CHANGE OF SUBJECT OF FORMULAE

A formula is an equation consisting of letters which represent quantities. For example, the volume, *V*, of a cylinder whose base radius is *r* and height, *h*, is given by the formula:

$$V = \pi r^2 h$$

In this illustration, *V* is expressed in terms of the *r* and *h* or we say that *V* is made the subject of the formula.

Sometimes it becomes necessary to change the subject of a formula. To do this, we regard the formula as an equation and solve for the letter which is to be the subject. For instance, in the above formula, $V = \pi r^2 h$, we can make *h* the subject of the formula:

$$V = \pi r^2 h$$

$$\frac{V}{\pi r^2} = h$$

$$\therefore h = \frac{V}{\pi r^2}$$

Rules for Changing the Subject of Formulae

1. If the operation that joins the character with other characters is times (×), transfer the other over the equals sign and change the sign to division.

$$a \times b = cd \; or \; ab = cd$$

$$a = cd \div b \; or \frac{cd}{b}$$

2. If the operation is division as you cross them over the equals sign, it would change to times (×).

$$a \div b = cd \; or \frac{a}{b} = cd$$

$$a = cd \times b \; or \; cdb$$

3. If the operation is plus (+) it would change to minus (-).

$$a + b = cd$$

$$a = cd - b \; or - b + cd$$

4. If the operation is minus (-) it would change to plus (+).

$$a - b = cd$$
$$a = cd + b \; or \; b + cd$$

5. If the operation squares (^{2}) the character, the square would jump over and become square root (√):

$$a^2 = cd$$
$$a = \sqrt{cd}$$

6. If the operation is a square root, √, the square root would go over the equals sign and become square (^{2}):

$$\sqrt{a} = cd$$
$$a = (cd)^2$$

Examples

1. Make *y* the subject of the formula, $a = c(1 + y)$

Solving

$a = c(1 + y)$	firstly, open the bracket
$a = c + cy$	secondly, rearrange the equation
$cy + c = a$	thirdly, move *c* over the equals sign
$cy = a - c$	fourthly, move *y* over the equals sign

$$y = \frac{a - c}{c}$$

2. Make *x* the subject of the formula, $h = \frac{c-x}{c+x}$

Solving

$h = \frac{c-x}{c+x}$	clear fraction by moving $c + x$ over the equals sign
$h(c + x) = c - x$	open the brackets
$hc + hx = c - x$	collect like terms
$hx + x = c - hc$	factorize
$x(h + 1) = c - hc$	move $h + 1$ over the equals sign

$$x = \frac{c - hc}{h + 1}$$

Remember: whenever you move any character over the equals sign the sign of that character would change.