

1. Suppose you launch a model rocket with an upward starting velocity of  $v$  ft/s. You can use the equation  $h = -16t^2 + vt + h_0$  to find the rocket's altitude,  $h$  represents height in feet,  $t$  seconds after launch and  $h_0$  represents initial height. Suppose the upward starting velocity is 315 ft/s and the initial height is 3 ft. When will the rocket hit the ground?

2. The height of a projectile can be described by the **Vertical motion model**:

$h = -16t^2 + vt + s$ , where  $t$  is the time (in seconds) the object has been in the air,  $v$  is the initial vertical velocity (in feet per second), and  $s$  is the initial height (in feet).

To catch a frisbee, a dog leaps into the air with an initial vertical velocity of 28 feet per second.

a. Write a model for the height of the dog above the ground.

b. After how many seconds does the dog land on the ground?

3. Hugh Betcha launched a model rocket with an initial speed of 88 feet per second. After how many seconds will the rocket be 40 feet high?  $h = -16t^2 + vt$ .

4. Suppose you launch a firecracker with an upward starting velocity of  $v$  ft/s. You can use the equation  $h = -16t^2 + vt + h_0$  to find the firecracker's altitude  $h$  feet  $t$  seconds after launch. Suppose the upward starting velocity is 185 ft/s and the initial height is 2 feet. At what time will the firecracker be at its maximum height? What is the maximum height?

5. Each of the "golden arches" at a McDonald's is in the shape of a parabola. Each arch is modeled by:  $h(x) = -x^2 + 6x$ , where  $h(x)$  is the height of the arch (in feet) at a distance  $x$  (in feet) from one side.

a. Find the equation of the axis of symmetry.

b. How high is the arch at the axis of symmetry?

6. The tallest building in the USA is in Chicago, Illinois. It is 1450ft. tall. How long would it take a penny to drop from the top of the building to the ground? Use the formula  $h = -16t^2 + h_0$ .

7. A study of air quality in a particular city by an environmental group suggest that  $t$  years from now the level of carbon monoxide, in parts per million, in the air will be  $A = 0.2t^2 + .01t + 5.1$ .

a. What is the level, in part per million, now?

b. How many years from now will the level of carbon monoxide be at 8 parts per million? Round to the nearest tenth.

8. A rocket is shot upward with an initial velocity of 125 feet per second from a platform 3 feet above the ground. Use the model  $h = -16t^2 + v_0t + h_0$  to find the maximum height of the rocket.

9. If an object is thrown vertically upward, its height  $h$ , above the ground in feet after  $t$  seconds is given by  $h = h_0 + v_0t - 16t^2$ , where  $h_0$  is the initial height from which the object is thrown and  $v_0$  is the initial velocity of the object. Using this formula solve the problem.

A ball thrown vertically into the air has the equation of motion  $h = 48 + 32t - 16t^2$ .

a. How high is the ball at  $t=0$ ?

b. How high is the ball at  $t=1$ ?

c. When does the ball hit the ground again?