Quadratic Formula

Like the formula for slope, it is IMPERATIVE to know the quadratic formula really well!

$$\mathbf{X = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}}$$

*Note**: b² - 4ac** *is ENTIRELY under the radical in the numerator of the formula*

b² - 4ac is called the **DISCRIMINANT** and it is the most important part of this formula because it helps us identify the number of REAL solutions a quadratic can have.

If **b² - 4ac** is GREATER than 0, the quadratic has **TWO** real solutions

If **b² - 4ac** is EQUAL to 0, the quadratic has **ONE** real solution

If **b² - 4ac** is LESS than 0, the quadratic has **ZERO** real solutions

You can use this formula to solve for the solutions/roots of ANY equation.

Examples:

Use the quadratic formula to find the roots of **$x^2 + 5x - 12$.**

First, identify the a, b and c coefficients in our trinomial.

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

a = 1 **b = 5** **c = -12**

Now plug into the formula and solve for **x**.

$$X = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

$$X = \frac{-5 \pm \sqrt{(5^2 - (4)(1)(-12)}}{2\,(1)}$$

$$X = \frac{-5 \pm \sqrt{(25 - (-48))}}{2}$$

$$X = \frac{-5 \pm \sqrt{73}}{2}$$

Since we cannot simplify √73, write this answer as 2 solutions (one with a + sign and one with a - sign).

$$X = \frac{-5 + \sqrt{73}}{2} \quad \text{AND} \quad X = \frac{-5 - \sqrt{73}}{2}$$

OR

$$X = \frac{-5}{2} + \frac{\sqrt{73}}{2} \quad \text{AND} \quad X = \frac{-5}{2} - \frac{\sqrt{73}}{2}$$

You can use this formula to find the solutions or roots of any quadratic whether it can be factored easily or not.

*What is the discriminant of **3x² + 8x + 7**? How many real solutions does this quadratic have?*

First identify the a, b and c coefficients in this quadratic.

$$\mathbf{3x^2 + 8x + 7}$$

a = 3 **b = 8** **c = 7**

To find the discriminant, plug in the a, b and c values for this quadratic into **$b^2 - 4ac$**.

$$\mathbf{b^2 - 4ac}$$

$$\mathbf{(8)^2 - (4)(3)(7)}$$

$$\mathbf{64 - 84}$$

$$\mathbf{-20}$$

Since the discriminant is negative, this quadratic has NO real solutions.

That is all you need to know for the quadratic formula! Keep practicing and it will become easier!

Tips for Solving Problems:

1. The a value of the quadratic is the COEFFICIENT in front of the $\mathbf{x^2}$ term, the b value of the quadratic is the COEFFICIENT in front of the **x** term and the **c** value of the quadratic is the CONSTANT of the quadratic.

2. Remember the quadratic formula! You can use it to find the solutions/roots of ANY quadratic, so feel free to use it if the quadratic you are trying to solve does not factor easily.

3. The discriminant is ONLY $\mathbf{b^2 - 4ac}$, not $\mathbf{\sqrt{b^2 - 4ac}}$. Use the discriminant to help determine the number of REAL solutions a quadratic has (Positive = 2 REAL solutions, Equal to 0 = 1 REAL solution and Negative = 0 REAL solutions).