Solving Quadratics

Three different methods!

Factorising

Example 2: $2x^2 + 7x - 15 = 0$

Step 2: $2x^2 + 7x - 15 = 0$
$2x^2 - 3x + 10x - 15 = 0$
$x(2x - 3) + 5(2x - 3) = 0$
$(2x - 3)(x + 5) = 0$

Step 3:
$2x - 3 = 0 \qquad x + 5 = 0$
$x = \dfrac{3}{2} \qquad x = -5$

Answer: $x = \dfrac{3}{2}, x = -5$ ✔

Example 1: $x^2 + 5x - 14 = 0$

Step 2: $x^2 + 5x - 14 = 0$
$(x + 7)(x - 2) = 0$

Step 3: $(x + 7)(x - 2) = 0$
$x + 7 = 0 \qquad x - 2 = 0$
$x = -7 \qquad x = 2$

Answer: $x = -7, x = 2$ ✔

⚠ Factorising only works sometimes! Some quadratics cannot be factorised. Use the quadratic formula method instead.

Step 1: Convert the quadratic to standard form

Step 2: Factorize the quadratic.

Step 3: Set each factor to 0 and solve

Quadratic Formula

Step 1: Convert the quadratic to standard form.

$$ax^2 + bx + c = 0$$

Step 2: Identify the a, b, and c terms.

Step 3: Substitute the values into the quadratic formula.

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

Step 4: Calculate twice, the first time with a plus and the second time with a minus.

Example: $x^2 + 5x + 6 = 20$

① $x^2 + 5x + 6 = 20$ ② $a = 1$
$-20 \qquad\qquad -20 \qquad\quad b = 5$
$x^2 + 5x - 14 = 0 \qquad\quad c = -14$

③ $x = \dfrac{-(5) \pm \sqrt{(5)^2 - 4(1)(-14)}}{2(1)} \qquad x = \dfrac{-5 \pm 9}{2}$

④
$x = \dfrac{-5 + 9}{2} \qquad\qquad x = \dfrac{-5 - 9}{2}$
$x = \dfrac{4}{2} \qquad\qquad\quad x = \dfrac{-14}{2}$
$x = 2 \qquad\qquad\qquad x = -7$ ✔

💡 **Tip:** If the question asks you to round the answer to 3 significant figures, then that's a hint that you should use the quadratic formula. 😊

Completing the Square

Step 1: Shift the constant to the other side

Step 2: Halve the b term, and complete the square

Step 3: Simplify the equation and square root both sides

Step 4: Calculate with both square roots of the constant

Example: $x^2 + 5x + 6 = 20$

Step 1: $x^2 + 5x + 6 = 20$
$-6 \qquad\qquad\qquad -6$
$x^2 + 5x = 20 - 6$

Step 2: $x^2 + 5x = 14$
$\left(x + \dfrac{5}{2}\right)^2 - \left(\dfrac{5}{2}\right)^2 = 14$

Step 3:
$\left(x + \dfrac{5}{2}\right)^2 = 14 + \left(\dfrac{5}{2}\right)^2$
$\left(x + \dfrac{5}{2}\right)^2 = \dfrac{81}{4}$
$x + \dfrac{5}{2} = \pm \dfrac{9}{2}$

Step 4:
$x + \dfrac{5}{2} = \dfrac{9}{2} \qquad\qquad x + \dfrac{5}{2} = -\dfrac{9}{2}$
$x = \dfrac{9 - 5}{2} \qquad\qquad x = \dfrac{-9 - 5}{2}$
$x = 2 \qquad\qquad\qquad x = -7$ ✔

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