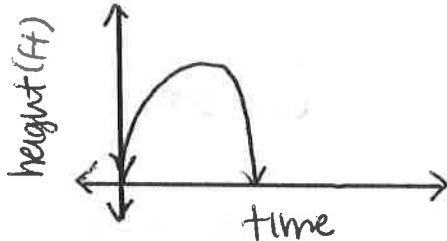# Problem Solving Using Quadratics

The flight of a super ball thrown in the air from the ground can be traced by the equation

$y = 112x - 16x^2$, where x represents the time in seconds with a height of y measured in feet.

A) Graph the situation (make sure to label all parts of the graph).
   Must find maximum point and roots.

B) What is the maximum height the super ball reaches?

   196 ft

C) How long did it take the ball to reach the maximum height?

   3.5 Sec.

D) When does it reach the ground again?

   7 Sec.

E) If a bird is flying overhead at 160 feet above the ground, is the bird in danger of getting hit?

   yes, max height is 196 ft

F) When would the bird be in danger of getting hit? By setting our height equal to 160, we will be able to solve for x, the time by using the graphing calculator.

   $112x - 16x^2 = 160$
   $112x - 16x^2 - 160 = 0$ (enter in calc & find roots)
                                    Roots: 2 and 5

   Therefore the bird could get hit __2 Sec.__ and __5 Sec.__ seconds after the ball is released.

Formula for velocity: $h(t) = -16t^2 + v_0 t + h_0$

h(t) represents height

t represents time

V_0 represents initial velocity

H_0 represents initial height

<u>Examples:</u>

1) A soccer player on the sideline throws the ball from an initial height of 5 feet and with an initial velocity of 16 ft/sec.

A) Write an equation. $h(t) = -16t^2 + 16t + 5$

B) How long did it take the ball to reach the ground?   1.25 sec.

C) How long did it take the ball to reach the maximum height?

0.5 sec.

D) What was the maximum height?

9 feet

E) Where is the ball when one second has passed?   table: x = 1

5 feet off the ground

F) How long did it take the ball to reach 8 feet?

.25 sec.   (set equation = 8 and solve)

2) From the top of a building 40 feet high a ball is thrown with an initial velocity of 9 ft/sec.

A) Write an equation to represent this.

$h(t) = -16t^2 + 9t + 40$

B) What is the maximum height?

41.27 feet

C) When did it reach the maximum height?

0.28 sec.

D) How long did it take to reach the ground?

1.89 sec.

3) A manufacturing company uses the function $r = 81p - 81p^2$ to model profit of a product. P represents the price of the object <u>in thousands</u> and r represents revenue.

A) Find the maximum profit. $20,250

B) How much does each item cost to yield the maximum profit?

$500

C) What is the break-even price for production?

$0 and $1000