75° 4. (a) 81° (b) 19° (c) 1°
5. (a) $\pi/4$ (b) $\pi/6$ (c) $\pi/3$ 6. (a) $\pi/3$ (b) $\pi/4$
(c) $\pi/6$ 7. (a) $2\pi/7$ (b) $0.4\pi$ (c) 1.4 8. (a) $0.3\pi$
(b) 0.84 (c) 0 9. $\frac{1}{2}$ 10. $-\sqrt{2}/2$ 11. $-\sqrt{2}/2$
12. $\frac{1}{2}$ 13. $-\sqrt{3}$ 14. 2 15. 1 16. $\sqrt{3}$ 17. $-\sqrt{3}/2$
18. $-2$ 19. $\sqrt{3}/3$ 20. $\frac{1}{2}$ 21. $\sqrt{3}/2$ 22. $-\sqrt{3}/2$
23. $-1$ 24. $\frac{1}{2}$ 25. $\frac{1}{2}$ 26. $-\sqrt{3}/3$ 27. 2 28. $-\sqrt{2}$
29. $-1$ 30. $\sqrt{2}/2$ 31. Undefined 32. $-\frac{1}{2}$

**33.** III **34.** IV **35.** IV **36.** II

**37.** $\tan\theta = -\sqrt{1-\cos^2\theta}/\cos\theta$ **38.** $\cot\theta = -\dfrac{\sqrt{1-\sin^2\theta}}{\sin\theta}$

**39.** $\cos\theta = \sqrt{1-\sin^2\theta}$ **40.** $\sec\theta = \dfrac{1}{\sqrt{1-\sin^2\theta}}$

**41.** $\sec\theta = -\sqrt{1+\tan^2\theta}$ **42.** $\csc\theta = -\sqrt{1+\cot^2\theta}$

**43.** $\cos\theta = -\frac{4}{5}$, $\tan\theta = -\frac{3}{4}$, $\csc\theta = \frac{5}{3}$, $\sec\theta = -\frac{5}{4}$, $\cot\theta = -\frac{4}{3}$

**44.** $\sin\theta = -\sqrt{95}/12$, $\tan\theta = \sqrt{95}/7$, $\csc\theta = -12\sqrt{95}/95$, $\sec\theta = -12/7$, $\cot\theta = 7\sqrt{95}/95$

**45.** $\sin\theta = -\frac{3}{5}$, $\cos\theta = \frac{4}{5}$, $\csc\theta = -\frac{5}{3}$, $\sec\theta = \frac{5}{4}$, $\cot\theta = -\frac{4}{3}$

**46.** $\sin\theta = -2\sqrt{6}/5$, $\cos\theta = \frac{1}{5}$, $\tan\theta = -2\sqrt{6}$, $\csc\theta = -5\sqrt{6}/12$, $\cot\theta = -\sqrt{6}/12$

**47.** $\sin\theta = \frac{1}{2}$, $\cos\theta = \sqrt{3}/2$, $\tan\theta = \sqrt{3}/3$, $\sec\theta = 2\sqrt{3}/3$, $\cot\theta = \sqrt{3}$

**48.** $\sin\theta = -4\sqrt{17}/17$, $\cos\theta = -\sqrt{17}/17$, $\tan\theta = 4$, $\csc\theta = -\sqrt{17}/4$, $\sec\theta = -\sqrt{17}$

**49.** $\sin\theta = 3\sqrt{5}/7$, $\tan\theta = -3\sqrt{5}/2$, $\csc\theta = 7\sqrt{5}/15$, $\sec\theta = -\frac{7}{2}$, $\cot\theta = -2\sqrt{5}/15$

**50.** $\sin\theta = 4\sqrt{17}/17$, $\cos\theta = -\sqrt{17}/17$, $\csc\theta = \sqrt{17}/4$, $\sec\theta = -\sqrt{17}$, $\cot\theta = -\frac{1}{4}$ **51.** (a) $\sqrt{3}/2$, $\sqrt{3}$ (b) $\frac{1}{2}$, $\sqrt{3}/4$ (c) $\frac{3}{4}$, 0.88967 **52.** 30.0 **53.** 19.1 **54.** 43.3

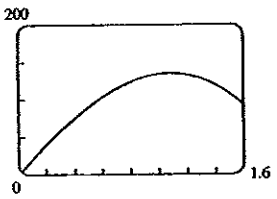
**55.** 66.1° **56.** $\sqrt{96}$ cm $\approx$ 9.8 cm **57.** $(4\pi/3) - \sqrt{3} \approx 2.46$

