

$$s(t) = \frac{1}{2}at^2 + v_0t + s_0$$

Sec. 2.2 MORE Applications

Name Answer Key

Solve each problem by using calculus. Show all work!

$a = -32 \text{ ft/s}^2$   
 $v_0 = 0$   
 $s_0 = 75.0 \text{ ft}$

1. A pumpkin pie is dropped from a height of 75.0 feet.  $s_0$

- a. Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$$s(t) = -16t^2 + 75$$

$$v(t) = -32t$$

$$a(t) = -32$$

- b. How long does it take for the pie to hit the ground?

$$s(t) = 0$$

$$t = 2.16506 \text{ sec}$$

$$2.17 \text{ sec}$$

- c. With what speed does the pie hit the ground? (No, the answer is not 0 ft/sec.)

$$v(2.16506) = -69.3 \text{ ft/sec}$$

$a = -32 \text{ ft/s}^2$   
 $v_0 = 40.0 \text{ ft/s}$   
 $s_0 = 0 \text{ ft}$

2. A frozen turkey is shot straight upward from the ground with a speed of 40.0 ft/sec.

- a. Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$$s(t) = -16t^2 + 40t$$

$$v(t) = -32t + 40$$

$$a(t) = -32$$

- b. How long does it take for the turkey to reach its peak height?

$$v(t) = 0$$

$$t = 1.25 \text{ sec}$$

- c. What is the peak height of the turkey?

$$s(1.25) = 49.375$$

$$49.4 \text{ ft}$$

$a = -9.8 \text{ m/s}^2$ . A bowl of cranberry sauce is thrown downward from a height of 60.0 m, with a speed of 20.0 m/s.

$V_0 = -20.0 \text{ m/s}$

$S_0 = 60.0 \text{ m}$

- a. Write the position, velocity and acceleration functions. Show the relationship with differentiation.

$$S(t) = -4.9t^2 - 20t + 60$$

$$V(t) = -9.8t - 20$$

$$a(t) = -9.8$$

- b. How long does it take for the cranberry sauce to hit the ground?

$$S(t) = 0$$

$$t = 2.01009 \text{ sec}$$

2.01 sec

- c. With what speed does it hit the ground?

$$V(2.01009) = -39.7 \text{ m/s}$$

$a = -9.8 \text{ m/s}^2$  4. You are standing on the roof of a building, throwing stuffing balls upward from a height of 10.0 meters, with a speed of 15.0 m/s.

$V_0 = 15.0 \text{ m/s}$

$S_0 = 10.0 \text{ m}$

- a. Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$$S(t) = -4.9t^2 + 15t + 10$$

$$V(t) = -9.8t + 15$$

$$a(t) = -9.8$$

- b. How long does it take for the stuffing ball to reach its peak height?

$$V(t) = 0$$

$$t = 1.5306 \text{ sec}$$

1.53 sec

- c. What is the peak height of the stuffing balls?

$$S(1.5306) = 21.480$$

21.5 m

$a = -9.8 \text{ m/s}^2$  A mincemeat pie is dropped from a height of 44.1 meters.

$v_0 = 0 \text{ m/s}$   
 $s_0 = 44.1 \text{ m}$

a. Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$S(t) = -4.9t^2 + 44.1$   
 $V(t) = -9.8t$   
 $a(t) = -9.8$

b. How long does it take for the pie to hit the ground?

$S(t) = 0$   
 $t = 3.0 \text{ sec}$

c. With what speed does the pie hit the ground?

$V(3.0) = -29.4 \text{ m/s}$

$a = -9.8 \text{ m/s}^2$  A ham is shot straight upward from the ground with a speed of 25.0m/sec.

$v_0 = 25.0 \text{ m/s}$   
 $s_0 = 0 \text{ m}$

a. Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$S(t) = -4.9t^2 + 25t$        $a(t) = -9.8$   
 $V(t) = -9.8t + 25$

b. How long does it take for the ham to reach its peak height?

$V(t) = 0$   
 $t = 2.55102 \text{ sec}$        $t = 2.55 \text{ sec}$

c. What is the peak height of the ham?

$S(2.55102) = 31.887755$   
 $s = 31.9 \text{ ft}$



7. A bowl of mashed potatoes is thrown downward from a height of 85.0 ft,

$a = -32 \text{ ft/s}^2$  with a speed of 10.0 ft/s.

$V_0 = -10.0 \text{ ft/s}$  Write the position, velocity and acceleration functions. Show the relationship with differentiation.

$S_0 = 85.0 \text{ ft}$

$$S(t) = -16t^2 - 10t + 85$$

$$V(t) = -32t - 10$$

$$a(t) = -32$$

b. How long does it take for the bowl of mashed potatoes to hit the ground?

$$S(t) = 0$$

$$t = 2.0135 \text{ sec}$$

$$t = 2.01 \text{ sec}$$

c. With what speed does the bowl hit the ground?

$$V(2.0135) = -74.432 \text{ ft/s}$$

$$V = -74.4 \text{ ft/s}$$

8. You are standing on the roof of a building, throwing popcorn balls upward from a height of 12.0 feet, with a speed of 24.0 ft/s.

$a = -32 \text{ ft/s}^2$  Write the position, velocity and acceleration equations. Show the relationship with differentiation.

$V_0 = 24.0 \text{ ft/s}$

$$S(t) = -16t^2 + 24t + 12$$

$$V(t) = -32t + 24$$

$$a(t) = -32$$

b. How long does it take for the popcorn ball to reach its peak height?

$$V(t) = 0$$

$$t = 0.75 \text{ sec}$$

c. What is the peak height of the popcorn balls?

$$S(0.75) = 21 \text{ ft}$$