CHANGING THE SUBJECT OF A FORMULA

We can make a variable the subject of a formula by rearranging the formula.

Check that you can:

- *solve simple equations.*

The subject of a formula should stand alone on one side of the formula.

For example, the subject of the formula $y = mx + c$ is y.

To make x the subject of a formula, the formula should be rearranged so that x stands alone on one side of the formula: $x = \ldots$

The process of changing the subject of a formula is very similar to that of solving equations using the balancing method.

Example 1:
Make w the subject of the following formula: $f = w + 9m$
If we want w on its own, then $9m$ must be removed from the right-hand side. ***Remember***, we must do the same to both sides of the formula in order to keep them balanced.

$$\begin{array}{rr} f = & w + 9m \\ -9m & -9m \end{array}$$

$$f - 9m = w$$

This can also be written as:

$$w = f - 9m$$

Example 2:
Make a the subject of the following formula: $c = 4a + b$
If we want a on its own, then b must be removed from the right-hand side. To keep the sides balanced, we must subtract b from each side of the formula.

$$\begin{array}{rr} c = & 4a + b \\ -b & -b \end{array}$$

$$c - b = 4a$$

The second step is to remove the 4 from the right-hand side. We do this by dividing both sides by 4.

$$\begin{array}{rr} c - b = & 4a \\ \div 4 & \div 4 \end{array}$$

$$\frac{c - b}{4} = a$$

which can be also written as:

$$a = \frac{c - b}{4}$$

Example 3:
Make q the subject of the following formula: $t = pq^2 r$
The first step is to remove the p and r from the right-hand side. We do this by dividing both sides by pr.

$$\frac{t}{pr} = q^2$$

The next step is to take the square root of both sides.

$$\sqrt{\frac{t}{pr}} = q$$

Example 4:
Make e the subject of the following formula: $d = \sqrt{3e - 5}$

First, remove the root by squaring both sides.

$$d^2 = 3e - 5$$

Then, we add 5 to both sides. $d^2 + 5 = 3e$

Finally, divide both sides by 3.

$$\frac{d^2 + 5}{3} = e$$

Example 5:
Make s the subject of the following formula:

$$4r = 5\,(t + 2s)$$

First, expand the brackets. $4r = 5t + 10s$

Then, subtract $5t$ from both sides. $4r - 5t = 10s$

Finally, divide both sides by 10.

$$\frac{4r - 5t}{10} = s$$

REMEMBER!
You must do the same to both sides of the formula in order to keep them balanced.