Quadratic Equations – Quick Reference

What is a Quadratic Equation?

$$ax^2 + bx + c$$

$ax^2 + bx + c = 0$ — coefficients: a, b; constant: c

$2x^2 + 3x + 4 = 0$ — coefficients: 2, 3; constant: 4

a and **b** are coefficients and **c** is a constant. The one factor that identifies these expressions as **quadratic** is the exponent 2. The first term must always be ax^2, and **a** cannot be 0.

Solving Simple Quadratic Equations

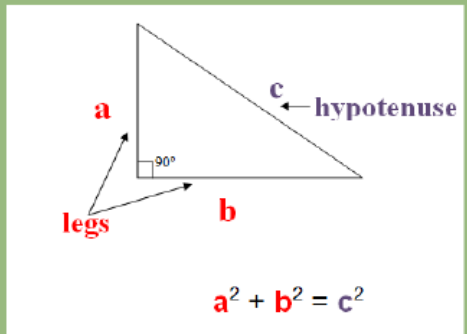
$x^2 - 4 = 77$	Our goal is to get x by itself on the left hand side of the equation. We must get rid of the -4 (first) then the exponent 2.
$x^2 - 4 + 4 = 77 + 4$	Add 4 to both sides of the equation.
$x^2 = 81$	Simplify: 77 + 4 = 81
$\sqrt{x^2} = \pm\sqrt{81}$	Take the square root of both sides. (Remember to use the ± sign.)
$x = \pm 9$	There are 2 solutions. X is equal to positive 9 and negative 9.

If $a^2 = b$, then $a = \sqrt{b}$ or $a = -\sqrt{b}$
This can also be written as:
$a = \pm\sqrt{b}$

Read as: a = "**plus or minus**" the square root of b.

The Pythagorean Theorem

In any **right triangle**, the sum of the squares of the legs (2 shorter sides) is equal to the square of the hypotenuse (the longest side).



$a^2 + b^2 = c^2$

Please Note: This theorem **ONLY** works for **Right Triangles**.

Solving Equations by Factoring

Solve: $x^2 - 7x + 2 = -10$ ← Our equation is not equal to 0.

$x^2 - 7x + 2 + 10 = -10 + 10$	Before we can factor, we must set our equation equal to 0. Add 10 to both sides.
$x^2 - 7x + 12 = 0$	Now our equation is equal to 0. I can factor.
$(x - 4)(x - 3) = 0$	Factor: $x^2 - 7x + 12$
$x - 4 = 0$ or $x - 3 = 0$	Set both factors equal to 0. (The zero-factor property)
$x = 4$ or $x = 3$	

Check:

$x^2 - 7x + 2 = -10$
$4^2 - 7(4) + 2 = -10$
$-10 = -10$ ☺

Substitute the two solutions into the original equation.

4 works! When I substituted I got an answer of -10.

$x^2 - 7x + 2 = -10$
$3^2 - 7(3) + 2 = -10$
$-10 = -10$ ☺

3 works! When I substituted I got an answer of -10.

The Quadratic Formula

Given any quadratic equation:

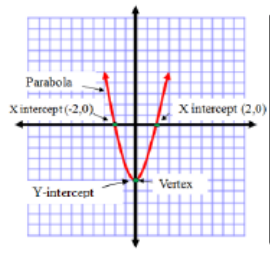
$$ax^2 + bx + c = 0$$

We can substitute the values for a, b, & c into the following formula and solve.

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

For any quadratic equation in the form:
$y = ax^2 + bx + c$

The graph will result in a parabola.



This parabola opens up and can be classified as **concave up.**

All parabolas that **open up** will have a **positive "a"** value.

The vertex is the lowest point or the **minimum point.**

This parabola opens down and can be classified as **concave down.**

All parabolas that **open down** will have a **negative "a"** value.

The vertex is the highest point or the **maximum point**.