


Rearranging Formulas



Make x the subject of the formula.

 **Undo the last thing done to the subject each time by doing the opposite.**

$$y = x - 2 \quad \longrightarrow$$

$$y = 3x + 2 \quad \longrightarrow$$

$$y = \sqrt{x} + 1 \quad \longrightarrow$$

$$y = \frac{x^2 - a}{4} \quad \longrightarrow$$

2: Subject trapped in a negative term

When the subject is within the first argument of a subtraction, it's easy to 'release'.

$$y = 2x - 3 \quad \longrightarrow \quad 2x =$$

However, it's a tiny bit harder if the subject is in the term being subtracted.

$$y = 3 - 2x \quad \longrightarrow$$
$$\longrightarrow$$

How could you rearrange the numbers in $9 - 5 = 4$ to get another subtraction?

This suggests you can swap the thing you're subtracting with the result. (i.e. Only the thing to the left of the subtraction stays put)

Examples:

$$a - x = b$$

$$yz^2 - ax^2 = by$$

In each case make x the subject of the formula.

1 $1 - \frac{a}{2}(b - x^2) = c$

2 $ab = c^2 - d\sqrt{x}$

In each case make x the subject of the formula.

$$3 \quad y = 1 - \sqrt{1 - \sqrt{1 - x}}$$

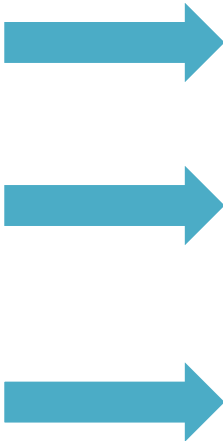
$$4 \quad a - \frac{b - c\sqrt{x}}{d + e} = f - g$$


3: Subject trapped in a denominator

When the subject is in the numerator of a fraction, it's easy to 'release' the subject from the fraction.

$$y = \frac{x}{q} \quad \longrightarrow \quad x =$$

But it's a bit harder if the subject is in the denominator...

$$y = \frac{q}{x + 1}$$


 Isolate the fraction on one side of the equation, then multiply by denominator.

$$1 \quad a = \frac{b - c}{x}$$

$$2 \quad \frac{a}{x} + b = c$$

How would you rearrange the numbers in $\frac{12}{4} = 3$ to get another division?



$$c = \frac{b}{4 - 2x}$$



Examples:

a $\frac{a - b^2}{x + 1} = c$

b $y = \frac{y^2}{x + y} - 2$

If you have just a fraction on each side of the equation, you can 'cross multiply'.

$$\frac{a}{b} = \frac{c}{d}$$

Examples:

Make x the subject:

1 $\frac{a+1}{b} = \frac{c}{x}$

2 $\frac{b^2}{x-1} = \frac{c}{d}$

In each case make x the subject of the formula.

1

$$y = \frac{1}{b - ax^2}$$

2

$$\frac{a}{\sqrt{b - 2x}} = \frac{2}{c}$$

What if the subject appears multiple times?

Make x the subject of:

$$2x + \pi x = 3$$

Make x the subject of:

$$y = \frac{x + 1}{2x}$$

Make x the subject of:

$$q = \frac{2x + 1}{2x - 1}$$

Method Reminder:

1. Isolate subject on one side (and other terms of other side).
2. Factorise it.

Make x the subject of the formula $x + 1 = ax + 3$

Make a the subject of the formula:

$$P = \frac{n^2 + a}{n + a}$$

1 Make x the subject of:

$$y = \frac{a - bx}{1 + ax}$$

2 Make v the subject of:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

In all cases make x the subject.

a

$$a = \frac{ax + a^2}{bx + 1}$$

b

$$a = \frac{3x + 1}{4 - 2x}$$