The Quadratic Formula

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

Why do we use the quadratic formula?

- The quadratic formula allows you to solve a quadratic equation
- It is used when the other methods (grouping or x-box) of factoring does not work.

What are "a", "b" and "c"?

Remember that quadratic equations are in the form

$y = ax^2 + bx + c$

These values are the co-efficient terms in a quadratic equation.

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

a = 3, b = -4, c = 2

How can you remember the formula?

♫"x equals negative b / plus or minus the square root / of b-squared / minus four a c / all over two a" ♫"All around the mulberry bush / The monkey chased the weasel / The monkey thought 'twas all in fun / Pop! goes the weasel"

Don't fall for these traps!

- The quadratic formula only uses the coefficient (no x's)
- The formula is equal to "x" (Remember we are using it to find x or the roots).

Example: Solve $x^2 + 2x - 8 = 0$

a = 1, b = 2, c = -8

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

$$x = \frac{-2 \pm \sqrt{(2)^2 - 4(1)(-8)}}{2(1)}$$

$$x = \frac{-2 \pm \sqrt{4 + 32}}{2}$$

$$x = \frac{-2 \pm \sqrt{36}}{2}$$

$$x = \frac{-2 \pm 6}{2} = \frac{-2+6}{2} = 2 \quad \text{or} \quad \frac{-2-6}{2} = -4$$

$x = \{2, -4\}$

Example 1: Solve for the zeroes (roots) of the following quadratic equation: $x^2 + 9x + 14 = 0$

a = 1
b = 9
c = 14

Steps:

1. Define a, b, and c. (make sure it is in standard form) * Solve equation for zero
2. Write the quadratic formula.
3. Substitute the given values into the formula.
4. Solve for x. (you should have 2 answers)

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

$$x = \frac{-9 \pm \sqrt{(9)^2 - 4(1)(14)}}{2(1)} = \frac{9 \pm \sqrt{81 - 56}}{2}$$

$$x = \frac{-9 \pm \sqrt{25}}{2} = \frac{-9+5}{2} = \frac{-4}{2} = -2 \quad \text{or} \quad \frac{-9-5}{2} = \frac{-14}{2} = -7$$

$x = \{-2, -7\}$

Example 2: Solve for the zeroes (roots) of the following quadratic equation: $2x^2 + 7x = 11$

$-11 \quad -11$

$2x^2 + 7x - 11 = 0$

a = 2
b = 7
c = -11

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

$$x = \frac{-7 \pm \sqrt{(7)^2 - 4(2)(-11)}}{2(2)} = \frac{-7 \pm \sqrt{49 + 88}}{4}$$

$$x = \frac{-7 \pm \sqrt{137}}{4} = \frac{-7 + \sqrt{137}}{4} = 1.176 \quad \text{or} \quad \frac{-7 - \sqrt{137}}{4} = -4.676$$

$x = 1.176, -4.676$

* If the # under the √ is NEGATIVE, the answer is NO SOLUTION

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

11-16-18 Examples

$a = 1$
$b = 5$
$c = -2$

1. $x^2 + 5x - 2 = 0$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(-2)}}{2(1)} = \frac{-5 \pm \sqrt{25 + 8}}{2}$$

$$x = \frac{-5 \pm \sqrt{33}}{2}$$

$$\frac{-5 + \sqrt{33}}{2} = .372$$

$$\frac{-5 - \sqrt{33}}{2} = -5.37$$

$x = .372, -5.37$

$a = 4$
$b = 0$
$c = -81$

2. $4x^2 - 81 = 0$

$$x = \frac{0 \pm \sqrt{0^2 - 4(4)(-81)}}{2(4)} = \frac{0 \pm \sqrt{0 - -1296}}{8}$$

$$x = \frac{0 \pm \sqrt{1296}}{8}$$

$$\frac{0 + 36}{8} = 4.5$$

$$\frac{0 - 36}{8} = -4.5$$

$x = 4.5, -4.5$

$a = 2$
$b = -4$
$c = -3$

3. $2x^2 - 4x = 3$

$-3 \quad -3 \longrightarrow 2x^2 - 4x - 3 = 0$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(2)(-3)}}{2(2)} = \frac{4 \pm \sqrt{16 + 24}}{4}$$

$$x = \frac{4 \pm \sqrt{40}}{4}$$

$$\frac{4 + \sqrt{40}}{4} = 2.581$$

$$\frac{4 - \sqrt{40}}{4} = -0.581$$

$x = 2.581, -0.581$