WARM UP

1) Solve by taking the square root: $9x^2 - 64 = 0$

$9x^2 = 64$

$\sqrt{x^2} = \sqrt{\frac{64}{9}}$

$x = \pm\frac{8}{3}$

2) Solve by factoring: $x^2 - 8x + 12 = 0$

$12x^2$

$-6x$ $-2x$

$-8x$

$(x-6)(x-2) = 0$

$x-6=0$ $x-2=0$

$x = 6, 2$

At this point you have learned how to solve quadratic equations by:

factoring
using square roots
graphing

Many quadratic equations may be solved using these methods; however, some cannot be conveniently solved using any of these methods.

Today we will discuss a tool to solve ANY quadratic equation.

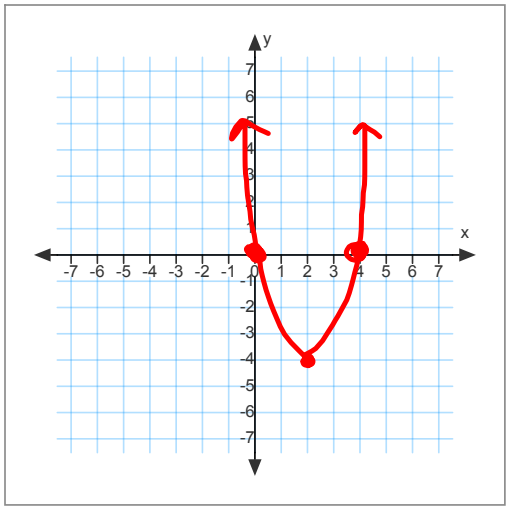
It ALWAYS works.

Getting Started

The objective is to be able to solve any quadratic equation by using the quadratic formula.

<u>Solving a Quadratic Equation</u>
means to find its:
solutions,
roots,
zero's,
x-intercepts

Looks like this:



$x - 4 = 0$

$x = 4$

5.8 The Quadratic Formula

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

YOU HAVE TO MEMORIZE THIS!

To solve using the quadratic formula

1. Identify a, b, and c
2. Write the quadratic formula
3. Substitute (plug in) the numbers you found for a, b, and c
4. Simplify everything under the radical
   - Can also simplify the denominator
5. Write your fraction as two separate problems
6. Use your calculator to solve each
   - The two answers are your roots

Example Problem 1

Use the quadratic formula to solve the following equation.

$$x^2 - 6x + 8 = 0$$

1.

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

3. $x = \dfrac{6 \pm \sqrt{36 - 4(1)(8)}}{2(1)}$

4. $x = \dfrac{6 \pm \sqrt{36 - 32}}{2}$

5. $x = \dfrac{6 + \sqrt{4}}{2}$

$x = \dfrac{6 - \sqrt{4}}{2}$

$x = 4 \quad or \quad x = 2$

Check your answer by graphing!

Click to reveal answer

6. $\dfrac{6+2}{2} = 4$ $\dfrac{6-2}{2} = 2$

Problem 1

Solve: $2x^2 - 13x + 20 = 0$

a = b = c =

click here to reveal answer

$x = \frac{5}{2}$ *or* $x = 4$

Check your answer by graphing!

Problem 2

$$2x^2 + 5x - 12 = 0$$

a = b = c =

click here to reveal answer

$x = \frac{15}{4}$ *or* $x = -\frac{7}{4}$

Check your answer by graphing!

Problem 3

$$2x^2 + 4x = 3$$

a = b = c =

click here to reveal answer

$x = .581 \quad or \quad x = -2.581$

Check your answer by graphing!

Problem 4

$$2x^2 - 12x = -18$$

a = b = c =

click here to reveal answer

$x = 3$

Check your answer by graphing!

Problem 5

$$3x^2 + 6x = -5$$

a = b = c =

click here to reveal answer

no solution

Check your answer by graphing!

How Many Solutions Will There Be?

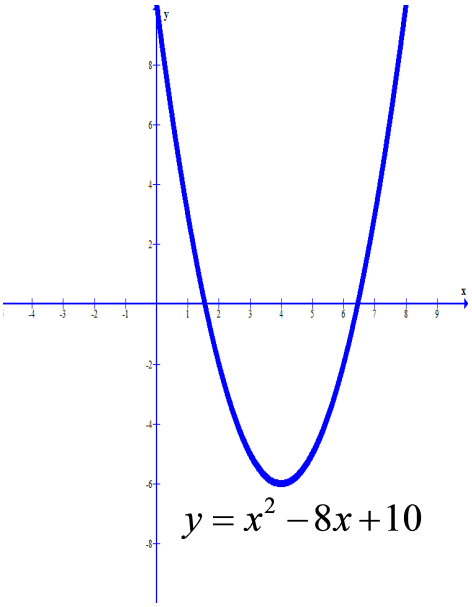
To determine how many solutions the quadratic equation will have, determine the value of the discriminant.

Discriminant - the part of the equation under the radical sign in a quadratic equation.

