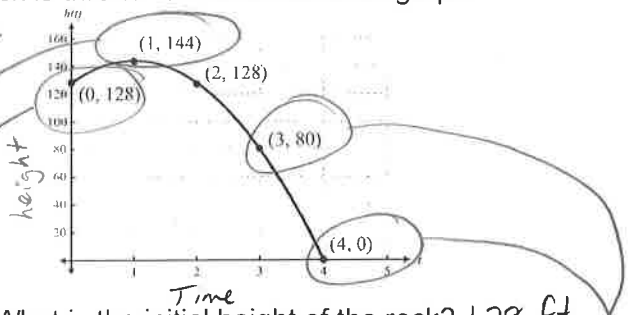
$h(t)$ → height
t → time (sec)

$h(t) = -16t^2 + v_0 t + h_0$ ← initial height
gravity; initial vertical velocity

A rock is thrown into a lake from the top of a cliff. The relationship between the height (in feet) of the rock and time (in seconds) after the rock is thrown is illustrated in the graph below.



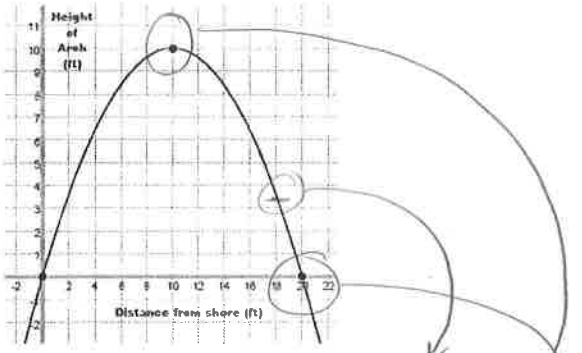
a) What is the initial height of the rock? 128 ft.

b) How high is the rock after 3 seconds? 80 ft.

c) What is the maximum height of the rock? 144 ft.

d) How long is the rock in the air? 4 sec.

A golfball is hit from the shoreline of a water hazard. The graph below illustrates the relationship between the height of the golfball and the distance from the shoreline.



a) What is the height of the golfball when it is 18 ft from the shoreline? 3.5 ft.

b) If the distance from the shoreline is 10 ft, how high is the golfball? 10 ft.

c) What is the total horizontal distance the golfball traveled through the air? 20 ft.

A soccer ball is kicked from the ground level with an initial velocity of 32 ft/s. After how many seconds will the ball hit the ground?

$h(t) = -16t^2 + 32t + 0$

$0 = -16t(t-2)$

$\frac{-16t}{-16} = \frac{0}{-16}$ $t = 0$

$t - 2 = 0$ $+2 \quad +2$ $t = 2$ sec

A golf ball is hit from ground level with an initial velocity of 80 ft/s. After how many seconds will the ball hit the ground?

$h(t) = -16t^2 + 80t + 0$

$0 = -16t(t-5)$

$\frac{-16t}{-16} = \frac{0}{-16}$ $t = 0$

$t - 5 = 0$ $+5 \quad +5$ $t = 5$ sec

A football is kicked from ground level with an initial velocity of 48 ft/s.

a) How long is the ball in the air?

b) How high is the football after 1.5 seconds?

$h(t) = -16t^2 + 48t + 0$

$0 = -16t(t-3)$

$\frac{-16t}{-16} = \frac{0}{-16}$ $t = 0$

$t - 3 = 0$ $+3 \quad +3$ $t = 3$ sec

Plug in for t

$h(1.5) = -16(1.5)^2 + 48(1.5)$

$h(1.5) = 36$ feet

A stunt woman jumps from a building 73 ft high and lands on an air bag that is 9 ft tall. Her height above ground *h* in feet can be modeled by $h(t) = 73 - 16t^2$, where t is the time in seconds. ↑ No initial velocity

a) How many seconds will the stunt woman fall before touching the air bag?

b) What is the maximum height of the stunt woman? 73 ft.

$h(t) = -16t^2 + 73 = 9$

$-73 \quad -73$

$\frac{-16t^2}{-16} = \frac{-64}{-16}$

$\sqrt{t^2} = \sqrt{4}$

$t = \pm 2$

2 sec.

The height of a diver above the water during a dive can be modeled by $h = -16x^2 + 8x + 48$, where h is the height in feet and x is the time in seconds.

a) What is the initial height of the diver? 48 ft

b) Find the time it takes for the diver to reach the water.

$h = -16x^2 + 8x + 48$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-8 \pm \sqrt{(8)^2 - 4(-16)(48)}}{2(-16)}$

$x = \frac{-8 \pm \sqrt{3136}}{-32}$

$\frac{-8 + \sqrt{3136}}{-32} = -1.5$

$\frac{-8 - \sqrt{3136}}{-32} =$ 2 sec

The height of a fireworks rocket in meters can be approximated by $h = -5t^2 + 30t$, where h is the height is meters and t is the time in seconds.

a) Find the time it takes the rocket to reach the ground after it has been launched.

b) How high is the firework after 2 seconds?

$h = -5t^2 + 30t$

$0 = -5t(t - 6)$

$\frac{-5t}{-5} = \frac{0}{-5} \qquad t - 6 = 0$

$t = 0 \qquad +6 \quad +6$

$t = 6$ sec

plug in

$h = -5(2)^2 + 30(2)$

$h = 40$ m.

The height is feet of a soccer ball kicked upward from the ground with initial velocity 60 feet per second is modeled by $h = -16t^2 + 60t$, where t is the time in seconds. Find the time it takes for the ball to return to the ground. Round to the nearest tenth of a second.

$0 = -16t^2 + 60t$

$0 = -4t(4t - 15)$

$\frac{-4t}{-4} = \frac{0}{-4} \qquad 4t - 15 = 0$

$t = 0 \qquad +15 \quad +15$

$\frac{4t}{4} = \frac{15}{4}$

$t = \frac{15}{4}$ or 3.75 sec