

Projectile Motion

Name _____

Isaac Newton found that the formula for the height of a ball after t seconds is

IN FEET:

$$h(t) = -16t^2 + v_0t + h_0$$

IN METERS:

$$h(t) = -4.9t^2 + v_0t + h_0$$

t = time given in seconds

$h(t)$ = the height of the ball after t seconds.

v_0 = the initial velocity (speed) ($v_0 = 0$ if the ball is dropped not thrown)

h_0 = the initial (starting) height

1. A ball is thrown up from the ground with an initial velocity of 56 feet per second.

a. What is the ball's initial height?

0

b. What is the ball's initial velocity?

56 ft/s

c. Write an equation to model this situation.

$h(t) = -16t^2 + 56t$

d. What is the ball's height when it reaches the ground?

0

e. How long does it take for it to reach the ground again?

$$x = \frac{-56 \pm \sqrt{56^2 - 4(-16)(0)}}{2(-16)} \quad x = \frac{-56 - 56}{-32} = 3.5 \text{ sec.}$$

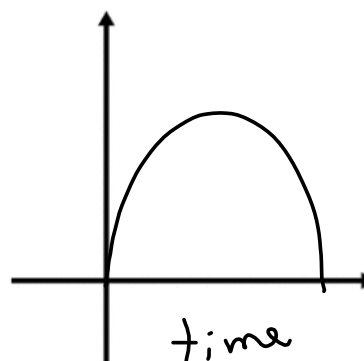
f. How long does it take to reach the maximum height?

$$\frac{-56}{2(-16)} = 1.75 \text{ sec.}$$

g. What is the maximum height that the ball reaches?

$$-16(1.75)^2 + 56(1.75) = 49$$

h. Draw a sketch of the ball's path through the air with respect to time.

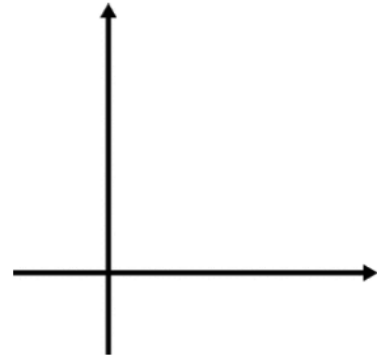


2. The height of a flare fired from the deck of a ship in distress can be modeled by $h(t) = -16t^2 + 104t + 56$, where h is the height of the flare above water and t is the time in seconds.

- a. What is the initial velocity of the flare? _____
- b. What does the 56 represent? _____
- c. Find the time it takes the flare to hit the water. _____

d. What is the maximum height of the flare? _____

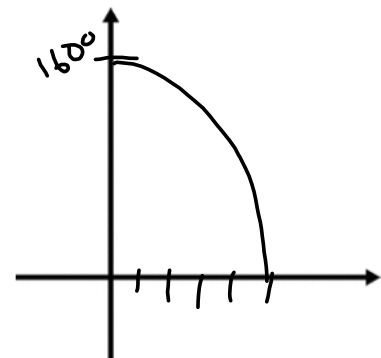
e. Draw a sketch of the flare's path through the air with respect to time.



3. A relief package is released from a helicopter at 1600 feet. The height of the package can be modeled by the equation $h = -16t^2 + 1600$.

- a. Why is there no middle term in this equation?
- b. The pilot wants to know how long it will take for the package to hit the ground. Help him find that time.

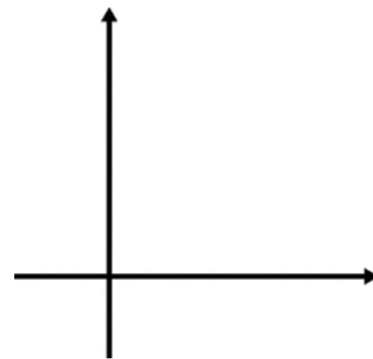
c. Draw a sketch of the situation.



4. Robert threw a rock off a bridge into the river. The height of the rock with respect to the river is modeled by the equation $h(t) = -16t^2 - 16t + 60$.

- a. What does the 60 represent?
- b. Why is the **second** 16 in the equation negative?

c. Draw a sketch of the situation.



5. During a game of golf, Kayley hits her ball out of a sand trap. The height of the golf ball is modeled by the equation $h = -16t^2 + 20t - 4$, where h is the height in feet and t is the time in seconds since the ball was hit.

- a. Why is the 4 negative?
- b. How long does it take Kayley's golf ball to hit the ground?

c. Draw a sketch of the situation.