**58.** $120\pi + 36\sqrt{3} \approx 439.3$

**61.** (b)

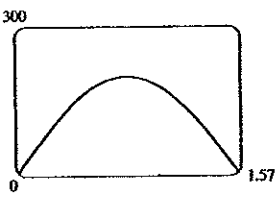
| $\theta$ | 20° | 60° | 80° | 85° |
|---|---|---|---|---|
| $h$ | 1922 | 9145 | 29,944 | 60,351 |

**62.** (b)




(c) 60° **63.** (a) $A(\theta) = 400 \sin\theta\cos\theta$

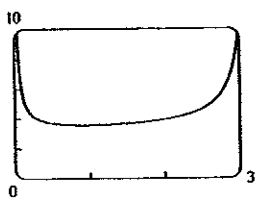
(b)




(c) width = depth $\approx$ 14.14 in. **64.** $S(\theta) = 8000\,k\cos\theta\sin^2\theta$

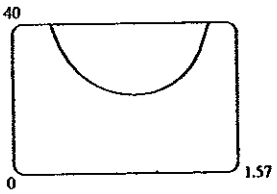
**65.** (a) $9\sqrt{3}/4$ ft $\approx$ 3.897 ft, $\frac{9}{16}$ ft = 0.5625 ft (b) 23.982 ft, 3.462 ft **66.** 15.8 s

**67.** (a)




(b) 0.946 rad or 54°

**68.** (b)




(c) 21.07 **69.** 42°

## Section 6.4 ■ page 506

**1.** 318.8 **2.** 25.4 **3.** 24.8 **4.** 40.3° **5.** 44° **6.** 144.9

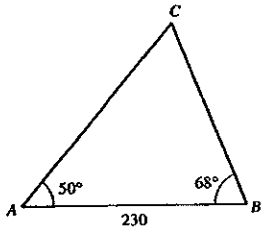
**7.** $\angle C = 114°$, $a \approx 51$, $b \approx 24$

**8.** $\angle B = 50°$, $a \approx 1.31$, $c \approx 2.57$

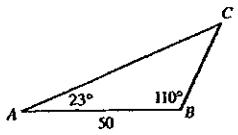
**9.** $\angle A = 44°$, $\angle B = 68°$, $a \approx 8.99$

**10.** $\angle B \approx 31.0°$, $\angle C \approx 69°$, $c \approx 6.2$

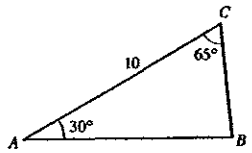
**11.** $\angle C = 62°$, $a \approx 200$, $b \approx 242$



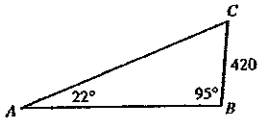

**12.** $\angle C = 47°$, $a \approx 26.7$, $b \approx 64.2$



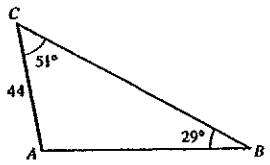

**13.** $\angle B = 85°$, $a \approx 5$, $c \approx 9$



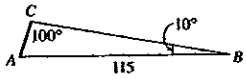

**14.** $\angle C = 63°$, $b \approx 1116.9$, $c \approx 999.0$




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




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




**17.** $\angle B \approx 30°$, $\angle C \approx 40°$, $c \approx 19$

**18.** $\angle B_1 \approx 89.6°$, $\angle C_1 \approx 53.4°$, $b_1 \approx 49.8$; $\angle B_2 \approx 16.4°$, $\angle C_2 \approx 126.6°$, $b_2 \approx 14.1$ **19.** No solution

