4.5 Quadratic Application Word Problems

1. 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 function \( h(t) = -16t^2 + 16t + 480 \), where \( t \) is the time in seconds and \( h \) is the height in feet.
   a. How long did it take for Jason to reach his maximum height?
   b. What was the highest point that Jason reached?
   c. What was Jason’s initial height?

2. 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 \( h(t) = -16t^2 + 128t \) (air resistance is neglected)
   a. How long will it take the rocket to hit its maximum height?
   b. What is the maximum height?
   c. How long did it take for the rocket to reach the ground?

3. 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 function \( h(t) = -16t^2 + 12t \). What is the maximum height your feet will be above the ground? Will you be able to dunk the basketball?
4. A ball is thrown in the air. The path of the ball is represented by the equation \( h(t) = -t^2 + 8t \). Graph the equation over the interval \( 0 < t < 8 \) on the following graph.

   a. What is the maximum height of the ball?
   b. How long is the ball above 7 meters?
   c. Rewrite the equation in vertex form.

7. The following equation represents the path of a donut hole being thrown by Mr. London where \( x \) represents the time (in seconds) the donut is in the air and \( y \) represents the height (in feet) of the donut.

   \[ y = -x^2 + 4x - 2 \]

   a. Graph the equation to show the path of the donut hole, show at least three points.
b. At what time does the donut reach its **maximum** height?

c. What is the maximum **height** of the donut?

d. Rewrite the equation in vertex form.

5. A small independent motion picture company determines the profit $P$ for producing $n$ DVD copies of a recent release is $P = -0.02n^2 + 3.40n - 16$. $P$ is the profit in thousands of dollars and $n$ is in thousands of units.

   a. How many DVDs should the company produce to maximize the profit?

   b. What will the maximize profit be?