Science, mathematics and other technical subjects are full of useful formulae such as *V* = *IR*

In this formula, *V* is the voltage in volts, *I* is the current in amps and *R* is the resistance in ohms. People who use the formula in electronics need to know what voltage, current and resistance are. They can work out V by **substituting** values for *I* and *R*.

Since mathematics is more abstract than electronics, you won’t need to know what the values mean, but you still to be able to find V by substituting in values for I and R.

**Finding V**

1. Using your knowledge of the rules of algebra, find *V* in each of the following cases:
	1. *I* = 3 and *R* = 5
	2. *I* = 2 and *R* = 7
	3. *I* = 5 and *R* = 2.6
2. The current in a circuit is 4 amps. The resistance in the circuit is 12 ohms. Find the voltage in a circuit.

**Why is algebra so powerful?**

1. You have a circuit where *V* = 28 volts and *I* is 4 amps. Work out the value of *R*.
2. *V* = 36 volts and *R* = 12 ohms. Work out the value of *I*?
3. **Bonus Question:** Write a formula that can be used to find *R* by **rearranging** the formula for *V*.

**Some other formulae**

For each of the formulae given, work out the value asked for by substituting in the values given. The formulae are all genuine ones from science. Aim to write correct units in your answers.

1. Another formula used in electronics is Power (in watts) = current × voltage, *P* = *IV*

Find *P* in each of the following cases:

* 1. *I* = 25 and *V* = 12
	2. *I* = 4 and *V* = 24
	3. *I* = 32 and *V* = 230
1. Find the current if *V* = 24 and *P* = 480
2. $C= \frac{5}{9}(F-32)$

(*C* = temperature in degrees Celsius, oC, *F* = temperature in degrees Fahrenheit, oF)

* 1. Find the temperature in oC which corresponds to a temperature of 50oF
	2. Find the temperature in oC which corresponds to a temperature of 23oF
	3. **Challenge**: Find the temperature that have the same value in both oC and oF
1. $s=ut+\frac{1}{2}at^{2}$

(*s* = displacement in metres, *u* = starting velocity, *a* = acceleration, *t* = time)

* 1. Find *s* if ***u* =** **2** m/s, ***t* = 3** s, ***a* = 6** m/s2
	2. Find *s* if ***u* = 0** m/s, ***t* = 10** s, ***a* = 4** m/s2
	3. Find *s* if ***u* = -2** m/s, ***t* = 5** s, ***a* = 2** m/s2
	4. Find *s* if ***u* = 10** m/s, ***t* = 4** s, ***a* = -3** m/s2
1. The kinetic energy of a moving object is given by$ E=\frac{1}{2}mv^{2}$ where:
* *E* = the kinetic energy of the object in J (Joules)
* *m* = the mass of the object in kg
* *v* = the speed of the object in m/s
	1. Find the energy of an object with mass 20 kg which is moving at 5m/s
	2. An object has a speed of 6 m/s and a kinetic energy of 72 J. What is its mass?
	3. An object has a mass of 5 kg and a kinetic energy of 40 J. How fast is it moving?
	4. **Challenge:** Two objects have the same kinetic energy. One has a mass of 2 kg and the other has a mass of 8 kg. Which one is fastest? How many times faster is it moving?
1. **Hard!** Newton’s universal law of gravitation states that $F=\frac{Gmn}{r^{2}}$ where F = the force in newtons (N) between two bodies where:
* *G* = Newton’s constant (= 6.673 x 10-11)
* *m* and *n* = mass of the two bodies
* *r* = distance between the two bodies

It is known that:

* The mass of the Earth (*m*) is 5.972 x 1024 kg
* The mass of the sun (*n*) is 1.989 x 1030 kg
* The distance from the Earth to the sun (*r*) is 1.496 x 1011 m

Calculate the gravitational force between the Earth and the sun.