Solving Quadratic Equations Using the Quadratic Formula

Quadratic Equation - An equation of the form $ax^2 + bx + c = 0$, where a, b and c are real numbers and $a \neq 0$.

Quadratic Formula - Used to solve a quadratic equation when factoring fails.

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

Step 1: Set the equation equal to zero.
Step 2: Identify a, b and c.
Step 3: Substitute a, b and c into the quadratic formula and solve for the variable.

Directions: Solve each quadratic equation by using the quadratic formula.

1. $2x^2 + 5x = 12$

$-12 \quad -12$

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

$a = 2 \quad b = 5 \quad c = -12$

$25 + 96 = 121$

$x = \dfrac{-5 \pm \sqrt{(5)^2 - 4(2)(-12)}}{2(2)} = \dfrac{-5 \pm \sqrt{121}}{4} = \dfrac{-5 \pm 11}{4}$

$x = \dfrac{-5 + 11}{4} \qquad\qquad x = \dfrac{-5 - 11}{4}$

$\boxed{x = \dfrac{3}{2}} \qquad\qquad \boxed{x = -4}$

2. $x^2 - 6x + 9 = 0$

$a = 1 \quad b = -6 \quad c = 9 \qquad\qquad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$6 \qquad 36 - 36 = 0$

$x = \dfrac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(9)}}{2(1)} = \dfrac{6 \pm \sqrt{0}}{2} = \dfrac{6 \pm 0}{2} = \dfrac{6}{2} = 3$

$\boxed{x = 3}$

3. $x^2 - 10x = -13$

$ +13 \quad +13$

$x^2 - 10x + 13 = 0$

$a = 1 \quad b = -10 \quad c = 13$

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

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(13)}}{2(1)} = \frac{10 \pm \sqrt{48}}{2}$$

$\overset{10}{} \quad \overset{100-52=48}{}$

$\sqrt{48} = \sqrt{16 \cdot 3}$

$4\sqrt{3}$

$$x = \frac{\overset{5}{10} \pm \overset{2}{4}\sqrt{3}}{\underset{1}{2}} = \boxed{5 \pm 2\sqrt{3}}$$

4. $3x^2 = 2(x+2)$

$3x^2 = 2x + 4$

$-2x - 4 \quad -2x - 4$

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

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

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-4)}}{2(3)} = \frac{2 \pm \sqrt{52}}{6}$$

$\overset{2}{} \quad \overset{4+48=52}{}$

$\sqrt{52} = \sqrt{4 \cdot 13}$

$2\sqrt{13}$

$$x = \frac{\overset{1}{2} \pm \overset{1}{2}\sqrt{13}}{\underset{3}{6}} = \boxed{\frac{1 \pm \sqrt{13}}{3}}$$

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

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

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

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

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(-1)(2)}}{2(-1)} = \frac{-2 \pm \sqrt{12}}{-2}$$

$\overset{-2}{} \quad \overset{4+8=12}{}$

$\sqrt{12} = \sqrt{4 \cdot 3}$

$2\sqrt{3}$

$$x = \frac{\overset{1}{-2} \pm \overset{-1}{2}\sqrt{3}}{\underset{1}{-2}} = \frac{1 \pm \sqrt{3}}{1} = \boxed{1 \pm \sqrt{3}}$$

6. $(x+6)^2 = -2x$

$(x+6)(x+6) = -2x$

$x^2 + 6x + 6x + 36 = -2x$

$x^2 + 12x + 36 = -2x$

$ +2x \qquad +2x$

$x^2 + 14x + 36 = 0$

$a = 1 \qquad b = 14 \qquad c = 36$

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

$-14 \qquad 196 - 144 = 52$

$x = \dfrac{-(14) \pm \sqrt{(14)^2 - 4(1)(36)}}{2(1)} = \dfrac{-14 \pm \sqrt{52}}{2}$

$x = \dfrac{-14 \pm 2\sqrt{13}}{2} = \boxed{-7 \pm \sqrt{13}}$