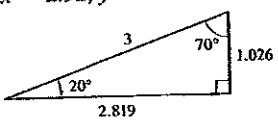
20. $\angle A_1 \approx 100.7°$, $\angle B_1 \approx 41.3°$, $a_1 \approx 67.0$; $\angle A_2 \approx 3.3°$, $\angle B_2 \approx 138.7°$, $a_2 \approx 3.9$
21. $\angle A_1 \approx 125°$, $\angle C_1 \approx 30°$, $a_1 \approx 49$; $\angle A_2 \approx 5°$, $\angle C_2 \approx 150°$, $a_2 \approx 5.6$
22. $\angle B_1 \approx 41.8°$, $\angle C_1 \approx 108.2°$, $c_1 \approx 142.5$; $\angle B_2 \approx 138.2°$, $\angle C_2 \approx 11.8°$, $c_2 \approx 30.7$ 23. No solution
24. $\angle B \approx 34.4°$, $\angle C = 10.6°$, $c \approx 25.9$
25. $\angle A_1 \approx 57.2°$, $\angle B_1 \approx 93.8°$, $b_1 \approx 30.9$; $\angle A_2 \approx 122.8°$, $\angle B_2 \approx 28.2°$, $b_2 \approx 14.6$
26. $\angle A_1 \approx 49.7°$, $\angle C_1 \approx 72.3°$, $a_1 \approx 65.7$; $\angle A_2 \approx 14.3°$, $\angle C_2 \approx 107.7°$, $a_2 \approx 21.3$
27. (a) 91.146° (b) 14.427° 28. 5.25 31. (a) 1018 mi (b) 1017 mi 32. (a) 3.77 mi (b) 2.00 mi 33. 219 ft
34. 678.5 ft 35. 55.9 m 36. 161.1 ft 37. 175 ft
38. 155 m 39. 192 m 40. 48.2° 41. 0.427 AU, 1.119 AU
42. (b) 12 cm (c) A plane

## Section [illegible]

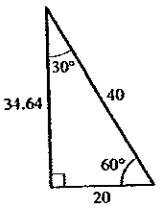
1. 28.9 2. 26.8 3. 47 4. 8.2 5. 29.89° 6. 111°
7. 15 8. 130.54° 9. $\angle A \approx 39.4°$, $\angle B \approx 20.6°$, $c \approx 24.6$
10. $\angle A \approx 63.0°$, $\angle B \approx 15.5°$, $\angle C \approx 101.5°$
11. $\angle A \approx 48°$, $\angle B \approx 79°$, $c \approx 3.2$
12. $\angle B \approx 80.5°$, $\angle C \approx 29.5°$, $a \approx 57.2$
13. $\angle A \approx 50°$, $\angle B \approx 73°$, $\angle C \approx 57°$
14. $\angle A \approx 38.6°$, $\angle B \approx 48.5°$, $\angle C \approx 92.9°$
15. $\angle A_1 \approx 83.6°$, $\angle C_1 \approx 56.4°$, $a_1 \approx 193$; $\angle A_2 \approx 16.4°$, $\angle C_2 \approx 123.6$, $a_2 \approx 54.9$ 16. No such triangle
17. No such triangle 18. $\angle A = 36°$, $b \approx 109.4$, $c \approx 124.1$
19. 2 20. 12.2 21. 25.4 22. 21.3° 23. 89.2°
24. 126.5° 25. 24.3 26. 1180.8 27. 54 28. 0.97
29. 26.83 30. 549.6 31. 5.33 32. 9.798 33. 40.77
34. 2.46 35. 3.85 $cm^2$ 37. 2.30 mi 38. 7.3, 3.8
39. 23.1 mi 40. 56.0 mi 41. 2179 mi 42. 28 mi
43. (a) 62.6 mi (b) S 18.2° E 44. (a) 232.5 mi (b) N 50° E 45. 96° 46. 31° 47. 211 ft 48. 161 ft
49. 3835 ft 50. 1679 ft 51. $165,554

## Chapter [illegible] Review

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 ≈ 80.2°
7. 82 ft 8. 21,609 9. 0.619 rad ≈ 35.4° 10. 25 $m^2$
11. 18,151 $ft^2$ 12. 0.4 rad ≈ 22.9°
13. $300\pi$ rad/min ≈ 942.5 rad/min, 7539.8 in./min = 628.3 ft/min
14. (a) $7000\pi$ rad/min ≈ 21,991 rad/min (b) $7777.8\pi$ rad/min ≈ 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.




22.



