

Chapter 3 Answers to Problems

1. (a) 10.00 km west (b) 4.88 km east (c) 4.88 km west 2. (a) 0.73 units in the $+x$ -direction (b) 2.73 units in the $+x$ -direction (c) 2.73 units in the $-x$ -direction 3. (a) same direction (b) perpendicular (c) opposite directions, 1.0 4. (a) 150 m (b) 95 m east 6. 230 m at 40° north of west 8. (a) about 1.4 cm (b) about 7.9 cm 9. (a) 45 km (b) 16 km 10. 2.0 km at 20° east of south 11. $\Delta \mathbf{r} = \mathbf{r}_n - \mathbf{r}_1$ 12. about 30 nautical miles at about 15° to 20° south of east 13. -17.3 m, 10.0 m 14. 8.7 units 15. (a) 2.0 units at 30° CCW from the $+y$ -axis (b) 2.0 units at 30° CW from the $+y$ -axis (c) -1.0 unit, $-\sqrt{(3.0)}$ units 16. (a) 5.0 m/s^2 (b) 37° CCW from the $+y$ -axis 17. 1.4 cm 18. 7.9 cm 19. A 6.6 m, 2.4 m, B 6.6 m/s, -2.4 m/s , C -2.4 m , 6.6 m, D -2.4 m/s , -6.6 m/s 20. (a) 31.0 m/s (b) 58.1° with the $+x$ -axis and 31.9° with the $-y$ -axis 21. (a) 9.4 m/s , 32° CCW from the $+y$ -axis (b) 130 m, 27° CW from the $+x$ -axis (c) 16.3 m/s , 33° CCW from the $-x$ -axis (d) 2.3 m/s^2 , 1.6° CCW from the $+x$ -axis 22. -14.3 cm , 17.0 cm 23. (a) 6.9, -1.7 (b) 15° CW from the $-y$ -axis (c) 9.8, 31° CCW from the $-y$ -axis (d) 10, 30° CCW from the $-x$ -axis (e) -8.7 , -5.0 24. 0.283 mi, 45.0° N of W or NW 25. 4.92 mi, 24.0° north of east 26. 2.0 km at 20° east of south 27. 29 nautical miles at 17° south of east 28. 4.4 miles at 58° north of east 29. (a) 5.03 m/s (b) 0.996 m/s at 12.4° west of north 30. (a) 6.7 m/s (b) 0 31. (b) 59.9 km at 85° north of east (c) 80 km/h at 85° north of east 32. (a) 70 mi/h (b) 59 mi/h at 14° south of west 33. 26 km/h at 31° north of east 34. (a) 110 km/h (b) 97 km/h at 35° north of east 35. (a) 102 km/h (b) 90.8 km/h at 16.6° south of west 36. (a) 21 m/s (b) 16 m/s 37. (a) 76.2 km (b) 102 km/h at 22.0° north of west (c) 32.6 km/h at 22.0° south of east (d) 0 (e) 63.3 km/h 38. 0.70 m/s^2 south 39. 13 m/s² up 40. (a) 9.4 m/s at 45° north of east (b) 15 m/s^2 at 45° south of east (c) changing the direction of the velocity requires an acceleration 41. (a) 9.82 m/s (b) 13.9 m/s southeast (c) 8.68 m/s^2 southeast 42. (b) 170 km/h at 7° south of west (c) 57 km/h^2 at 7° south of west 43. (a) 180 km/h at 24° south of east (b) 280 km/h at 24° south of east 44. 44.7 m/s at 26.6° south of east 45. 0.8 s 46. the ball is on the ground at a horizontal distance of 42.0 m from the launch point 47. it is on the ground after 1.32 s, so the horizontal distance along the ground is 26.3 m 48. (a) the ball has fallen 12.5 m vertically and has traveled 32.0 m horizontally (b) The ball will land after another 0.09 s and will then be at a horizontal distance of 33.8 m. 49. (a) 5.9 m (b) 17.0 m/s 50. (a) 10.0 m/s, -12 m/s (b) 30 m, 8 m 51. (a) 202 m (b) 51.1° below the horizontal 52. 37.1 m 53. (a) 37 m (b) 170 m (c) 32 m/s, -27 m/s 54. 21 m/s 55. (b) 27.6 m/s at 25.0° above the horizontal (c) 37.5 m (d) 44.4 m above the ground 56. (a) 127 m, 127 m (b) 96.2 m, 96.2 m (c) 134 m (d) The ranges are the same for each pair of complementary angles. The largest range occurred for an angle of 45.0° above the horizontal. 57. (a) $2v_i \sin\theta/g$ (c) 45° , v_i^2/g 58. (a) v_i^2/g (b) 45° 59. (a) $v_x = v_i \cos\theta$ and $v_y = 0$ (b) $v_i \sin\theta/g$ 60. (a) 18.5 m higher than where it was hit (b) 3.89 s (c) 42.8 m 61. 15.8 m 62. (a) 3.49 s (b) 2.01 s (c) 80.6 m 63. 11 m/s, 2.5 m 65. 130 km/h north 66. 254 s 67. 63 km/h at 40° south of west 68. 0.42 km/h 69. 50 m/s east 70. (a) 39.0 m/s (b) 7.4° south of west 71. (a) 9.6° north of west (b) 38 m/s 72. 27° upstream 73. $v_x = 50 \text{ km/h}$ east, $v_y = 40 \text{ km/h}$ east 74. (a) 1.80 mi/h (b) 48.0 min (c) 0.800 mi upstream (d) 32.2° upstream 75. (a) 30.0 N of W (b) 9.1 min 77. (a) 1.00 m/s (b) 1.12 m/s 78. (a) 76.37° north of east (b) 2.717 h 79. (a) 1.1 m (b) down 80. (a) 68.5 km/h at 12.5° north of east (b) 68.5 km/h at 12.5° south of west 81. (a) 873 km (b) 9.90° south of east (c) 2.250 h (d) 2.18 h 82. (a) 4.5 s (b) 81 m 83. (a) 160 km/h at 20° N of E (b) 150 km/h at 21° N of E (c) 10 km/h west 84. 200 km 85. 68 m/s 86. (a) 54 mi at 26° north of east (b) 134 mi 87. 12 m east and 40 m north 88. 46 m 89. (a) 28.6 cm (b) smaller (c) larger (d) 85.1 cm 90. 23 m 91. (a) 33.1 h (b) 34.1 h (c) 33.6 h 92. (a) 7.67 m (b) 13.9 m/s (c) 12.5 m/s 93. 63° below the horizontal 94. 32.0° 95. (a) 15 km/h

due west (b) 5.8° west of north **96.** (a) 2.02 s (b) 2.02 s **97.** (a) 1.5 s (b) step 4 **98.** 2.6 m/s^2 at 18° west of north **100.** 39 s