Solving Equations with One Variable

Prior Knowledge:

Before attempting this sheet, students should be confident in using BIDMAS. They should also be familiar with multiplying algebraic expressions and substitution.

Solving equations means to find the **value** of x (or whatever letter is used) that makes the equation **true**. To do this, you will have to **rearrange** the equation to get x (or whatever letter is used) on its own.

Rather than using trial and error or guessing the value of x, it is best to keep **rearranging** the equation until you get the 'x =' on one side. There are a few **important** things to remember when rearranging.

1. You must always do the **same thing** to **both sides of the equation**.
2. To 'get rid' of something, do the **opposite** (use its inverse).
   - The inverse of + is – and the inverse of – is +.
   - The inverse of × is ÷ and the inverse of ÷ is ×.
3. Finally, you must keep going until you have a letter **on its own**.

Solve $x + 5 = 12$

The inverse of (+ 5) is (– 5) so we must subtract 5 from both sides of the equation.

$x + 5 - 5 = x$

$12 - 5 = 7$

It's a good idea to write down what you're doing at every stage – put it in brackets next to the equation to help you see the calculations you are doing.

$$\begin{array}{l} \\ (-5) \\ \\ \end{array} \begin{array}{c} x + 5 = 12 \\ \\ x = 7 \end{array} \begin{array}{l} \\ (-5) \\ \\ \end{array}$$

Solve $5x = 15$

Remember that there is an invisible × sign between the 5 and the x. The opposite of (× 5) is (÷ 5) so you must divide both sides of the equation by 5.

$$\begin{array}{l} \\ (\div 5) \\ \\ \end{array} \begin{array}{c} 5x = 15 \\ \\ x = 3 \end{array} \begin{array}{l} \\ (\div 5) \\ \\ \end{array}$$

Sometimes, you might be given an equation where there is an **x-term** and a **number** on the **same side**. You must still use the **rearranging** method but there will be an extra step.

Solve $4x + 8 = 20$

Start by moving the 8 to the opposite side. The opposite of (+ 8) is (– 8).

$$\begin{array}{l} \\ (-8) \\ \\ \end{array} \begin{array}{c} 4x + 8 = 20 \\ \\ 4x = 12 \end{array} \begin{array}{l} \\ (-8) \\ \\ \end{array}$$

Now, divide to get the 'x =' on the one side:

$$\begin{array}{l} \\ (\div 4) \\ \\ \end{array} \begin{array}{c} 4x = 12 \\ \\ x = 3 \end{array} \begin{array}{l} \\ (\div 4) \\ \\ \end{array}$$

BEYOND MATHS

Your Turn

Solve each equation to find the value of x.

1. $x - 4 = 3$
2. $x + 15 = 41$
3. $x + 7 = 12$
4. $6x = 24$
5. $7x = 56$
6. $16x = 80$
7. $\frac{x}{3} = 2$
8. $\frac{x}{5} = 20$

Solve each of the two-step equations:

1. $4x - 3 = 17$
2. $5x + 4 = 19$
3. $2x - 1 = 7$
4. $2t + 3 = 10$
5. $10d - 7 = 33$
6. $3x - 5 = 4$
7. $2y - 5 = 9$
8. $2a - 10 = -6$

Challenge

Solve each equation to find the value of x.

$4(x + 2) = 20$

$3\frac{1}{2}x + 1 = 8$