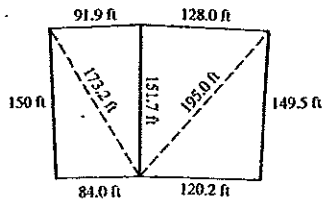

23. $a = \cot\theta$, $b = \csc\theta$ 24. 550 m
25. 48 m
26. $h = \sqrt{64 - 4\cos^2\theta} + 2\sin\theta$
27. 1076 mi 28. 14,400 ft
29. $-\sqrt{2}/2$ 30. $\sqrt{2}$
31. 1 32. $-\sqrt{3}/2$ 33. $-\sqrt{3}/3$
34. $\sqrt{2}/2$ 35. $-\sqrt{2}/2$ 36. −2
37. $2\sqrt{3}/3$ 38. $2\sqrt{3}/3$ 39. $-\sqrt{3}$ 40. −1
41. $\sin\theta = \frac{12}{13}$, $\cos\theta = -\frac{5}{13}$, $\tan\theta = -\frac{12}{5}$, $\csc\theta = \frac{13}{12}$, $\sec\theta = -\frac{13}{5}$, $\cot\theta = -\frac{5}{12}$ 42. $\frac{1}{2}$ 43. 60°
44. $\sin\theta = -\sqrt{5}/5$, $\cos\theta = -2\sqrt{5}/5$, $\tan\theta = \frac{1}{2}$, $\csc\theta = -\sqrt{5}$, $\sec\theta = -\sqrt{5}/2$, $\cot\theta = 2$
45. $\tan\theta = -\sqrt{1 - \cos^2\theta}/\cos\theta$
46. $\sec\theta = -1/\sqrt{1 - \sin^2\theta}$ 47. $\tan^2\theta = \sin^2\theta/(1 - \sin^2\theta)$
48. $\csc^2\theta\cos^2\theta = \dfrac{1}{\sin^2\theta} - 1$
49. $\sin\theta = \sqrt{7}/4$, $\cos\theta = \frac{3}{4}$, $\csc\theta = 4\sqrt{7}/7$, $\cot\theta = 3\sqrt{7}/7$
50. $\sin\theta = -\frac{9}{41}$, $\cos\theta = \frac{40}{41}$, $\tan\theta = -\frac{9}{40}$, $\cot\theta = -\frac{40}{9}$
51. $\cos\theta = -\frac{4}{5}$, $\tan\theta = -\frac{3}{4}$, $\csc\theta = \frac{5}{3}$, $\sec\theta = -\frac{5}{4}$, $\cot\theta = -\frac{4}{3}$
52. $\sin\theta = -\frac{12}{13}$, $\cos\theta = -\frac{5}{13}$, $\tan\theta = \frac{12}{5}$, $\csc\theta = -\frac{13}{12}$, $\cot\theta = \frac{5}{12}$
53. $-\sqrt{5}/5$ 54. $\sqrt{3}$ 55. 1 56. $-\sqrt{3}/2$ 57. 5.32
58. 1.46 59. 148.07 60. 9.17 61. 77.82 62. 3.3
63. 77.3 mi 64. 1160 ft 65. 3.9 mi 66. 80.8 mi
67. 32.12 68. 14.98

## Chapter [illegible] Test

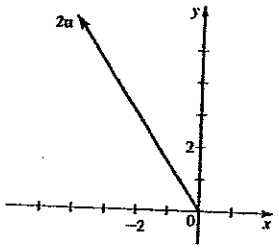
1. $11\pi/6$, $-3\pi/4$ 2. 240°, −74.5°
3. (a) $240\pi$ rad/min ≈ 753.98 rad/min (b) 12,063.7 ft/min = 137 mi/h 4. (a) $\sqrt{2}/2$ (b) $\sqrt{3}/3$ (c) 2 (d) 1 5. $(26 + 6\sqrt{13})/39$
6. $a = 24\sin\theta$, $b = 24\cos\theta$ 7. $(4 - 3\sqrt{2})/4$
8. $-\frac{13}{12}$ 9. $\tan\theta = -\sqrt{\sec^2\theta - 1}$ 10. 19.6 ft
11. 9.1 12. 250.5 13. 8.4 14. 19.5 15. (a) 15.3 $m^2$ (b) 24.3 m 16. (a) 129.9° (b) 44.9 17. 554 ft

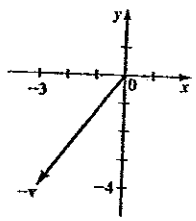
## Focus on Modeling

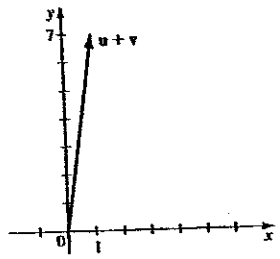
1. 1.41 mi 2. 1.31 mi
3. 14.3 m 4. 119.2 m
5. (c) 2349.8 ft 6. 4194 ft
7.

