The Discriminant

An important part of the quadratic equation is called **the discriminant.**

Remember, the quadratic equation is:

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

The part known as the discriminant is:

$$b^2 - 4ac$$

Just by looking at the discriminant, we're able to tell how many **real** roots an equation has (remember, we're only looking at real roots, not imaginary ones)

When we have a quadratic equation of the form:

$ax^2 + bx + c$, if the discriminant is

a) **Greater than zero,** then the quadratic equation will give us **two** different roots.
b) **Less than zero**, then the quadratic equation will give us **no** real roots.
c) **Equal to zero,** then the quadratic equation will give us **one** real root.

So, even without calculating out what the roots are, we can find out some information about the number of roots just by examining the discriminant.

Example:

How many roots does the following equation have:

$$2x^2 - 3x + 1$$

In this equation, $a = 2, b = -3$, and $c = 1$.

The discriminant is:

$$b^2 - 4ac = (-3)^2 - 3(2)(1) = 9 - 6 = 3$$

This tells us that there would be 2 real roots.

Note: The discriminant doesn't give us any information about what the roots look like. It only tells us how many there are.

Now try and find how many roots these equations have (Don't solve for the actual roots):

1. $x^2 + x + 1$
2. $x^2 - 2x + 1$
3. $2x^2 - 3x + 2$
4. $x^2 - 3x + 1$
5. $x^2 - x$
6. $-2x^2 + 4x - 2$
7. $4x^2 + 4x + 1$
8. $x^2 - 2x + 2$
9. $4x^2 + 2x - 1$
10. $0x^2 + 2x + 1$