

04 Simultaneous Equations

Eddie has just bought a new pen and his friend Pete would also like one, but Eddie can't remember how much it cost. He does remember that he bought the pen and ruler for £2.20.

Writing this information in algebra gives:

$$p + r = 220$$

This does not help Pete to work out the cost of the pen as there are too many values of p and r which would fit the equation.

Fiona then remembers that she bought two of the same type of pen and a ruler for £3.50.

Pete can now work out the cost of the pen:

$$p + r = 220$$

$$2p + r = 350$$

The extra pen which Fiona bought must have cost $(350 - 220)$ pence, i.e. 130 pence

Therefore the pen cost £1.30 and the ruler 90 pence.

If an equation has two unknown values (variables), it cannot be solved on its own. Two variables require two equations which are solved at the same time i.e. simultaneously. Three variables would require three simultaneous equations etc.

To solve a pair of simultaneous equations the method of elimination is used.

Example – Solve the equations:

$$4x + 3y = 24 \quad (1)$$

$$2x - 6y = 18 \quad (2)$$

The only difference between the left hand sides of the two equations is that equation (1) has $2x$ more, which must be balanced by the extra 6 on the right hand side.

Subtracting equation (2) from equation (1) gives:

$$\begin{array}{r} 4x + 3y = 24 \\ -(2x + 3y = 18) \\ \hline \end{array}$$

$$2x = 6$$

$$x = 3$$

The value of y can be found by substituting the value of x into one of the equations.

Substitute $x = 3$ into (2):

$$2 \times 3 + 3y = 18$$

$$6 + 3y = 18$$

$$3y = 12$$

$$y = 4$$

The solution is $x = 3, y = 4$.