Chapter 2

Problems & Exercises

1.

(a) 7 m

(b) 7 m

(c) +7 m

3.

a. $8\text{ m} + 2\text{ m} + 3\text{ m} = 13\text{ m}$

b. 9 m

c. $\Delta x = 11\text{ m} - 2\text{ m} = 9\text{ m}$

5.

(a) 3.0×10^4 m/s

(b) 0 m/s

7.

2×10^7 years

9.

34.689 m/s = 124.88 km/h

11.

(a) 40.0 km/h

(b) 34.3 km/h, 25º S of E.

(c) average speed = 3.20 km/h, $\bar{v} = 0$.

13.

384,000 km

15.

(a) 6.61×10^{15} rev/s

(b) 0 m/s

16.

4.29 m/s^2

18.

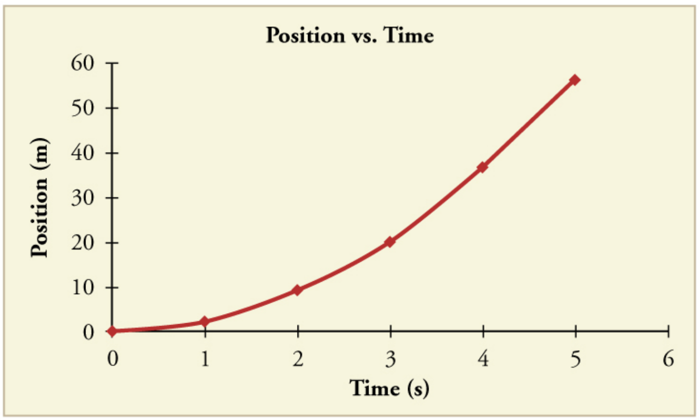
(a) 1.43 s

(b) $-2.50\ \text{m/s}^2$

20.

(a) 10.8 m/s

(b)



21.

38.9 m/s (about 87 miles per hour)

23.

(a) 16.5 s

(b) 13.5 s

(c) $-2.68\ \text{m/s}^2$

25.

(a) 20.0 m

(b) -1.00 m/s

(c) This result does not really make sense. If the runner starts at 9.00 m/s and decelerates at $2.00\ \text{m/s}^2$, then she will have stopped after 4.50 s. If she continues to decelerate, she will be running backwards.

27.

0.799 m

29.

(a) 28.0 m/s

(b) 50.9 s

(c) 7.68 km to accelerate and 713 m to decelerate

31.

(a) 51.4 m

(b) 17.1 s

33.

(a) -80.4 m/s^2

(b) 9.33×10^{-2} s

35.

(a) 7.7 m/s

(b) $-15 \times 10^2 \text{ m/s}^2$. This is about 3 times the deceleration of the pilots, who were falling from thousands of meters high!

37.

(a) 32.6 m/s^2

(b) 162 m/s

(c) $v > v_{\text{max}}$, because the assumption of constant acceleration is not valid for a dragster. A dragster changes gears, and would have a greater acceleration in first gear than second gear than third gear, etc. The acceleration would be greatest at the beginning, so it would not be accelerating at 32.6 m/s^2 during the last few meters, but substantially less, and the final velocity would be less than 162 m/s.

39.

104 s

40.

(a) $v = 12.2$ m/s; $a = 4.07 \text{ m/s}^2$

(b) $v = 11.2$ m/s

41.

(a) $y_1 = 6.28$ m; $v_1 = 10.1$ m/s

(b) $y_2 = 10.1$ m; $v_2 = 5.20$ m/s

(c) $y_3 = 11.5\ \ m$; $v_3 = 0.300$ m/s

(d) $y_4 = 10.4$ m; $v_4 = -4.60$ m/s

43.

$v_0 = 4.95$ m/s

45.

(a) $a = -9.80\text{ m/s}^2$; $v_0 = 13.0\text{ m/s}$; $y_0 = 0\text{ m}$

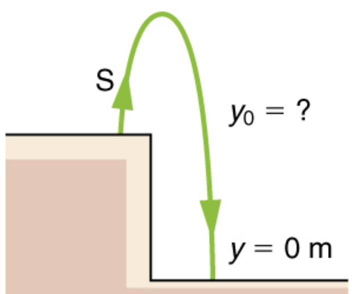
(b) $v = 0\text{m/s}$. Unknown is distance y to top of trajectory, where velocity is zero. Use equation $v^2 = v_0^2 + 2a\,(y - y_0)$ because it contains all known values except for y, so we can solve for y. Solving for y gives

$$\begin{aligned} v^2 - v_0^2 &= 2a(y - y_0) \\ \frac{v^2 - v_0^2}{2a} &= y - y_0 \\ y &= y_0 + \frac{v^2 - v_0^2}{2a} = 0\text{ m} + \frac{(0\text{ m/s})^2 - (13.0\text{ m/s})^2}{2\left(-9.80\text{ m/s}^2\right)} = 8.62\text{ m} \end{aligned}$$

Dolphins measure about 2 meters long and can jump several times their length out of the water, so this is a reasonable result.

