EXPANSION

In mathematics, we often want to transform the form of an expression to make it easier to work with, to simplify calculations, or to solve equations. **Expanding** an expression means rewriting a multiplication as a sum of terms.

A EXPANSION

Definition Expansion

Expansion is the process of writing an expression as a sum of terms by distributing multiplication over addition.

Ex 1: Expand and simplify $5(x+3)$.

Answer:

$$\begin{aligned} 5\,(x+3) &= 5\times x + 5\times 3 \\ &= 5x + 15 \end{aligned}$$

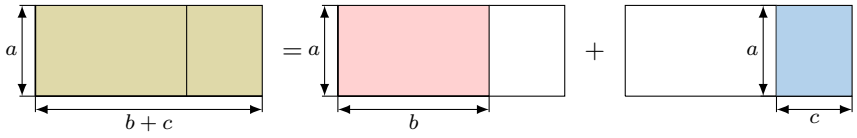
B DISTRIBUTIVE LAW 1

Proposition Distributive Law 1

Multiplication is distributive over addition and subtraction:

- **Addition:**

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



- **Subtraction:**

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

Ex: Expand and simplify $2(l+L)$.

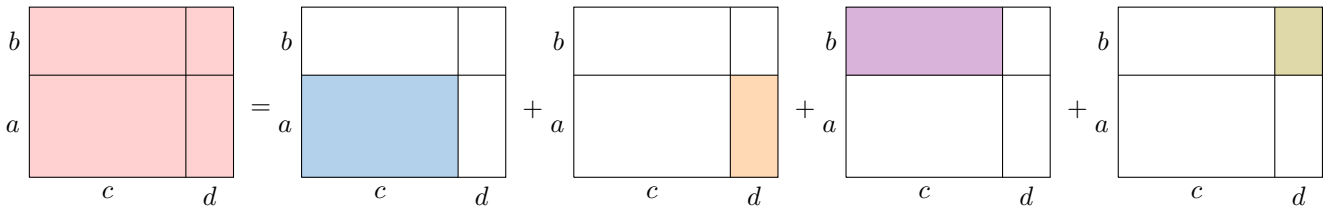
Answer:

$$\begin{aligned} 2\,(\,l+L\,) &= 2\times l + 2\times L \\ &= 2l \;+\; 2L \end{aligned}$$

C DISTRIBUTIVE LAW 2

Proposition Distributive law 2

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



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

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

Answer:

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

D DIFFERENCE OF TWO SQUARES

Proposition Difference of Two Squares

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

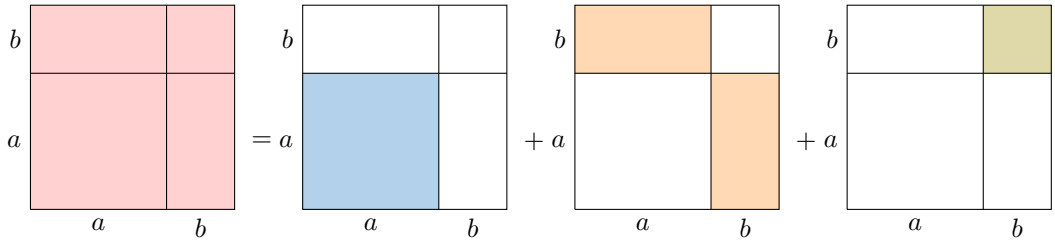
Ex: Expand and simplify: $(x-3)(x+3)$.

Answer:

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

E PERFECT SQUARES EXPANSION

Proposition Perfect Squares Expansion



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

and

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

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

Answer: In the perfect squares expansion, we substitute $a = x$ and $b = 2$:

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