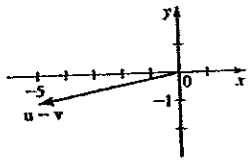


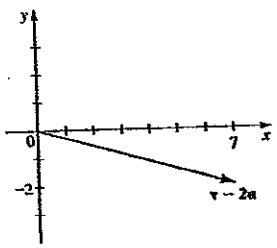
Section 5.6

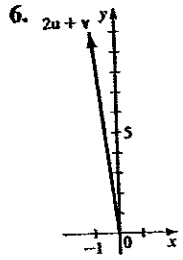
1. 


2. 


3. 


4. 


5. 


6. 


7. $\langle 3, 3\rangle$ 8. $\langle -5, 3\rangle$ 9. $\langle 3, -1\rangle$ 10. $\langle 2, -3\rangle$ 11. $\langle 5, 7\rangle$
12. $\langle 8, 8\rangle$ 13. $\langle -4, -3\rangle$ 14. $\langle -5, -4\rangle$ 15. $\langle 0, 2\rangle$
16. $\langle 7, 5\rangle$ 17. $\langle 4, 14\rangle, \langle -9, -3\rangle, \langle 5, 8\rangle, \langle -6, 17\rangle$
18. $\langle -4, 10\rangle, \langle -6, 24\rangle, \langle 0, -3\rangle, \langle -14, 47\rangle$
19. $\langle 0, -2\rangle, \langle 6, 0\rangle, \langle -2, -1\rangle, \langle 8, -3\rangle$
20. $2\mathbf{i}, 6\mathbf{j}, \mathbf{i} - 2\mathbf{j}, 3\mathbf{i} + 8\mathbf{j}$
21. $4\mathbf{i}, -9\mathbf{i} + 6\mathbf{j}, 5\mathbf{i} - 2\mathbf{j}, -6\mathbf{i} + 8\mathbf{j}$
22. $2\mathbf{i} + 2\mathbf{j}, -3\mathbf{i} + 3\mathbf{j}, 2\mathbf{i}, -\mathbf{i} + 7\mathbf{j}$
23. $\sqrt{5}, \sqrt{13}, 2\sqrt{5}, \frac{1}{2}\sqrt{13}, \sqrt{26}, \sqrt{10}, \sqrt{5} - \sqrt{13}$
24. $\sqrt{13}, \sqrt{5}, 2\sqrt{13}, \sqrt{5}/2, \sqrt{2}, \sqrt{34}, \sqrt{13} - \sqrt{5}$
25. $\sqrt{101}, 2\sqrt{2}, 2\sqrt{101}, \sqrt{2}, \sqrt{73}, \sqrt{145}, \sqrt{101} - 2\sqrt{2}$
26. $6\sqrt{2}, \sqrt{5}, 12\sqrt{2}, \sqrt{5}/2, \sqrt{89}, \sqrt{63}, 6\sqrt{2} - \sqrt{5}$
27. $20\sqrt{3}\mathbf{i} + 20\mathbf{j}$ 28. $-25\mathbf{i} + 25\sqrt{3}\mathbf{j}$ 29. $-\frac{\sqrt{2}}{2}\mathbf{i} - \frac{\sqrt{2}}{2}\mathbf{j}$
30. $800 \cos 125°\mathbf{i} + 800 \sin 125°\mathbf{j} \approx -458.86\mathbf{i} + 655.32\mathbf{j}$
31. $4 \cos 10°\mathbf{i} + 4 \sin 10°\mathbf{j} \approx 3.94\mathbf{i} + 0.69\mathbf{j}$
32. $\frac{\sqrt{3}}{2}\mathbf{i} - \frac{3}{2}\mathbf{j}$ 33. 5, 53.13° 34. 1, 225° 35. 13, 157.38°
36. 41, 12.68° 37. 2, 60° 38. $\sqrt{2}$, 45° 39. $15\sqrt{3}, -15$
40. 469.85 mi/h, 171.01 mi/h 41. $2\mathbf{i} - 3\mathbf{j}$
42. $\left(\frac{5\sqrt{2}}{2} + 3\right)\mathbf{i} + \left(\frac{5\sqrt{2}}{2}\right)\mathbf{j}$ 43. (a) $40\mathbf{j}$ (b) $425\mathbf{i}$
(c) $425\mathbf{i} + 40\mathbf{j}$ (d) 427 mi/h, N 84.6° E

