# The Quadratic Formula

Consider the general quadratic equation

$$ax^2 + bx + c = 0$$ where $a, b, c$ are constants

$\div a$

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

complete the square

$$\left(x + \frac{b}{2a}\right)^2 + \frac{c}{a} - \frac{b^2}{4a^2} = 0$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{c}{a}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

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

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

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

# Applying the Formula

Solve $x^2 - 5x - 6 = 0$

$a = 1, \quad b = -5, \quad c = -6$

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

$$x = \frac{+5 \pm \sqrt{(-5)^2 - 4(1)(-6)}}{2(1)}$$

$$x = \frac{+5 \pm \sqrt{25 + 24}}{2}$$

$$x = \frac{+5 \pm \sqrt{49}}{2}$$

$$x = \frac{+5 + 7}{2} \quad \text{or} \quad \frac{+5 - 7}{2}$$

$$x = 6 \quad \text{or} \quad x = -1$$

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The above equation could have been solved by factorising. We tend to use the formula when the question asks for answers to 3 sig fig or 2 dec places.

Ex 2 $2x^2 + 7x - 8 = 0$ to 3 sig fig

$a = 2 \quad b = 7 \quad c = -8$

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

$$x = \frac{-7 \pm \sqrt{7^2-4(2)(-8)}}{2(2)}$$

$$x = \frac{-7 \pm \sqrt{49+64}}{4}$$

$$x = \frac{-7 \pm \sqrt{113}}{4}$$

$$x = \frac{-7+\sqrt{113}}{4} \quad \text{or} \quad \frac{-7-\sqrt{113}}{4}$$

$$x = 0.908 \qquad x = -4.41$$

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Ex 3 Solve $5x^2 + 11x + 3 = 0$

$a = 5 \quad b = 11 \quad c = 3$

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

$$x = \frac{-11 \pm \sqrt{11^2-4(5)(3)}}{2(5)}$$

$$x = \frac{-11 \pm \sqrt{121-60}}{10}$$

$$x = \frac{-11 \pm \sqrt{61}}{10}$$

$$x = \frac{-11 + \sqrt{61}}{10} \quad \text{or} \quad \frac{-11 - \sqrt{61}}{10}$$

$$x = -0.319 \quad \text{or} \quad x = -1.88$$

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Now complete exercise that accompanies the 16 minute video lesson on this topic.