Factorisation

Matthew Williams • Math • May 6, 2026

Factorisation is the reverse of expansion. Instead of multiplying brackets out, you are rewriting an expression as a product of simpler factors. This matters because many CSEC algebra questions hide the solution inside a form that becomes much easier once it is factorised.

On Paper 01, factorisation may be tested as a direct skill: identify the correct factor form. On Paper 02, it often appears inside a longer algebra question, especially when solving quadratics, simplifying algebraic fractions, or proving identities. As you read the examples, keep asking: **what common structure can I pull out or rewrite?**

Factoring Out Common Terms

Start by looking for something every term shares. It may be a number, a variable, or both. Factoring out the common term is useful because it makes the expression shorter and often prepares it for solving or cancelling later.

$$3x + 6 = 3(x + 2)$$

$$5a^2 - 10a = 5a(a - 2)$$

$$2xy + 4y = 2y(x + 2)$$

📋 **Example**

Factor $6x^2 + 9x$:

GCD of 6 and 9 is 3
GCD of x^2 and x is x

$$6x^2 + 9x = 3x(2x + 3)$$

Factoring by Grouping

Grouping works when there is no single factor common to every term, but pairs of terms share factors. The goal is to create the same bracket twice; once that matching bracket appears, it becomes the common factor.

$$ax + ay + bx + by = a(x + y) + b(x + y) = (x + y)(a + b)$$

📋 **Example**

Factor $ax + ay + bx + by$:

Group the terms in pairs:

$$ax + ay + bx + by = (ax + ay) + (bx + by)$$

Factor each pair:

$$= a(x + y) + b(x + y) = (x + y)(a + b)$$

The repeated bracket $(x + y)$ is the sign that grouping has worked.

Difference of Squares

Use this pattern when there are exactly two square terms with a subtraction sign between them. It is called a "difference" because one square is being subtracted from another.

$$a^2 - b^2 = (a + b)(a - b)$$

Visually, think of $a^2 - b^2$

as "a big square minus a smaller square." The leftover L-shape can be cut and rearranged into a rectangle. That rectangle has length

$a + b$ and width $a - b$, so its area is $(a + b)(a - b)$.

📋 **Example**

$x^2 - 9 = x^2 - 3^2 = (x + 3)(x - 3)$

$4a^2 - 25 = (2a)^2 - 5^2 = (2a + 5)(2a - 5)$

Perfect Square Trinomials

Perfect square trinomials come from expanding the same bracket twice, such as $(x+3)(x+3)$. The first and last terms are squares, and the middle term is twice the product of the two square roots.

$$a^2+2ab+b^2=(a+b)^2$$

$$a^2-2ab+b^2=(a-b)^2$$

📋 **Example**

$x^2+6x+9=x^2+2(3)x+3^2=(x+3)^2$

$a^2-10a+25=a^2-2(5)a+5^2=(a-5)^2$

Trinomial Factorization

For trinomials, you are rebuilding the two brackets that would expand to make the expression. The middle term is the important clue because it comes from adding the two "cross products" created during expansion.

$$ax^2+bx+c=(px+q)(rx+s)$$

Where $pr=a$, $qs=c$, and $ps+qr=b$

📋 **Example**

Factor x^2+5x+6:

Need two numbers that multiply to 6 and add to 5: 2 and 3

$$x^2+5x+6=(x+2)(x+3)$$

Check: $(x+2)(x+3)=x^2+3x+2x+6=x^2+5x+6$

📋 **Example**

Factor $2x^2 + 7x + 3$:

Need factors of $2 \times 3 = 6$ that add to 7: 6 and 1

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

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

Check: $(x + 3)(2x + 1) = 2x^2 + x + 6x + 3 = 2x^2 + 7x + 3$

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