‘How To’ Guide – Rearranging Formulae

Formulae:

Students are required to use formulae across a number of subjects in schools, in particular, Science. Other subjects may include Geography, Psychology, History and, of course, Mathematics. Students are quite often required to rearrange formulae to allow them to calculate different quantities that appear in the formula, usually given as a letter. For example ‘a’ in F = ma represents ‘acceleration’.

Example 1

Rearrange the Following formula to make **a** the subject: **F = ma**

F = **ma** (÷ m)

$\frac{F}{m}$ = **a**

a = $\frac{F}{m}$

Example 2 From the Formula:

Speed = $\frac{\text{Distance}}{\text{Time}}$

OR: **S** = $\frac{D}{T}$

We can write down two more formulae.

To make **D** the subject:

S = $\frac{D}{T}$ (x T)

S x T = D

ST = D

D = ST

To make **T** the subject:

S = $\frac{D}{T}$ (x T)

S x T = D (÷ S)

T = $\frac{D}{S}$

How we teach it

- Rather than have students using a formulae triangle, we much prefer for students to learn one formula (for example, the speed formula), then be able to rearrange this to enable them to calculate any quantity in the formula.
- In Example 1, making ‘a’ the subject is required. In other words, we need to rewrite it starting with ‘a = ‘.
- Have the students look at what is stopping the ‘a’ from being on its’ own. In this case it is the ‘m’. Emphasise that ‘ma’ just means ‘m x a’. The ‘a’ is being multiplied by ‘m’.
- To eliminate the ‘m’ we use inverse operations. The inverse of ‘x m’ is ‘÷ m’, so we do this to both sides of the formula.
- It now appears that ‘m’ is eliminated from the RHS and now appears on the LHS as ‘F ÷ m’
- Please note we prefer that fraction notation is used here. i.e. $\frac{F}{M}$ instead of ‘F ÷ m’
- Teachers when teaching this and students when learning this find it extremely useful to write in brackets the inverse operations carried out at each stage in their quest to get a variable on its’ own. (see purple)
- Now, in example 1, we have a on its own.

Example 3a

V = u + at

To make **u** the subject:

V = u + at (- at)

V – at = u

u = V - at

‘How To’ Guide – Rearranging Formulae

Example 3b

To make **t** the subject:

$V = u + at \quad (-u)$

$V - u = at \quad (\div a)$

$\frac{V-u}{a} = t$

$$t = \frac{V-u}{a}$$

Example 4 **$K = \frac{1}{2} mv^2$**

To make **v** the subject:

$K = \frac{1}{2} mv^2 \quad (\times 2)$

$2K = mv^2 \quad (\div m)$

$\frac{2K}{m} = v^2 \quad (\sqrt{\ })$

$\sqrt{\frac{2K}{m}} = v$

$$v = \sqrt{\frac{2K}{m}}$$

What can you do to help?

- Try to persuade students to adopt this approach rather than learning formula triangles that are (unfortunately) published in a lot of revision guides.
- Explain that adopting this approach will help them across multiple topics in multiple subjects. They will hopefully be able to apply this strategy to formulae that is unfamiliar to them.
- Emphasise the idea of “inverse operations” when rearranging formulae in your subject.

Please note that this whole process does have a few different descriptors commonly used across the national curriculum:

‘Rearranging Formulae’

‘Changing the subject of a Formula’

‘Transposition of Formulae’