


Rearranging equations: know right from wrong

True laws always apply 	Why?	Exercise
$ax + ay = a(x + y)$		$mt + ms =$
$\frac{a \cdot x}{b \cdot x} = \frac{a}{b}$		$\frac{2k}{7k} =$ $\frac{2+k}{7k} =$ $\frac{a \cdot p}{p \cdot k} =$
$\frac{(a \cdot p + b \cdot p)}{bp} = \frac{a + b}{b}$		$\frac{5x + 5y}{5} =$ $\frac{5a + 2p}{5} =$ $\frac{a \cdot x + a \cdot y}{a} =$
$(c + d)^2 = c^2 + 2cd + d^2$	Multiply out and simplify to see this for yourself $(c + d)^2 = (c + d)(c + d) =$	
$(5z)^2 = 5^2 z^2$	$(5z)^2 = 5z \times 5z =$ $= 5 \times 5 \times z \times z = 5^2 z^2$	$(3n)^2 =$

Some definitions

Terms are the entities separated by addition or subtraction: $2 - 3x^2 + 4a$
term term term

A product is made up of **factors**: 4×7 , $3pq = 3 \times p \times q$
factor factor factor factor factor

If the **same factor** is present in **every term** we can factor it out (put outside a bracket):

$$4a - 2 + 6p = 2 \times 2a - 2 \times 1 + 2 \times 3p = 2(2a - 1 + 3p)$$



Concept question 2.1

Which of the following equations are correct? Justify your choice.

(a) $\frac{a+3p}{p} = a + 3$

(b) $\frac{ap+3p}{p} = a + 3$



Key concept:



Concept question 2.2

Given the equation

$$x + 3 = \frac{\pi}{2}$$

and after **doubling both sides** we obtain

$$2x + 3 = \pi$$

True or false? Why?



Key concept:



Concept question 2.3

After squaring both sides of the equation

$$\sqrt{x} = q + 4$$

we obtain

(a) $x = q^2 + 16?$ **or** (b) $x = q^2 + 8q + 16?$



Key concept:



Concept question 2.4

$$\sqrt{p^2 - r^2} = p - r$$

True or false?



Key concept:

Exercise 2.1

1. Which of these is the solution to $\frac{x}{7} = 56$?

- (a) $x = 49$ (b) $x = 392$ (c) $x = 8$ (d) $x = 63$

2. Make p the subject of the equation $m = \sqrt{p + 9}$

- (a) $p = m^2 - 81$ (b) $p = m^2 - 9$
(c) $p = \sqrt{m} - 3$ (d) $p = (m - 9)^2$

3. What does $\frac{3m+m^2}{m}$ simplify to?

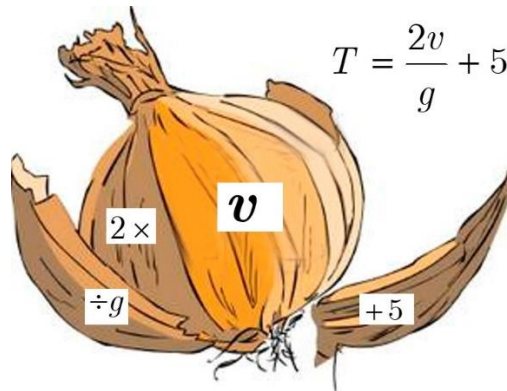
- (a) $3 + m^2$ (b) $3m^2 + m^3$
(c) $3 + m$ (d) none of the above

Key Main principles of rearranging formulae

- we can do anything to an equation as long as we **do the same thing to both sides**;
- we simplify/rearrange equations **step by step** by applying **inverse operations**.

More general guidelines

- Perhaps start by removing the entities that are furthest away from your subject. Work in small steps, removing one operation at a time, thus getting closer and closer to the subject.
- Think of peeling an onion, removing outer layers before getting to the core, as an analogy of getting to the subject in your formula.



- It is OK to do many small (but correct) steps. It is also OK to only think of the next small step instead of ‘having to plan the entire route in detail from the start’.

Rearrange $T = \frac{2v}{g} + 5$ to make v the subject.

<i>Want to get rid of</i>		<i>Do to both sides</i>
	$T = \frac{2v}{g} + 5$	

Rearrange $q = \frac{4t}{5} - 2$ to make t the subject.

<i>Want to get rid of</i>		<i>Do to both sides</i>
	$q = \frac{4t}{5} - 2$	

Exercise 2.2 **What's the first step towards isolating the variable?**

Equation	Want to get rid off	Do to both sides	New equation
$4s - 7 = 10$			
$3 \cdot \sqrt{z^2 - 4} = 6$			
$\frac{2p + 5}{3} = 4$			
$\sqrt{x - 6} = 2$			

Homework 1

1. Make **c** the subject of the formula

$$bc - d = a$$

2. Transpose the following formula for **t**

$$v = u + at$$

3. Transpose the following formula for **q**

$$\frac{p + q}{2} = r$$

4. Make **d** the subject of the formula

$$I = \frac{db^3}{12}$$

5. Make **s** the subject of the formula

$$u^2 + 2as = v^2$$

6. Make **R** the subject of the formula

$$A = P \left(1 + \frac{R}{100} \right)$$

Homework 2 “Spot the error!”

In the table below, identify and circle the error (left column) and then write down the correct solution in the right column.

Wrong solution	Correct solution
$ax = 2b$ $x = 2b - a$	
$3s = 7 - 2s$ $3s - 2s = 7$ $s = 7$	
$R = \frac{p}{a} + q$ $R - q = \frac{p}{a}$ $aR - q = p$	
$v^2 = u^2 + 2as$ $\frac{v^2}{2a} = u^2 + s$ $s = \frac{v^2}{2a} - u^2$	
$\sqrt{m - n} = p + q$ $m - n = p^2 + q^2$ $m = p^2 + q^2 + n$	