Quadratic Formula

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

- Uses the a, b, and c values of the coefficients from the standard form of a quadratic equation: $ax^2 + bx + c = 0$
- In order for the quadratic formula to work, your equation must be arranged to equal 0.
- the "2a" in the denominator of the formula is underneath *everything* above, not just the square root.
- Don't drop the ± or the square root throughout the process!

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

$a = 1 \quad b = 3 \quad c = -4$

- This quadratic happens to factor: $x^2 + 3x - 4 = (x + 4)(x - 1) = 0$
  - Solutions: $x = -4, x = 1$
- What would the process look like using the quadratic formula?

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

$$\frac{-3+5}{2} = 1 \qquad \frac{-3-5}{2} = -4$$

$$\frac{-3 \pm \sqrt{9+16}}{2} = \frac{-3 \pm \sqrt{25}}{2} = \frac{-3 \pm 5}{2}$$

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

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

- Note: The solution or roots or zeroes of a quadratic are usually required to be in the "exact" form of the answer. That means leave them in radical form!

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

$$x = \frac{4 \pm \sqrt{40}}{4} = \frac{4 \pm 2\sqrt{10}}{4} = \frac{2 \pm \sqrt{10}}{2}$$

Solve $x(x - 2) = 4$

$a=1 \quad b=-2 \quad c=-4$

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

$$\frac{2 \pm \sqrt{-2^2 - 4(1)(-4)}}{2(1)} = \frac{2 \pm \sqrt{20}}{2} = \frac{2 \pm 2\sqrt{5}}{2}$$

$$x = 1 \pm \sqrt{5}$$

$20 \quad 10 \quad 5$ (2)

Making Connections to the Graph

- You can tell how many x-intercepts you're going to have from the value inside the square root.
- **Solve $9x^2 + 12x + 4 = 0$ using the quadratic formula. Then graph the equation.**

$$\frac{1 \pm \sqrt{-1^2 - 4(2)(6)}}{2(2)}$$

$$\frac{1 \pm \sqrt{49}}{4} = \frac{1+7}{4} = 2$$

$$\frac{1-7}{4} = \frac{-3}{2}$$

Solve $3x^2 + 4x + 2 = 0$.

- What do your solutions look like? How does that change the graph?