

More Real Life Situations Modeled With Quadratic Equations

(Use the most efficient method to solve the problems below. Round all answers to two decimal places)

$$\text{Vertical Motion Formula: } h = -16t^2 + vt + s$$

h : height in feet, t : time in seconds, v : initial velocity, and s : starting height

- Jason jumped off of a cliff into the ocean in Acapulco while vacationing with some friends. His height as a function of time could be modeled by the equation $h = -16t^2 + 16t + 480$.
 - How long did it take for Jason to reach his maximum height?
 - What was the highest point that Jason reached?
 - Jason hit the water after how many seconds?
- If a toy rocket is launched vertically upward from ground level with an initial velocity of 128 feet per second, then its height h after t seconds is given by the equation $h = -16t^2 + 128t$ (if air resistance is neglected).
 - How long will it take for the rocket to return to the ground?
 - After how many seconds will the rocket be 112 feet above the ground?
 - How long will it take the rocket to hit its maximum height?
 - What is the maximum height?
- During World War I, mortars were fired from trenches 3 feet down. The mortars had a velocity of 150 ft/s. Determine how long it will take for the mortar shell to strike its target.
- You and a friend are hiking in the mountains. You want to climb to a ledge that is 20 ft. above you. The height of the grappling hook you throw is given by the equation $h = -16t^2 + 32t + 5$. What is the maximum height of the grappling hook? Can you throw it high enough to reach the ledge?
- You are trying to dunk a basketball. You need to jump 2.5 ft. in the air to dunk the ball. The height that your feet are above the ground is given by the equation $h = -16t^2 + 12t$. What is the maximum height your feet will be above the ground? Will you be able to dunk the basketball?
- A diver is standing on a platform 24 ft. above the pool. He jumps from the platform with an initial upward velocity of 8 ft/s. Use the vertical motion equation where h is his height above the water. How long will it take for him to hit the water?
- A ball is thrown upward from a height of 15 ft. with an initial upward velocity of 5 ft/s. Use the equation $h = -16t^2 + vt + s$ to find how long it will take for the ball to hit the ground.
- One of the games at a carnival involves trying to ring a bell with a ball by hitting a lever that propels the ball into the air. The height of the ball is modeled by the equation $h = -16t^2 + 39t$. If the bell is 25 ft. above the ground, will it be hit by the ball?

- 9.** An amateur rocketry club is holding a competition. There is cloud cover at 1000 ft. If a rocket is launched with a velocity of 315 ft/s, use the equation $h = -16t^2 + vt + s$ to determine how long the rocket is out of sight.
- 10.** A ship drops anchor in a harbor. The anchor is 49 ft. above the surface of the water when it is released.
- What is the value of x , the starting height?
 - What is the value of h when the anchor hits the water?
 - The starting velocity is zero. After how many seconds will the anchor hit the water?
 - The depth of the harbor is 52 feet, how long will it take the anchor to hit the bottom of the harbor?
(Remember: Below sea level is negative height!)
- 11.** A trebuchet launches a projectile on a parabolic arc at a velocity of 35 ft/s. Using the equation $h = -16t^2 + vt + s$, determine when the projectile will first reach a height of 80 ft., and how many seconds later will it again be at 80 feet.
- 12.** A rocket is launched from atop a 101 foot cliff with an initial velocity of 116 ft/s.
- Write an equation in the form $h = -16t^2 + vt + s$ that represents this situation.
 - Use the quadratic formula to find out how long the rocket will take to hit the ground after it is launched.
- 13.** A water balloon is catapulted into the air so that its height h , in meters, after t seconds is:
 $h = -4.9t^2 + 27t + 2.4$
- How high is the balloon after 1 second?
 - How long is the balloon more than 30 meters high?
 - What is the maximum height of the balloon?
 - How long before the balloon bursts when it hits the ground?
- 14.** A rectangular lawn measuring 8 m by 4 m is surrounded by a flower bed of uniform width. The combined area of the lawn and the flower bed is 165 m^2 . What is the width of the flower bed?
- 15.** Last year, talent show tickets were sold for \$11 each and 400 people attended. It has been determined that an increase of \$1 in ticket price would cause a decrease in attendance of 20 people. What ticket price would maximize revenue?
- 16.** 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.
- How far below the level of the golf course is the sand trap?
 - How long will it take Kayley's golf ball to hit the ground once she hits it?
- 17.** When a driver needs to stop a car, the approximate stopping distance (d) in feet is given by the equation, $d = 0.05v^2 + 2.2v$, where v is the speed of the car in miles per hour. If a car takes 200 feet to stop, how fast was it going?
- 18.** Juliet was standing on a balcony with her arms outstretched 13 feet above the ground. Romeo, standing on the ground below, tosses a rose up to her. The rose leaves his hand 4 feet above the ground with a speed of 20 ft/sec. How many chances will Juliet have to catch the rose?