44. (a) $\left\langle \frac{55}{2}, \frac{55\sqrt{3}}{2} \right\rangle$ (b) $\left\langle \frac{765\sqrt{2}}{2}, \frac{765\sqrt{2}}{2} \right\rangle$
(c) $\langle 568.44, 588.57\rangle$ (d) 818 mi/h, N 44° E
45. 794 mi/h, N 26.6° W 46. N 2.1° W
47. (a) $10\mathbf{i}$ (b) $10\mathbf{i} + 17.32\mathbf{j}$ (c) $20\mathbf{i} + 17.32\mathbf{j}$
(d) 26.5 mi/h, N 49.1° E 48. N 30° W
49. (a) $22.8\mathbf{i} + 7.4\mathbf{j}$ (b) 7.4 mi/h, 22.8 mi/h
50. 25.08 mi/h, N 4.57° W 51. (a) $\langle 5, -3\rangle$ (b) $\langle -5, 3\rangle$
52. (a) $\langle 0, 0\rangle$ (b) None 53. (a) $-4\mathbf{j}$ (b) $4\mathbf{j}$

54. (a) $\mathbf{j}$ (b) $-\mathbf{j}$ 55. (a) $\langle -7.57, 10.61\rangle$
(b) $\langle 7.57, -10.61\rangle$ 56. (a) $\langle 2, -4\rangle$ (b) $\langle -2, 4\rangle$
57. $\mathbf{T}_1 \approx -56.5\mathbf{i} + 67.4\mathbf{j}$, $\mathbf{T}_2 \approx 56.5\mathbf{i} + 32.6\mathbf{j}$
58. $\mathbf{T}_1 \approx -14{,}116\mathbf{i} + 5{,}789\mathbf{j}$, $\mathbf{T}_2 \approx 14{,}116\mathbf{i} + 12{,}488\mathbf{j}$

Section 5.7

1. (a) 2 (b) 45° 2. (a) 0 (b) 90° 3. (a) 13 (b) 56°
4. (a) $-12$ (b) 180° 5. (a) $-1$ (b) 97°
6. (a) 4 (b) 60.3° 7. (a) $5\sqrt{3}$ (b) 30°
8. (a) 0 (b) 90° 9. Yes 10. Yes 11. No 12. Yes
13. Yes 14. No 15. 9 16. 9 17. $-5$ 18. $-10$
19. $-\frac{12}{5}$ 20. $\sqrt{2}$ 21. $-24$ 22. $\frac{28}{5}$
23. (a) $\langle 1, 1\rangle$ (b) $\mathbf{u}_1 = \langle 1, 1\rangle, \mathbf{u}_2 = \langle -3, 3\rangle$
24. (a) $\langle 4, 2\rangle$ (b) $\mathbf{u}_1 = \langle 4, 2\rangle, \mathbf{u}_2 = \langle 3, -6\rangle$
25. (a) $\langle -\frac{1}{2}, \frac{3}{2}\rangle$ (b) $\mathbf{u}_1 = \langle -\frac{1}{2}, \frac{3}{2}\rangle, \mathbf{u}_2 = \langle \frac{3}{2}, \frac{1}{2}\rangle$
26. (a) $\langle 9, 6\rangle$ (b) $\mathbf{u}_1 = \langle 9, 6\rangle, \mathbf{u}_2 = \langle 2, -3\rangle$
27. (a) $\langle -\frac{18}{5}, \frac{24}{5}\rangle$ (b) $\mathbf{u}_1 = \langle -\frac{18}{5}, \frac{24}{5}\rangle, \mathbf{u}_2 = \langle \frac{28}{5}, \frac{21}{5}\rangle$
28. (a) $\langle \frac{2}{5}, -\frac{1}{5}\rangle$ (b) $\mathbf{u}_1 = \langle \frac{2}{5}, -\frac{1}{5}\rangle, \mathbf{u}_2 = \langle \frac{3}{5}, \frac{6}{5}\rangle$
29. $-28$ 30. 80,400 31. 25 32. 280 38. $\mathbf{u} \cdot \mathbf{v}$
39. 16 ft-lb 40. 82 ft-lb 41. 8660 ft-lb 42. 260,000 ft-lb
43. 1164 lb 44. (a) 2822 lb (b) 2779 lb 45. 23.6°
46. 54.6 lb