More Real Life Situations Modeled With Quadratic Equations

1. $h = -16t^2 + 16t + 480$

a) How long to reach max. height?
Find L.O.S.

$LOS = \frac{-b}{2a} = \frac{-16}{2(-16)} =$ {$\frac{1}{2}$ second}

b) Highest point? Find vertex

$h = -16t^2 + 16t + 480$
$= -16(0.5)^2 + 16(0.5) + 480$
$=$ {484 feet}

c) When does he hit the water?
Find 2nd x-intercept

$\frac{0}{-16} = \frac{-16t^2}{-16} + \frac{16t}{-16} + \frac{480}{-16}$

$0 = t^2 - t - 30$

$0 = (t-6)(t+5)$

$t-6=0$ ↙ ↘ $t-5=0$

{6 seconds}

2. $h = -16t^2 + 128t = -16t(t-8)$

a) How long to return to ground?
Find 2nd x-intercept

$0 = -16t(t-8)$

$-16t=0$ ↙ ↘ $t-8=0$

$t=0$ $t=8$

{8 seconds}

b) When will it be at 112 ft?
Solve for * when $h=112$

$112 = -16t^2 + 128t$
$-112 \qquad -112$

$\frac{0}{-16} = \frac{-16t^2}{-16} + \frac{128t}{-16} - \frac{112}{-16}$

$0 = t^2 - 8t + 7$

$0 = (t-7)(t-1)$

$0 = t-7$ $0 = t-1$

{At 1 and 7 seconds}

c) When will it reach max. height?
Find LOS

$LOS = \frac{-b}{2a} = \frac{-128}{2(-16)} = 4$

{4 seconds}

d) What is max height?
Substitute in LOS

$h = -16(4)^2 + 128(4)$
$=$ {256 feet}

3. $h = -16t^2 + 150t - 3$

When will it hit the target?

Find 2nd x-intercept

9.35 seconds

$0 = -16t^2 + 150t - 3$

$t = \frac{-150 \pm \sqrt{(150)^2 - 4(-16)(-3)}}{-16(2)}$

$t = \frac{-150 \pm \sqrt{150^2 - 192}}{-32}$

$t = 9.39$

4. $h = -16t^2 + 32t + 5$

a) Maximum Height?

Find vertex

$\text{LOS} = \frac{-b}{2a} = \frac{-32}{2(-16)} = 1$

$h = -16(1)^2 + 32(1) + 5$

$= 21$ feet

b) Can you throw high enough to reach ledge 20 ft above?

Yes, according to vertex

Can also use discriminant.

$20 = -16t^2 + 32t + 5$

$-20 \qquad\qquad -20$

$0 = -16t^2 + 32t - 15$

$b^2 - 4ac = 32^2 - 4(32)(-15)$

$= 2944$

> 0

YES

5. $h = -16t^2 + 12t = -4t(4t - 3)$

a) Max height of feet above ground?

Find vertex

$\text{LOS} = \frac{-b}{2a} = \frac{-12}{2(-16)} = 0.375$

$h = -4(0.375)(4(.375) - 3)$

$= 2.25$

2.25 feet

NO, you can't dunk!

6. a. $h = -16t^2 + 8t + 24$

$= -8(t + 1)(2t - 3)$

How long to hit the water? Find 2nd x-intercept

$0 = -8(t + 1)(2t - 3)$

$t + 1 = 0$ $\qquad$ $2t - 3 = 0$

$t = -1$ $\qquad$ $t = \frac{3}{2}$

1.5 seconds

7. $h = -16t^2 + 5t + 15$

How long to hit the ground? Find 2nd x-int

$$x = \frac{-5 \pm \sqrt{5^2 - 4(-16)(15)}}{2(-16)} = \frac{-5 \pm \sqrt{25 + 960}}{-32}$$

= 1.14 seconds

8. $h = -16t^2 + 39t$

Can the ball reach 25 ft? Use the discriminant.

$25 = -16t^2 + 39t$

$-25 \quad -25$

$0 = -16t^2 + 39t - 25$

$b^2 - 4ac = (39)^2 - 4(-16)(-25)$

$= 1521 - 1600$

$= -79$

The ball will NOT hit the ball.