

1.) Betsy fires a giant rock in a catapult, which forms a parabolic shape. Let's say her altitude, or height, above the earth is modeled by this equation:  $h(t) = -16t^2 + 224t$  where  $h$  is measured in feet, and  $t$  is measured in seconds.

a) When will Betsy's rock reach its highest point, or *maximum height*?

**7 SECONDS**

$$t = \frac{-224}{2(-16)} = \frac{-224}{-32} = 7$$

b) What will the rocks *maximum height* be?

**$h(7) = 784$  FT**

$$h(7) = -16(7)^2 + 224(7) = 784$$

c) When will the rock hit the ground?

**14 SECONDS**

$$\begin{aligned} 0 &= -16t^2 + 224t \\ 0 &= -16t(t - 14) \\ -16t &= 0 \quad t - 14 = 0 \\ t &= 0 \quad t = 14 \end{aligned}$$

2.) A cannon, perched atop a tower is shot in a parabolic-path. Suppose the height of the cannon ball is modeled by  $h(t) = -16t^2 + 192t + 200$ , again where  $h$  is measured in feet and  $t$  is measured in seconds.

a) When will the cannon ball reach its highest point?

**6 SECONDS**

$$x = \frac{-192}{2(-16)} = \frac{-192}{-32} = 6$$

b) How far above the *ground* will it be at this time?

**776 FT**

$$h(6) = -16(6)^2 + 192(6) + 200 = 776$$

c) When will the cannon ball land?

**12.96 SECS**

$$\begin{aligned} 0 &= -16t^2 + 192t + 200 \\ 0 &= 8(-2t^2 + 24t + 25) \\ t &= \frac{-24 \pm \sqrt{(24)^2 - 4(-2)(25)}}{2(-2)} \end{aligned}$$

$$t = \frac{-24 \pm \sqrt{576 + 200}}{-4} \rightarrow t = -0.96$$

$$t = \frac{-24 \pm \sqrt{776}}{-4} \rightarrow t = 12.96$$

d) How high was the tower that the cannon was shot from?

**200 FT**

$$\begin{aligned} h(0) &= -16(0)^2 + 192(0) + 200 \\ h(0) &= 200 \end{aligned}$$

3.) A toy rocket is launched vertically upward with an initial velocity of 128 feet per second. Its height  $h$  after  $t$  seconds is given by the equation  $h(t) = -16(t-4)^2 + 256$ .

$$(4, 256)$$

a.) How long will it take the rocket to hit its maximum height?

**4 SECONDS**

b.) What is the maximum height?

**256 FT**

c.) How long will it take for the rocket to return to the ground?

**8 SECONDS**

$$0 = -16(t-4)^2 + 256$$

$$-256 = -16(t-4)^2$$

$$16 = (t-4)^2$$

$$t - 4 = \pm 4$$

$$t = 4 \pm 4$$

$$t = 8$$

$$t = 0$$

d.) How high is the rocket when it is launched?

**0 FT**

$$h(0) = -16(0-4)^2 + 256$$

$$= -16(-4)^2 + 256$$

$$= -16(16) + 256$$

$$= -256 + 256$$

$$h(0) = 0$$

4.) Tiger Woods hit a golf ball. The path of TW's golf ball can be modeled by the equation  $f(t) = -16(t-3)^2 + 192$ , where  $t$  represents time in seconds and  $f$  represents height in feet.

$$(3, 192)$$

a.) What was the highest point that the ball reached?

**192 FT**

b.) How long did it take for Tiger Woods ball to reach its maximum height?

**3 SECONDS**

c.) The ball hits the ground after how many seconds?

**6.46 SECS**

$$0 = -16(t-3)^2 + 192$$

$$-192 = -16(t-3)^2 +$$

$$12 = (t-3)^2$$

$$t-3 = \pm\sqrt{12}$$

$$t = 3 \pm \sqrt{12}$$

$$t = 6.46$$

$$t = -0.46$$

d.) At what height is TW striking the golf ball from?

**48 FT**

$$h(0) = -16(0-3)^2 + 192$$

$$= -16(-3)^2 + 192$$

$$= -144 + 192$$

$$h(0) = 48$$