

Many quadratic equations can be solved by graphing, factoring, taking the square root, or completing the square. Some cannot be solved using any of these methods, but you can always use the **QUADRATIC FORMULA** to solve any quadratic equation.

Quadratic Formula

Before substituting values for a, b, and c, rearrange your equation into the form $ax^2+bx+c=0$.

$$\boxed{a}x^2 + \boxed{b}x + \boxed{c} = 0$$

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

Ex 1: Solve $2x^2 - 8x + 1 = 0$

$$\boxed{2}x^2 + \boxed{-8}x + \boxed{1} = 0$$

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

$$x = \frac{8 \pm \sqrt{64 - 8}}{4} = \frac{8 \pm \sqrt{56}}{4}$$

$$x = \frac{8 + \sqrt{56}}{4} \text{ or } x = \frac{8 - \sqrt{56}}{4}$$

Use a calculator: $x \approx 3.87$ or $x \approx 0.13$.

Actually completing the square also always works.

Solve the following using the quadratic formula.

1. $x^2 + 3x - 7 = 0$

$$\boxed{1}x^2 + \boxed{3}x + \boxed{-7} = 0$$

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

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

$$= \frac{-3 \pm \sqrt{9 + 28}}{2}$$

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

$$\frac{3.08}{2} = 1.54 \quad \frac{-9.08}{2} = -4.54$$

2. $2x^2 - 5x + 3 = 0$

$$\boxed{2}x^2 + \boxed{-5}x + \boxed{3} = 0$$

$$x = \frac{-\boxed{-5} \pm \sqrt{\boxed{-5}^2 - 4\boxed{2}\boxed{3}}}{2\boxed{2}}$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(3)}}{2(2)}$$

$$= \frac{5 \pm \sqrt{25 - 24}}{4}$$

$$= \frac{5 \pm \sqrt{1}}{4}$$

$$= \frac{6}{4} \text{ or } \frac{4}{4}$$

$$1.5 \text{ or } 1$$

3. $a=1, b=0, c=7$
 $x^2 + 7 = 0$

$-7 -7$
 $x^2 = -7$
 $x = \pm\sqrt{-7}$

No real solution

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

$x = \frac{-0 \pm \sqrt{0^2 - 4(1)(7)}}{2(1)}$
 $x = \frac{\pm\sqrt{-28}}{2}$

$x = \frac{-4 \pm \sqrt{4^2 - 4(2)(3)}}{2(2)}$
 $= \frac{-4 \pm \sqrt{16 - 24}}{4}$
 $= \frac{-4 \pm \sqrt{-8}}{4}$
 No real solution

5. $12x^2 - 12x + 3 = 0$

$x = \frac{12 \pm \sqrt{(-12)^2 - 4(12)(3)}}{2(12)}$
 $= \frac{12 \pm \sqrt{144 - 144}}{2(12)}$
 $x = \frac{12 \pm 0}{24} = \left(\frac{1}{2}\right)$

6. $-2x^2 - 5x + 20 = 0$

$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(-2)(20)}}{2(-2)}$
 $\frac{5 \pm \sqrt{25 + 160}}{-4}$
 $\frac{5 \pm \sqrt{185}}{-4}$
 $\frac{18.6}{-4} = -4.65$
 $\frac{-8.6}{4} = -2.15$

7. $3x^3 - 4x = 0$

$a=3, b=-4, c=0$
 $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(0)}}{2(3)}$
 $= \frac{4 \pm \sqrt{16}}{6}$
 $= \frac{4 \pm 4}{6}$
 $\frac{0}{6} = 0$
 $\frac{8}{6} = \frac{4}{3}$

8. $x^2 - 4x + 7 = 0$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(7)}}{2(1)}$
 $\frac{4 \pm \sqrt{16 - 28}}{2}$
 $\frac{4 \pm \sqrt{-12}}{2}$
 No real solution