A ball is thrown into the air from an initial height of 50 feet with an initial velocity of 120 ft/sec. The following equation models the height of the ball as a function of time: $h(t) = -16t^2 + 120t + 50$

Find the time it takes the ball to come back $\underbrace{\text{down to the ground}}_{h=0}$ to the nearest hundredth.

$$0 = -16t^2 + 120t + 50$$

You have four methods to solve this equations but because of the numbers and terms involved I would suggest using the Quadratic Formula!

$$b^2 - 4ac = 17600$$

$$t = \frac{-120 \pm \sqrt{17600}}{-32} = -\cancel{0.40} \text{ \& } \boxed{7.90 \text{ sec}}$$

negative time is not possible in this situation.

A ball is thrown into the air from an initial height of 50 feet with an initial velocity of 120 ft/sec. The following equation models the height of the ball as a function of time: $h(t) = -16t^2 + 120t + 50$

Find the time it takes the ball to reach a height of 300 feet to the nearest hundredth.

$$\begin{aligned} 300 &= -16t^2 + 120t + 50 \\ -300 & \qquad\qquad\qquad\quad -300 \end{aligned}$$

$$0 = -16t^2 + 120t - 250$$

$$\underbrace{b^2 - 4ac = -1600}$$

This would lead to imaginary solutions. But this means that the ball will never "really" reach a height of 300 ft.

A ball is thrown into the air from an initial height of 50 feet with an initial velocity of 120 ft/sec. The following equation models the height of the ball as a function of time: $h(t) = -16t^2 + 120t + 50$

Find the time it takes the ball to reach a height of 140 feet to the nearest hundredth.

$$\begin{aligned} 140 &= -16t^2 + 120t + 50 \\ -140 & \qquad\qquad\qquad\quad -140 \end{aligned}$$

$$0 = -16t^2 + 120t - 90$$

$$b^2 - 4ac = 8640$$

$$t = \frac{-120 \pm \sqrt{8640}}{-32}$$

$$\boxed{t = 0.85 \text{ sec \& } 6.65 \text{ sec}}$$

Both answers are reasonable. The ball could reach 140 on the way up to the maximum and then again on the way back down to the ground.

A ball is thrown into the air from an initial height of 50 feet with an initial velocity of 120 ft/sec. The following equation models the height of the ball as a function of time: $h(t) = -16t^2 + 120t + 50$

Find the time it takes the ball to reach a height of 30 feet to the nearest hundredth.

$$\begin{aligned} 30 &= -16t^2 + 120t + 50 \\ -30 & \qquad\qquad\qquad\quad -30 \end{aligned}$$

$$0 = -16t^2 + 120t + 20$$

$$b^2 - 4ac = 15680$$

$$t = \frac{-120 \pm \sqrt{15680}}{-32} = -\cancel{0.16} \text{ \& } \boxed{7.66 \text{ sec}}$$

negative time is not possible in this situation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

What part of the Quadratic Formula determines if there are Real solutions or not?

The DISCRIMINANT $\longrightarrow b^2 - 4ac$

Depending on the value of the DISCRIMINANT you can determine how many and what kind of solutions there will be.

Discriminate: recognize a distinction; differentiate

Discriminant	# and kind of solutions
$b^2 - 4ac > 0$	2 Real Solutions
$b^2 - 4ac = 0$	1 Real Solution
$b^2 - 4ac < 0$	2 Imaginary Solutions

Tell the number of solutions each quadratic equation has and if they are real or imaginary.

1. $x^2 + 8x - 3 = 0$

   $b^2 - 4ac = 76$

   $\boxed{\text{2 real sol's}}$

2. $2x^2 - 7x + 8 = 0$

   $b^2 - 4ac = -15$

   $\boxed{\text{2 imag. sol's}}$

3. $-3x^2 - 4x + 5 = 0$

   $b^2 - 4ac = 76$

   $\boxed{\text{2 real sol's}}$

4. $2x^2 + 50 = 20x$

   $-20x \quad -20x$

   $2x^2 - 20x + 50 = 0$

   $b^2 - 4ac = 0$

   $\boxed{\text{1 real sol}}$

5. $-4x^2 + 7x = 2$

   $-2 \quad -2$

   $-4x^2 + 7x - 2 = 0$

   $b^2 - 4ac = 17$

   $\boxed{\text{2 real sol's}}$

Tell the number of solutions each quadratic equation has and if they are real or imaginary.

1. $x^2 + 8x - 3 = 0$
2. $2x^2 - 7x + 8 = 0$
3. $-3x^2 - 4x + 5 = 0$
4. $2x^2 + 50 = 20x$
   $2x^2 - 20x + 50 = 0$
5. $-4x^2 + 7x = 2$
   $-4x^2 + 7x - 2 = 0$

For some of these equations you can tell that there will be 2 Real solutions without doing anything. Which ones?

You can tell by just looking at the equations in #1 & #3 that there will be 2 real solutions

A Quadratic Equation always has two real solutions if: $b^2 - 4ac$ is POSITIVE

$b^2 - 4ac$ will ALWAYS be Posiitve if:

Either a OR c is negative.

How many x-intercepts does each Quadratic Function have?

1. $y = 4x^2 - 6x + 3$
2. $y = -x^2 + 3x + 20$

Since x-intercepts are Real Solutions all you need to do is find the Discriminant.

1. $b^2 - 4ac = -12$
   NO Real Sol's
   $\downarrow$
   $\boxed{\text{NO x-inT}}$

2. $b^2 - 4ac = 89$
   2 real sol's
   $\downarrow$
   $\boxed{\text{2 x-inT}}$

A ball is thrown into the air from an initial height of 100 feet with an initial velocity of 280 ft/sec. The following equation models the height of the ball as a function of time: $h(t) = -16t^2 + 280t + 100$

Will the ball ever reach a height of 1000 ft?

You can answer this one of two ways:

Replace h(t) with 1000 and use the discriminant to find out if there are real solutions.

$1000 = -16t^2 + 280t + 100$
$-1000 \qquad\qquad\qquad\qquad -1000$

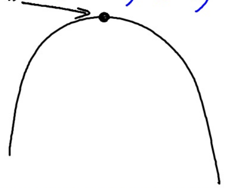
$0 = -16t^2 + 280t - 900$

$b^2 - 4ac = 20{,}800$

Since the discriminant is positive there are two real solutions meaning that the object will "really" reach a height of 1000ft, maybe twice.

Find the vertex and compare the maximum height to a height of 1000 ft.

$(t, h) = (8.75, 1325)$



find t

LOS: $t = \frac{-280}{2(-16)}$

$t = 8.75$

$h(8.75) = 1325$

Given the maximum height is 1325ft and it started at an initial height of 100ft, it will reach 1000ft twice, once on the way up to the max height and again on the way down to the ground.

You can now finish Hwk #19

Sec 5-8

Page 293 Due Tomorrow

Problems: 31-33, 57-59, 64, 65

Factor completely.

$$72x^3 - 392x$$

$8x(9x^2 - 49)$ 1ST GCF

$GCF(3x \pm 7)$ 2nd factor using difference of perfect squares.