

Factorising quadratics 1

Notes & Steps



Key idea

For $ax^2 + bx + c$ with $a > 1$, multiply $a \times c$, find two numbers that multiply to that product and add to b , then split the middle term and factor by grouping.

AC method

1. Write the quadratic in standard form $ax^2 + bx + c$.
2. Multiply $a \times c$.
3. Find two integers whose product is ac and whose sum is b .
4. Split the middle term using those two numbers.
5. Factor each pair, then take out the common bracket.

Common mistake

Jumping straight to brackets without checking that the inside terms multiply to ac .
For $2x^2 + 7x + 3$, the middle-term split is $6x + x$, not $3x + 4x$.

Quick checks

- ▶ If the constant term is positive and the middle term is positive, both signs are usually $+$.
- ▶ If the constant term is negative, the signs must be different.
- ▶ If there is an HCF first, take it out before using the ac method.
- ▶ Expand your answer to check it returns to the original quadratic.

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Example 1: positive middle term

Factorise $2x^2 + 7x + 3$.

$$ac = 2 \times 3 = 6$$

The pair that multiplies to 6 and adds to 7 is 6 and 1.

$$2x^2 + 7x + 3 = 2x^2 + 6x + x + 3$$

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

Example 2: negative constant term

Factorise $3x^2 - 8x + 4$.

$$ac = 3 \times 4 = 12$$

The pair that multiplies to 12 and adds to -8 is -6 and -2 .

$$3x^2 - 8x + 4 = 3x^2 - 6x - 2x + 4$$

$$3x(x - 2) - 2(x - 2) = (3x - 2)(x - 2)$$

Try these

1. Factorise $2x^2 + 9x + 10$.
2. Factorise $4x^2 + 4x - 3$.
3. Factorise $5x^2 - 13x + 6$.

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Example 3: larger leading coefficient

Factorise $4x^2 + 4x - 15$.

$$ac = 4 \times (-15) = -60$$

The pair that multiplies to -60 and adds to 4 is 10 and -6 .

$$4x^2 + 10x - 6x - 15$$

$$2x(2x + 5) - 3(2x + 5) = (2x - 3)(2x + 5)$$

Example 4: HCF first

Factorise $18x^2 - 33x + 15$ fully.

$$18x^2 - 33x + 15 = 3(6x^2 - 11x + 5)$$

Now factorise the bracket:

$$ac = 6 \times 5 = 30, \quad -10 + (-1) = -11$$

$$6x^2 - 11x + 5 = 6x^2 - 10x - x + 5$$

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

So the full factorisation is $3(2x - 1)(3x - 5)$.

Common mistake

Stopping after grouping when there is still a common factor outside. In a question that says *fully*, keep going until no factor can be taken out.