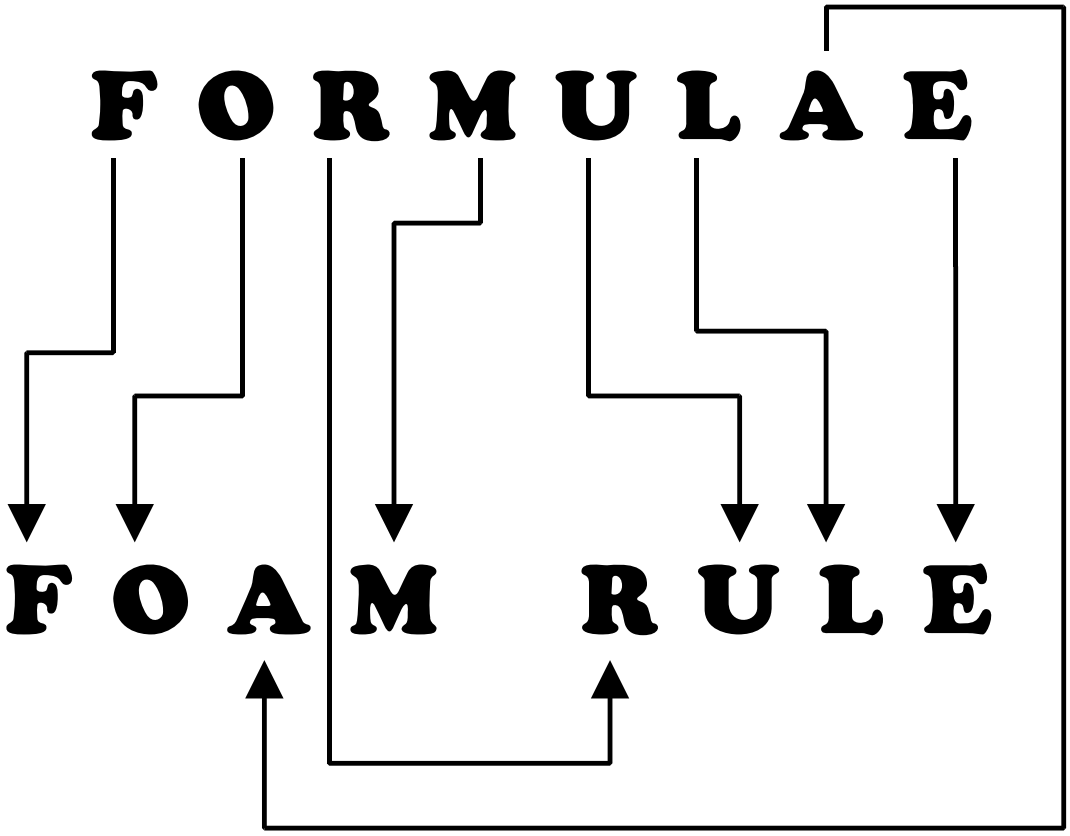
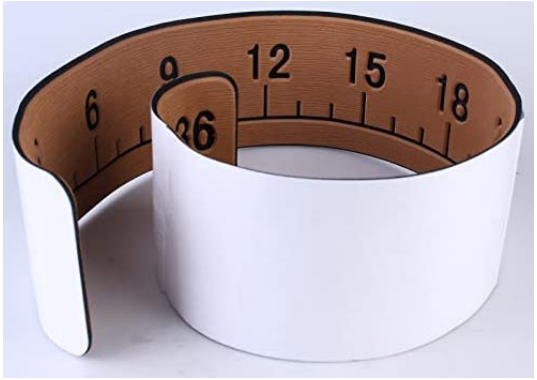
REARRANGING





In algebra, the golden rule for manipulating equations

“DO THE SAME TO THE WHOLE OF BOTH SIDES”

Lesson 1

GCSE Mathematics
Algebra, Rearranging Formulae

1.1 Introduction

From London, William is talking over a phone to his friend Dwain in New York. Dwain tells William that the temperature in New York is 59° F (Fahrenheit). William is only familiar with temperatures being expressed in ° C (Centigrade). Fortunately, he knows a formula to convert from Fahrenheit to Centigrade.

$$C = \frac{5(F - 32)}{9}$$

In this formula we say that C is the subject.

William proceeds by substitution in the number 59 in place of F.

$$= \frac{5(59 - 32)}{9}$$

$$= \frac{5 \times 27}{9}$$

$$= 15\ °C$$

In continuing the conversation, William tells Dwain that it is much colder in London, "The temperature in London is a cold -5 °C". Dwain immediately wants to know what this is in °F.

William does not know the formula with F as the subject.

But he can work it out.

He can ***change the subject*** of the formula.

	$C = \frac{5(F-32)}{9}$	
multiply both sides by 9	$9C = 5(F - 32)$	*multiply both sides by* 9
divide both sides by 5	$\frac{9C}{5} = F - 32$	*divide both sides by* 5
add 32 *to both sides*	$\frac{9C}{5} + 32 = F$	*add* 32 *to both sides*
	$F = \frac{9C}{5} + 32$	

William now inserts London's 5 °C into this rearranged formula.

$$F = \frac{9C}{5} + 32$$

$$= \frac{9 \times (-5)}{5} + 32$$

$$= -9 + 32$$

$$= 21\ °F$$

New York	-5 °C	15 °C
London	21 °F	59 °F

1.2 The Golden Rule

In algebra, there is one golden rule for manipulating all equations

"DO THE SAME TO THE WHOLE OF BOTH SIDES"

1.3 Example

Question:

Showing full working, make x the subject of the equation,

$$3dx - 5m = 4$$

Solution:

add $5m$ *to both sides*	$3dx - 5m = 4$	*add* $5m$ *to both sides*
divide both sides by $3d$	$3dx = 4 + 5m$	*divide both sides by* $3d$
	$x = \frac{4 + 5m}{3d}$	

More succinctly:

$+ 5m$	$3dx - 5m = 4$	$+ 5m$
	$3dx = 4 + 5m$	
$/ 3d$	$x = \frac{4 + 5m}{3d}$	$/ 3d$

Note the use of "/" for "divide"
This is because when projected onto a white board ÷ is easily mistaken for +

1.4 Example

Question:

Showing full working, make x the subject of the equation,

$$7xw + 8 = 3k$$

Solution:

1.5 Exercise

Take care over how you set out your solutions, as demonstrated by the examples.

Question 1

Showing full working, make x the subject of the equation,

$$ax - b = 7$$

Question 2

Showing full working, make x the subject of the equation,

$$3c + wx = pqr$$

Question 3

Showing full working, make x the subject of the equation,

$$4x - vw = 9$$

Question 4

Showing full working, make x the subject of the equation,

$$5 + 4bx + z = a$$

Question 5

Showing full working, by first adding y^2 to both sides, make x the subject of,

$$7x - y^2 = 4z + 1$$

Question 6

Showing full working, by first expanding the brackets, make x the subject of,

$$4(2x + y) = 7$$

Question 7

Showing full working, by first expanding the brackets, make x the subject of,

$$a(3x + b) = c$$

Question 8

Showing full working, by first subtracting y from both sides, make x the subject of,

$$\frac{x}{7} + y = 3z$$

Write your answer without any brackets.

Question 9

Showing full working, by first subtracting 11 from both sides, make x the subject of,

$$11 + \frac{4x}{5} = z$$

Write your answer without any brackets.

Question 10

Showing full working, by first adding 7 to both sides, make x the subject of,

$$\frac{x + p^2}{q} - 7 = R$$