



## Algebra

### Expanding and factorising:

Expanding: multiply the expression outside the bracket by everything inside the bracket:

$$x(x+4) = x \text{ times } x \text{ and } x \text{ times } 4 = x^2 + 4x$$

Also may be asked to multiply two brackets together:

$$(x+2)(x+6) = x \text{ times } x, x \text{ times } 6, x \text{ times } 2, \text{ and } 2 \text{ times } 6.$$

So  $x^2 + 6x + 2x + 12$ , which then becomes  $x^2 + 8x + 12$

### Expand and simplify $3(2x - 1) - 2(2x - 3)$

Factorising: with x squared:

$x^2 + 7x + 10$ . To factorise this you must find two numbers that add up to 7, but also multiply together to make 10. This is usually done by trial and error. You can start by listing factors of 10: 1 and 10, 5 and 2. These two numbers must add to make 7. Therefore, the two numbers we will use will be 5 and 2.

Therefore  $x^2 + 7x + 10$  is the same as  $(x+5)(x+2)$  You can check you factorised this correct by multiplying out the brackets again and see if you get the original equation.

### Factorise $x^2 - 6x$

<this one is simpler than the one I just explained, you just take out the largest factor.

### Finding x:

When asked to find x from an equation:

Eg:  $5x + 3 = 18$

First, you subtract 3 from both sides:  $5x = 15$

Then, divide by 5 from both sides:  $x = 3$

More complicated one:  $\frac{x}{2} + 4 = 12$

First, subtract 4.

$$\frac{x}{2}$$

Then, multiply both sides by 2.  $x = 16$

You may have to set up your own equations to find x.

Eg: The perimeter of this shape is 36. Find x

4



We know the perimeter is adding all the sides together. The question tells us the perimeter is 36.

$$\text{So } 36 = 4 + 4 + x+2 + x+2$$

$$\text{Which simplifies to: } 36 = 12 + 2x$$

Then, subtract 12 from both sides, and divide by 2 to get x.

$$X = 12$$

Rearranging formulas: <https://mathsmadeeasy.co.uk/wp-content/uploads/2020/02/Rearranging-Formulae-Questions-MME.pdf>

Changing the subject of the formula. Sometimes we want to rearrange formulas to make them easier to use. Eg:

$P = 2(X+3)$  Make  $x$  the subject of the formula

(must get  $x$  on its own, instead of  $p$ )

We can divide both sides by 2:  $P/2 = X+3$

Then, we can subtract 3 from both sides:  $P/2 - 3 = x$

Simultaneous equations: <https://mathsmadeeasy.co.uk/wp-content/uploads/2020/02/Simultaneous-Equations-Linear-Questions-MME.pdf>

There are two methods you can do to work these out. You can do this by substitution, and also by matching coefficients (the number before the  $x$  or  $y$ ).

Method 1: substitution:

In this method you have to find out what  $x$  is in terms of  $y$ , then substitute that into one of the equations. Example:

$$X + 2y = 10$$

$$2x + 3y = 18$$

First, we can make  $x$  or  $y$  the subject of either of the formulas. To make it most easy for ourselves, lets make  $x$  the subject of the first formula because the  $x$  is by itself.

So  $x + 2y = 10$ , we can take  $2y$  away from both sides to get:  $x = 10 - 2y$

Because we know that this is  $x$ , we can sub this into the second equation.  $2(10-2y) + 3y = 18$

I just put what  $x$  equals into where the  $x$  was in the equation. Then, expand and simplify:

$$20 - 4y + 3y = 18$$

We can simplify this to:  $-y = -2$

Therefore,  $y = 2$ . Now we sub  $y = 2$  back into one of the equations (doesn't matter which).

$$X + 2(2) = 10$$

Therefore,  $x = 6$ .

We can do another method to work this out: (using the same equations)

$$X + 2y = 10$$

$$2x + 3y = 18$$

The coefficients on either the  $x$  or the  $y$  have to be the same. We can multiply equation 1 by 2 to get  $2x + 4y = 20$ , this means that there is a 2 in front of both of the  $x$ s in the equations. Now we can take

equation 2 away from equation 1. (you can do this either way but this way might be easier as they'll be no negatives)

$$2x + 4y = 20$$

$$\text{Take away: } 2x + 3y = 18$$

$$2x - 2x = 0. \quad 4y - 3y = y \quad \text{and} \quad 20 - 18 = 2$$

So then we are left with  $y = 2$ . Now we can sub  $y = 2$  into any of the equations. Let's choose the first one.

$$X + 2y = 10. \quad \text{We put } y = 2 \text{ into this to get:}$$

$$X + 4 = 10. \quad \text{Minus 4 from both sides to get } x = 6.$$