

## Rearranging formulae

### General points

- The aim is to **isolate the required subject** at one side of the formula – all the other terms should be at the other side.
- Always do the **same thing to both sides** of the equation.
- To '**get rid**' of a term, do the opposite (e.g. to get rid of  $+mv^2$ , subtract  $mv^2$  from both sides).
- You may need to **remove brackets** or **multiply through by a number to remove fractions** (to simplify the expression) before starting to rearrange the terms.
- If the required subject is in a **negative** term, add this term to both sides to avoid having a negative sign with your subject at the end.
- If the subject is in the **denominator** of a fraction, multiply to 'bring it to the top'.
- If the subject is in a **square** (or **square root**), isolate the square (or root), then take the square root (or square) on both sides.
- If the subject appears in **more than one term**, bring these terms together at one side of the equation, then write the subject outside a bracket as a common factor.

### Examples

Make  $t$  the subject of  $v = \frac{d}{t}$

$$vt = d$$

$$t = \frac{d}{v}$$

Make  $s$  the subject of  $v^2 = u^2 + 2as$

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

$$v^2 - u^2 = 2as$$

$$s = \frac{v^2 - u^2}{2a}$$

Make  $u$  the subject of  $v^2 = u^2 + 2as$

$$v^2 - 2as = u^2$$

$$u = \sqrt{v^2 - 2as}$$

Make  $l$  the subject of  $A = \pi r(l + r)$

$$A = \pi r l + \pi r^2 \quad \text{or} \quad \frac{A}{\pi r} = l + r$$

$$A - \pi r^2 = \pi r l \quad \frac{A}{\pi r} - r = l$$

$$l = \frac{A - \pi r^2}{\pi r} \quad l = \frac{A}{\pi r} - r$$

### Method

Multiply both sides by  $t$  to 'bring  $t$  to the top'.

Divide by  $v$  to leave  $t$  on its own.

There is only one term in the formula with  $s$  in it ( $2as$ ).

Subtract  $u^2$  from both sides to isolate the term  $2as$ .

Divide (the whole of) both sides by  $2a$  to leave  $s$  on its own and write with  $s$  at the left hand side.

There is only one term in the formula with  $u$  in it ( $u^2$ ).

Subtract  $2as$  from both sides to leave only the term involving  $u$  on one side of the formula.

Take the square root to give the formula for  $u$ .

There is more than one method:

Remove the bracket or Divide by the term outside

Isolate the term with  $l$

Write with  $l$  at the left hand side.

### Examples

Make  $m$  the subject of:

$$E = \frac{1}{2}mv^2 + mgh$$

$$2E = mv^2 + 2mgh$$

$$2E = m(v^2 + 2gh)$$

$$m = \frac{2E}{v^2 + 2gh}$$

### Method

Multiply every term by 2 to get rid of the fraction.

Write  $m$  outside a bracket as a common factor.

Divide by the bracket to leave  $m$  on its own.