# Simultaneous Equations

**UNIT 2.1: Graphical Method**

Write the table of values for both x an y then graph them on graph paper.You would be able to a get the coordinate of the intersection of the two equations.

**UNIT 2.2: Substitution Method**

A familiar example that you will come across will be as follow.
Marcus bought 7 pens and 9 pencils for $39.
Tim bought 3 pens and 2 pencils for $13.
What is the price of 1 pen and 1 pencil respectively?

In Marcus' problem, let the price of pens be $x$ and the price of pencils be $y$,

$$7x + 9y = 39 \rightarrow (1)$$
$$3x + 2y = 13 \rightarrow (2)$$

Make $x$ the subject of the equation in terms of $y$.

$$3x + 2y = 13$$
$$3x = 13 - 2y$$
$$x = \frac{13 - 2y}{3} \rightarrow (3)$$

Substitute (3) into (1), we have

$$7\left(\frac{13 - 2y}{3}\right) + 9y = 39$$
$$7(13 - 2y) + 27y = 117$$
$$91 - 14y + 27y = 117$$
$$13y = 26$$
$$y = 2$$

Substitute $y = 2$ into (1), we have

$$x = \frac{13 - 2(2)}{3}$$
$$x = 3$$

**UNIT 2.3 : Elimination Method**

In this method, we try to "eliminate" one of the variables by a series of operations.

Let us look at Marcus' problem again, letting the price of pens be x and the price of pencils be y,

$$7x + 9y = 39 \rightarrow (1)$$
$$3x + 2y = 13 \rightarrow (2)$$

Instead of substituting one equation into another, we need to eliminate one variable fully.

Multiplying (1) by 2 **throughout**, we have $14x + 18y = 78 \rightarrow (3)$

Multiplying (2) by 9 **throughout**, we have $27x + 18y = 117 \rightarrow (4)$

Which if we do (4)-(3) we have 13x = 117-78

We can then solve for x which equals to 39

We can then use x value to substitute in equation 1 7(39) + 9y = 39

We can then solve for y which equals to -26