

**Key Vocabulary**

Unknown or variable	The value we are trying to find. This is typically represented by a letter of the alphabet, often x.
Equation	A piece of algebra with an equals sign and variables. These can often be solved. E.g. $2x + 3 = 7$
Operations	Things that can be done to values, e.g. +, -, x, ÷, square and square root.
Solve	Find the value of the unknown variable(s).
Solution	The answer. The value for each unknown variable. E.g. in $2x + 3 = 7$ , $x = 2$ .
Brackets	( and ). In order to solve an equation, you might need to start by expanding brackets. E.g. $2(x + 3) = 9$ $2x + 6 = 9$ $2x = 3$ $x = 1 \frac{1}{2}$
Substitute	Put the given value of the unknown into an equation. This can be used to check an answer. E.g. $2(x + 3) = 9$ , check the answer $x = 1 \frac{1}{2}$ $2(1 \frac{1}{2} + 3) = 2 \times 4 \frac{1}{2} = 9$ , so $x = 1 \frac{1}{2}$ is a correct solution.
Inequalities	$>$ , $<$ , $\geq$ and $\leq$

**Key facts / Diagrams**

In order to solve an equation you must:

1. Do the same to BOTH sides of the equals sign
2. Remember the correct order of operations and work backwards to remove elements
3. Use the inverse of operations. To “remove” +2, you must -2 to each side

Remember that if algebraic methods are used correctly, problems can be solved in different ways:

$$2(x + 3) = 10 \qquad 2x + 6 = 10$$

$$2x = 4 \qquad x = 2$$

OR

Start by dividing each side by 2

$$2(x + 3) = 10 \qquad x + 3 = 5$$

$$x = 2$$

Your answer may contain a negative:

$$-3(x+2) = 10 + x$$

$$-3x - 6 = 10 + x$$

$$\quad -x \qquad -x$$

$$-4x - 6 = 10$$

$$\quad +6 \qquad +6$$

$$-4x = 16$$

$$\div -4 \quad \div -4$$

$$x = -4$$

You can check your solution by substituting:

$$-3(\boxed{-4} + 2) = 10 + \boxed{-4}$$

$$12 - 6 = 10 - 4$$

$$6 = 6 \quad \checkmark$$

**Common misconceptions**

- Some pupils may think that you always have to manipulate the equation to have the unknowns on the LHS of the equal sign, for example  $2x - 3 = 6x + 6$
- Some pupils think if  $4x = 2$  then  $x = 2$ .
- When solving equations of the form  $2x - 8 = 4 - x$ , some pupils may subtract ‘x’ from both sides.

**Worked examples**

When the unknown appears on both sides, deal with the “lower” one first. E.g.:

$$5x + 3 = 2x + 15 \text{ (subtract } 2x \text{ from BOTH sides)}$$

$$3x + 3 = 15 \text{ (subtract 3 from BOTH sides)}$$

$$3x = 12 \text{ (divide by 3)}$$

$$x = 4$$

With negatives more care is needed:

$$2x - 5 = 25 - 3x \text{ (-3x is “lower” than } 2x, \text{ so start by adding } 3x \text{ to BOTH sides)}$$

$$5x - 5 = 25 \text{ (add 5 to BOTH sides)}$$

$$5x = 30 \text{ (divide by 5)}$$

$$x = 6$$

With inequalities, remember that the symbol might need to be reversed.

$$3x - 2 < 5x - 10$$

$$-2 < 2x - 10$$

$$2x - 10 > -2 \qquad 2x > -2 + 10$$

$$2x > 8 \qquad x > 4$$