



16 - Changing the Subject of a Formula

Content

A formula usually has a single variable on one side of the equals sign. This is called the subject of the formula. Sometimes you will want to rearrange the formula so that one of the other variables becomes the subject. To do this you use inverse operations (in a similar way to solving equations) in order to isolate the new subject.

Example 1

Make r the subject of $C = 2\pi r$.

To isolate r , divide by 2π .

$$\frac{C}{2\pi} = r$$

We often write formulae with the subject on the left-hand side, so this becomes

$$r = \frac{C}{2\pi}$$

Example 2

Make x the subject of $y = \frac{x}{5} + 3$.

To isolate x , start by subtracting 3.

$$y - 3 = \frac{x}{5}$$

Next, multiply by 5 – remember to multiply each term of the left-hand side.

$$5(y - 3) = x$$

$$x = 5(y - 3)$$

Example 3

Make r the subject of $V = \frac{1}{3}\pi r^2 h$.

To start, isolate r^2 by multiplying by 3 and then dividing by πh .

$$3V = \pi r^2 h$$

$$\frac{3V}{\pi h} = r^2$$

Now we square root both sides.

$$\sqrt{\frac{3V}{\pi h}} = r$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

Example 4

Make x the subject of $3x + 5 = y - ax$.

When a formula contains the new subject more than once, start by isolating any terms including it on one side of the equals sign.

Here, add ax and subtract 5.

$$3x + ax = y - 5$$

Now we factorise the side with our new subject.

$$x(3 + a) = y - 5$$

Then divide by the bracket to leave x on its own.

$$x = \frac{y - 5}{3 + a}$$

Linked Prior Topics

Equations, inverse operations, factorising

Vocabulary

Formula, rearranging, inverse subject, isolate

Linked Future Topics

Differential equations, other applications of mathematics