

Solving quadratics

Notes & Steps



Key idea

To solve a quadratic by factorising, first make one side equal to zero. Then factorise. Finally use the zero-product property: if two brackets multiply to zero, at least one bracket must equal zero.

Steps

1. Rearrange so the equation is $ax^2 + bx + c = 0$.
2. Factorise the quadratic fully.
3. Set each factor equal to zero.
4. Solve the two linear equations.
5. Check both solutions in the original equation.

Common mistake

Stopping after factorising. For example, $(2x + 1)(x + 3) = 0$ is not the final answer. You still need $2x + 1 = 0$ or $x + 3 = 0$, so the roots are $x = -\frac{1}{2}$ and $x = -3$.

Useful reminders

- Keep the $= 0$ before trying to use factors.
- If there is an HCF, take it out first.
- A repeated factor gives a repeated root.
- Fractions in the roots are normal when $a > 1$.

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Example 1: already equal to zero

Solve $2x^2 + 7x + 3 = 0$.

$$2x^2 + 7x + 3 = (2x + 1)(x + 3)$$

$$(2x + 1)(x + 3) = 0$$

So $2x + 1 = 0$ or $x + 3 = 0$.

$$x = -\frac{1}{2} \quad \text{or} \quad x = -3$$

Example 2: rearrange first

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

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

$$(2x + 3)(2x - 1) = 0$$

So $2x + 3 = 0$ or $2x - 1 = 0$.

$$x = -\frac{3}{2} \quad \text{or} \quad x = \frac{1}{2}$$

Try these

1. Solve $3x^2 + 8x + 4 = 0$.
2. Solve $5x^2 - 13x + 6 = 0$.
3. Solve $2x^2 + 7x = -3$.



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Example 3: HCF first

Solve $18x^2 - 33x + 15 = 0$.

$$3(6x^2 - 11x + 5) = 0$$

$$3(2x - 1)(3x - 5) = 0$$

The factor 3 does not give a root, so:

$$2x - 1 = 0 \quad \text{or} \quad 3x - 5 = 0$$

$$x = \frac{1}{2} \quad \text{or} \quad x = \frac{5}{3}$$

Example 4: repeated root

Solve $16x^2 - 24x + 9 = 0$.

$$16x^2 - 24x + 9 = (4x - 3)^2$$

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

So $4x - 3 = 0$, which gives

$$x = \frac{3}{4}$$

This is a repeated root.

Common mistake

Forgetting to solve both brackets, or treating the common factor outside as another root. Only the variable brackets create roots.

