

S 10.6 Problems Solving Using Quadratic Equations

For some problems a quadratic equation will serve as a mathematical model.

In Lesson 10.2 you studied the model for the height of a falling object that is *dropped*. For an object that is *thrown* down or up, the model has an extra term to take into account, the initial velocity. Problems involving these two models are called *vertical motion* problems.

- **OBJECT IS DROPPED:** $h = -16t^2 + s$
- **OBJECT IS THROWN:** $h = -16t^2 + vt + s$

h = height (feet)

t = time in motion (seconds)

s = initial height (feet)

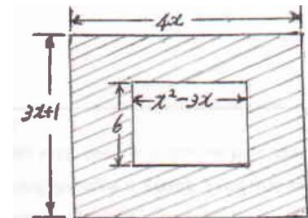
v = initial velocity (feet per second)

In these models the coefficient of t^2 is one half the acceleration due to gravity. On the surface of Earth, this acceleration is approximately 32 feet per second per second.

Example

1. BALLON COMPETITION You are competing in the Field Target Event at a hot-air balloon festival. You throw a marker down from an altitude of 200 feet toward a target. When the marker leaves your hand, its speed is 30 feet per second. How long will it take the marker to hit the target?

2. Find the value for x . Area of shaded region is 260 square units.



3. The length of a bedroom is 3 feet less than twice its width. The area of the bedroom is 135 square feet. What are the dimensions of the room.

• **The Pythagorean Theorem**

In any right triangle, if a and b are the lengths of the legs and c is the length of the hypotenuse, then $a^2 + b^2 = c^2$.

4. The hypotenuse of a right triangle is 26 m long. One leg is 14 m longer than the other. Find the lengths of the legs.

5. Find three consecutive integers such that the square of the first plus the product of the other two is 46.

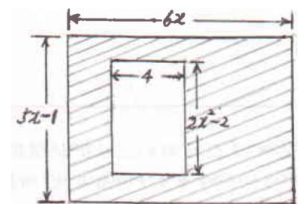
Homework

1. Two balloonists compete in the Field Target Event at a hot-air balloon festival. Calculate the amount of time it takes for the marker to hit the target when thrown down from the given initial height (in feet) with the given initial velocity (in feet per second).

(1) $s = 200$, $v = -50$

(2) $s = 100$, $v = -10$

2. Find the value for x . Area of shaded region is 84 square units.



3. A picture frame measure 14 cm by 20 cm. 160 cm^2 of picture shows inside the frame. Find the width of the frame.

4. The width of a photo is 5cm less than the length. The area is 24 cm^2 . Find the length and width.

5. The hypotenuse of a right triangle is 25 km long. The length of one leg is 17 km less than the other. Find the lengths of the legs.