M.2 Rearranging equations

videos

Here are some tips for rearranging equations:

- Whatever you do to one side of an equation, you must do to the other.
- Don't use the ÷ symbol. (e.g. write $\frac{F}{m}$ rather than $F \div m$).

Equations with involving adding and subtracting

The following equation has a as the subject (i.e. $a = \cdots$):

$$\boxed{a = b + c}$$

Making b the subject:

$$a - c = b + \cancel{c} - \cancel{c}$$

Subtract c from both sides and cancel

$$a - c = b$$

$$\boxed{b = a - c}$$

Making c the subject:

$$a - b = \cancel{b} - \cancel{b} + c$$

Subtract b from both sides and cancel

$$a - b = c$$

$$\boxed{c = a - b}$$

Practice

1) Make y the subject in the following equation:

$$x = y + z$$

2) Make $braking\ distance$ the subject in the following equation:

$$stopping\ distance = thinking\ distance + braking\ distance$$

Equations with involving adding and subtracting

The following equation has F as the subject (i.e. $F = \cdots$):

$$F = m \times a$$

Making m the subject:

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

Divide both sides by a and cancel

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

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

Making a the subject:

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

Divide both sides by m and cancel

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

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

Practice

3) Make m the subject in the following equation:

$$p = m \times v$$

4) Make $resistance$ the subject in the following equation:

$$potential\ difference = current \times resistance$$

The following equation has P as the subject (i.e. $P = \cdots$):

$$\boxed{P = \frac{E}{t}}$$

Making E the subject (note that E is the numerator):

$$P \times t = \frac{E \times \cancel{t}}{\cancel{t}}$$

Multiply both sides by t and cancel

$$P \times t = E$$

$$\boxed{E = P \times t}$$

Making t the subject (note that t is the denominator):

$$P \times t = \frac{E \times \cancel{t}}{\cancel{t}}$$

Multiply both sides by t and cancel

$$P \times t = E$$

$$\frac{\cancel{P} \times t}{\cancel{P}} = \frac{E}{P}$$

Divide both sides by P and cancel

$$\boxed{t = \frac{E}{P}}$$

Practice

5) Make M the subject in the following equation (M is the numerator):

$$\rho = \frac{M}{V}$$

6) Make time the subject in the following equation (time is the denominator):

$$speed = \frac{distance}{time}$$

Equations involving squares

The following equation has V^2 as the subject (i.e. $F = \cdots$):

$$V^2 = P \times R$$

Making V the subject:

$$\sqrt{V^2} = \sqrt{P \times R}$$

Take the square root of both sides and simplify

$$V = \sqrt{P \times R}$$

Practice

7) Make b the subject in the following equation:

$$b^2 = c \times e$$

8) Make $current$ the subject in the following equation:

$$current^2 = \frac{power}{resistance}$$

Combination equations

Sometimes you will need to do a combination of steps to rearrange. Consider the following equation (kinetic energy is the subject):

$$kinetic\ energy = 0.5 \times mass \times speed^2$$

Making $mass$ the subject:

$$\frac{kinetic\ energy}{0.5 \times speed^2} = \frac{\cancel{0.5} \times mass \times \cancel{speed^2}}{\cancel{0.5 \times speed^2}}$$

Divide both sides by $(0.5 \times speed^2)$ and cancel

$$\frac{kinetic\ energy}{0.5 \times speed^2} = mass$$

$$mass = \frac{kinetic\ energy}{0.5 \times speed^2}$$

Making *speed* the subject:

$$\frac{kinetic\ energy}{0.5 \times mass} = \frac{\cancel{0.5 \times mass} \times speed^2}{\cancel{0.5 \times mass}}$$

Divide both sides by $(0.5 \times mass)$ and cancel

$$\frac{kinetic\ energy}{0.5 \times mass} = speed^2$$

$$\sqrt{\frac{kinetic\ energy}{0.5 \times mass}} = \sqrt{speed^2}$$

Take square roots of both sides and simplify

$$\sqrt{\frac{kinetic\ energy}{0.5 \times mass}} = speed$$

$$speed = \sqrt{\frac{kinetic\ energy}{0.5 \times mass}}$$

Practice

9) Make I the subject in the following equation:

$$P = I^2R$$

10) Make e the subject in the following equation (note E_e = elastic energy):

$$E_e = 0.5 \times k \times e^2$$

Consider the following equation:

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

Making u the subject:

$$v^2 - \cancel{u^2} + \cancel{u^2} = 2as + u^2$$

Add u^2 to both sides and cancel

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

$$v^2 - 2as = \cancel{2as} - \cancel{2as} + u^2$$

Subtract $2as$ from both sides and cancel

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

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

Take square roots of both sides and simplify

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

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

Practice

11) Make v the subject in the following equation:

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

12) Make s the subject in the following equation:

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