Solving Quadratics for x:

Recall that we have learned two different strategies for solving for x in quadratic equations:

- Square Root Method
- Solve by Factoring

Warm-Up Examples:

1. $y = 2x^2 - 12$

$0 = 2x^2 - 12$

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

$x^2 - 6 = 0$

$\pm\sqrt{x^2} = \pm\sqrt{6}$

$x = \pm\sqrt{6}$

This means this parabola crosses the x-axis at $(\sqrt{6}, 0)$ & $(-\sqrt{6}, 0)$

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

$0 = x^2 - 4x + 3$

$0 = (x-3)(x-1)$

$x - 3 = 0$, $+3 \; +3$, $x = 3$

$x - 1 = 0$, $+1 \; +1$, $x = 1$

This means this parabola crosses the x-axis at $(3, 0)$ & $(1, 0)$

3. $y = x^2 - 2x - 10$

$0 = 1x^2 - 2x - 10$

$1 \cdot -10 = -10$

$10 \cdot 1$

$2 \cdot 5$

__ + __ $= -2$

Why are we having so much trouble with #3?

Not factorable

Does the parabola in #3 cross the x-axis? (Check on the calculator!) YES

Is there another strategy we can use to find out where exactly it crosses the x-axis? 😊 Yep

The Quadratic Formula:

Standard Form of a Parabola: $ax^2+bx+c=0$

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

☆The $\pm$ means we will have to solve this twice ① with + ② with −.

☆While the factoring and square root methods work with some quadratics but not all,

this formula will ALWAYS work!

Example Let's revisit that equation, $y = x^2 - 2x - 10$. Solve for x!

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

$a = 1$ $b = -2$ $c = -10$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-10)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{44}}{2}$$

44

22 2

2 11

$2\sqrt{11}$

$$x = \frac{\cancel{2} \pm \cancel{2}\sqrt{11}}{\cancel{2}}$$

$$\boxed{x = 1 \pm \sqrt{11}}$$

$(1 + \sqrt{11}, 0)$

$(1 - \sqrt{11}, 0)$

Quadratic Foldable!

The Quadratic Formula

For a quadratic equation in standard form
$ax^2 + bx + c = 0$

The quadratic formula is a sure way to solve a quadratic equation. It will always work! You first have to be sure to get the quadratic equation in standard form, $= 0$.

The roots for $ax^2 + bx + c = 0$ are

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

Note: These really are two equations – one with $-b + \sqrt{\ }$... and one with $-b - \sqrt{\ }$...

quadratic formula.

$$x^2 - 3x = 7$$

$$-7 \quad -7$$

$$x^2 - 3x - 7 = 0$$

$a = 1 \quad b = -3 \quad c = -7$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-7)}}{2(1)}$$

$$x = \frac{3 \pm \sqrt{37}}{2}$$

$$\left(\frac{3+\sqrt{37}}{2}, 0\right)\left(\frac{3-\sqrt{37}}{2}, 0\right)$$

* Don't forget to take the signs

quadratic formula.

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

$$-4x \quad -4x$$

$$3x^2 - 4x - 3 = 0$$

$a = 3$ $b = -4$

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

$$x = \frac{4 \pm \sqrt{52}}{6} \qquad x = \frac{4 \pm 2\sqrt{13}}{6} \qquad x = \frac{2 \pm \sqrt{13}}{3}$$

$$\left(\frac{2+\sqrt{13}}{3}, 0\right)$$

$$\left(\frac{2-\sqrt{13}}{3}, 0\right)$$