

EXPANSION OF ALGEBRAIC EXPRESSIONS

In algebra, expressions can be written in different forms. A **factored form** represents an expression as a product, like $a(b + c)$. An **expanded form** represents it as a sum of terms, like $ab + ac$.

Expanding is the algebraic process of converting a factored form into an expanded form. In practice, this means *removing the brackets by multiplying* the factor outside by each term inside. This is a fundamental skill used for simplifying expressions and solving equations.

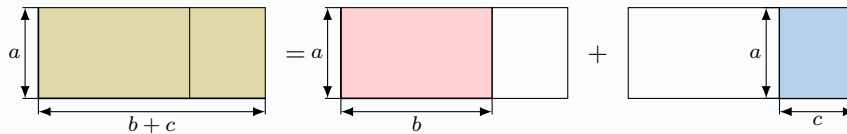
A DISTRIBUTIVE LAW 1

Proposition Distributive Law

Multiplication is distributive over addition and subtraction:

- Addition:**

$$a(b + c) = ab + ac$$



- Subtraction:**

$$a(b - c) = ab - ac$$

Ex: Show that $2(\ell + L) = 2\ell + 2L$.

Answer:

$$\begin{aligned} 2(\ell + L) &= 2 \times \ell + 2 \times L \\ &= 2\ell + 2L \end{aligned}$$

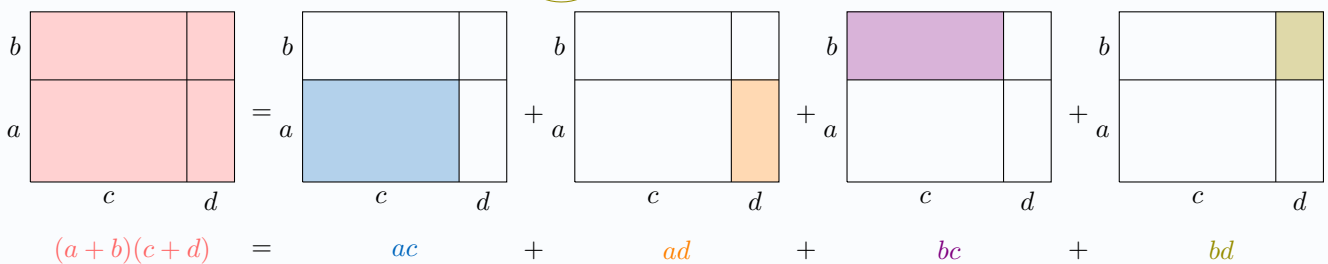
So $2(\ell + L) = 2\ell + 2L$.

B DISTRIBUTIVE LAW 2

Proposition Distributive Law 2

Each term in the first bracket multiplies each term in the second bracket.

$$(a+b) \cdot (c+d) = ac + ad + bc + bd$$



Ex: Expand and simplify $(x + 4)(2x + 2)$.

Answer:

$$\begin{aligned} (x+4) \cdot (2x+2) &= x \times 2x + x \times 2 + 4 \times 2x + 4 \times 2 \\ &= 2x^2 + 2x + 8x + 8 \\ &= 2x^2 + 10x + 8 \end{aligned}$$

So $(x + 4)(2x + 2) = 2x^2 + 10x + 8$.

C DIFFERENCE OF TWO SQUARES

Proposition Difference of Two Squares

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

This identity is called the **difference of two squares**.

Ex: Expand and simplify: $(x - 3)(x + 3)$.

Answer:

$$\begin{aligned}(x - 3)(x + 3) &= x^2 - 3^2 \\ &= x^2 - 9.\end{aligned}$$

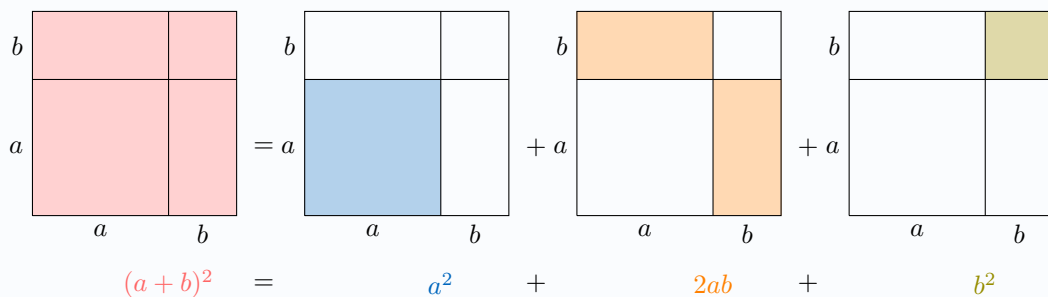
So $(x - 3)(x + 3) = x^2 - 9$.

D PERFECT SQUARES EXPANSION

Proposition Perfect Squares Expansion

The square of a sum and the square of a difference can be written as:

$$(a + b)^2 = a^2 + 2ab + b^2 \quad \text{and} \quad (a - b)^2 = a^2 - 2ab + b^2.$$



Ex: Expand and simplify $(x + 2)^2$.

Answer: Using the formula $(a + b)^2 = a^2 + 2ab + b^2$ with $a = x$ and $b = 2$:

$$\begin{aligned}(x + 2)^2 &= x^2 + 2 \times x \times 2 + 2^2 \\ &= x^2 + 4x + 4.\end{aligned}$$

So $(x + 2)^2 = x^2 + 4x + 4$.