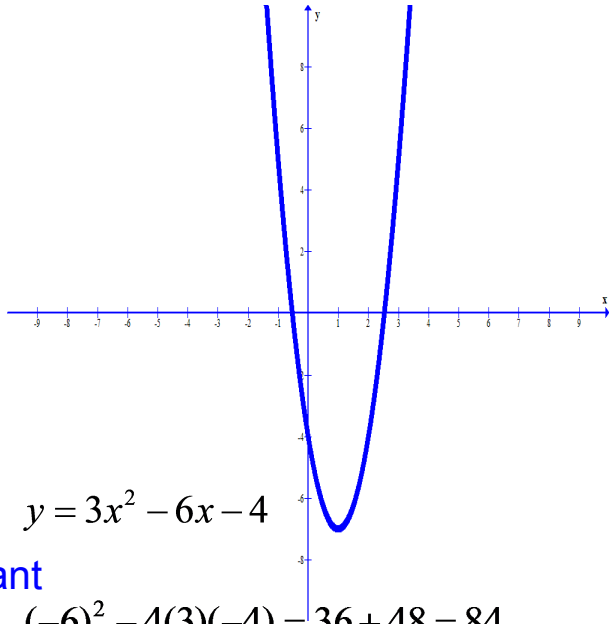
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$b^2 - 4ac$ is the discriminant

What is the relationship between the discriminant of a quadratic and its graph?



$y = x^2 - 8x + 10$



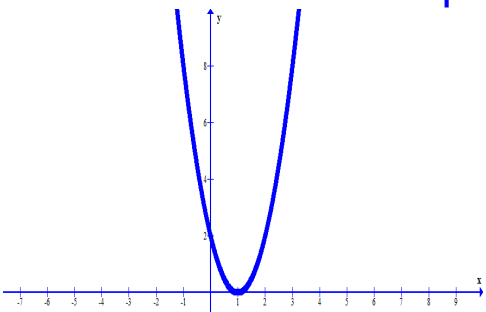
$y = 3x^2 - 6x - 4$

Discriminant

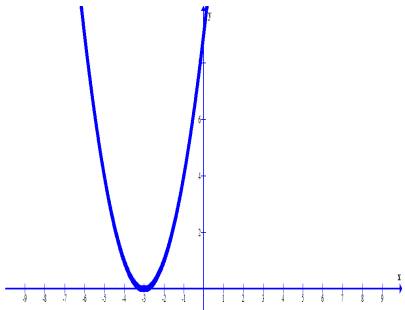
$(8)^2 - 4(1)(10) = 64 - 40 = 24$

$(-6)^2 - 4(3)(-4) = 36 + 48 = 84$

What is the relationship between the discriminant of a quadratic and its graph?



$$y = 2x^2 - 4x + 2$$



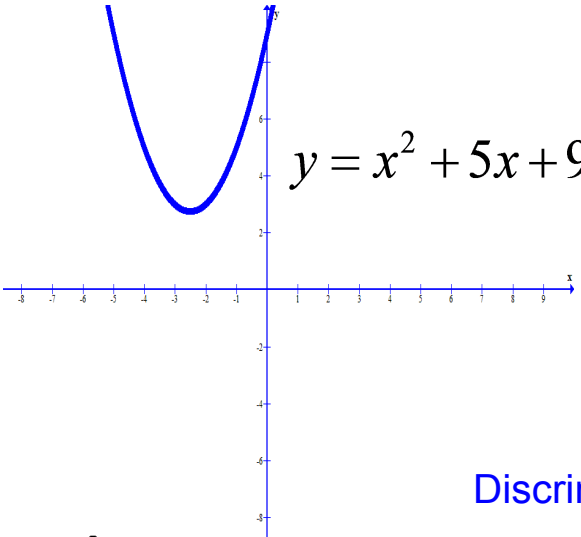
$$y = x^2 + 6x + 9$$

Discriminant

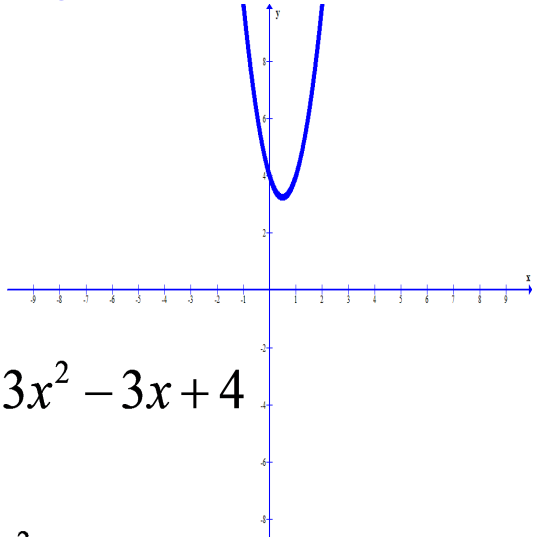
$$(-4)^2 - 4(2)(2) = 16 - 16 = 0$$

$$(6)^2 - 4(1)(9) = 36 - 36 = 0$$

What is the relationship between the discriminant of a quadratic and its graph?



$$y = x^2 + 5x + 9$$



$$y = 3x^2 - 3x + 4$$

Discriminant

$$(5)^2 - 4(1)(9) = 25 - 36 = -11$$

$$(-3)^2 - 4(3)(4) = 9 - 48 = -39$$

$D > 0$ 2 solutions

$D = 0$ 1 solution

$D < 0$ No Solutions

HW

WS Front and back
due Friday