

1. Understanding Expressions & Substitution

Algebra uses letters called **variables** to represent unknown numbers

$$2x - 3 \quad \text{An unknown multiplied by 2 then subtract 3} \quad \text{If } x = 6, \quad 2x - 3 = 2 \times 6 - 3 = 9$$

$$\frac{x+4}{2} \quad \text{An unknown number add 4, then divided by 2} \quad \text{If } x = 6, \quad \frac{x+4}{2} = \frac{6+4}{2} = 5$$

2. Simplification

When we add **like terms** we describe how many of each letter we have

$$c + c + d + d + c + b = b + 3c + 2d$$

$$5z + 2y - 3z + y = 2z + 3y$$

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6. Solving equations with unknowns on one side

This is where you work backwards to find the unknown number

$$\begin{array}{l} 2x + 8 = 18 \\ (-8) \quad (-8) \\ 2x = 10 \\ (\div 2) \quad (\div 2) \\ x = 5 \end{array}$$

$$\begin{array}{l} 3(x + 4) = 33 \\ (\div 3) \quad (\div 3) \\ x + 4 = 11 \\ (-4) \quad (-4) \\ x = 7 \end{array}$$

$$\begin{array}{l} \frac{x-8}{2} = 6 \\ (\times 2) \quad (\times 2) \\ x - 8 = 12 \\ (+8) \quad (+8) \\ x = 20 \end{array}$$

7. Solving equations with unknowns on both sides

Start by eliminating the unknowns from one side of the equation

$$\begin{array}{l} 6x + 7 = 4x + 19 \\ (-4x) \quad (-4x) \\ 2x + 7 = 19 \\ (-7) \quad (-7) \\ 2x = 12 \\ (\div 2) \quad (\div 2) \\ x = 6 \end{array}$$

$$\begin{array}{l} 3x + 3 = 7x - 5 \\ (-3x) \quad (-3x) \\ 3 = 4x - 5 \\ (+5) \quad (+5) \\ 8 = 4x \\ (\div 4) \quad (\div 4) \\ 2 = x \end{array}$$

$$\begin{array}{l} 5x + 3 = -6x + 19 \\ (+6x) \quad (+6x) \\ 11x + 3 = 19 \\ (-3) \quad (-3) \\ 11x = 16 \\ (\div 11) \quad (\div 11) \\ x = 1.45 \text{ (to 2 dp)} \end{array}$$

3. Expanding single brackets

Multiply everything in the bracket by the number on the outside

$$6(x + 2) = 6x + 12$$

×	x	2
6	6x	12

4. Factorising single brackets

This is the reverse of expanding brackets.

Take the expressions and put the brackets back in.

Factorise the expression.

$$6x + 24$$

Do this by finding the highest common factor of your terms

6x and 24 are both multiples of 6.

Therefore 6x + 24 can be written as 6 × (something).

×		
6	6x	24

To find out what the unknown is you must divide 6x and 24 by 6.

$$6x \div 6 = x$$

$$24 \div 6 = 4$$

×	x	4
6	6x	24

$$= 6(x + 4)$$

5. Expanding double brackets

$$(x + 2)(x + 3)$$

×	x	2
x	x ²	2x
3	3x	6

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

$$= x^2 + 5x + 6$$

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

×	x	3
2x	2x ²	6x
-5	-5x	-15

$$= 2x^2 + 6x - 5x - 15$$

$$= x^2 + x - 15$$