(c) 2.65 s

47.



(a) 8.26 m

(b) 0.717 s

49.

1.91 s

51.

(a) 94.0 m

(b) 3.13 s

53.

(a) -70.0 m/s (downward)

(b) 6.10 s

55.

(a) 19.6 m

(b) 18.5 m

57.

(a) 305 m

(b) 262 m, -29.2 m/s

(c) 8.91 s

59.

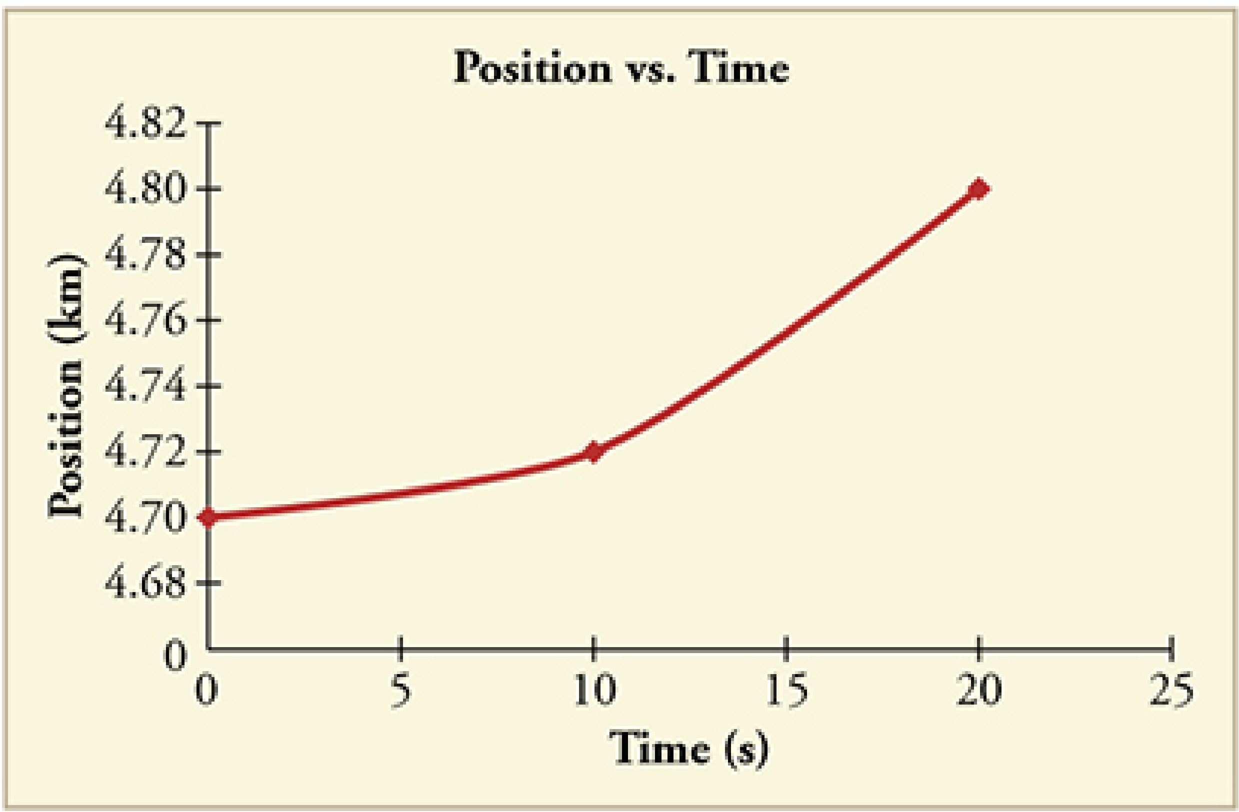
(a) 115 m/s

(b) 5.0 m/s^2

61.

$v = \frac{(11.7 - 6.95)\times 10^3 \text{ m}}{(40.0 - 20.0) \text{ s}} = 238 \text{ m/s}$

63.



65.

(a) 6 m/s

(b) 12 m/s

(c) 3 m/s^2

(d) 10 s

67.

(a) Car A is traveling faster at the checkpoint because it must go past the speed of car B to reach the same distance.

(b) i. Yes, the equation is consistent with the answer because the speed of car A is only a constant away from the correct answer. ii. Yes, the equation makes sense because $V = 2V_0$.

(c)