## CHAPTER SIX

## SIMULTANEOUS EQUATIONS

\* In simultaneous equation, one may be given two equations, containing two unknown variables.

\* To solve these equations simultaneously means that you must determine a set of values for these unknown variables, such that when these values are substituted into any of the two equations in turn, each will be satisfied.
\* Different methods such as the elimination method, the substitution method

or the graphical method can be applied.

(Q1) Solve the equations given simultaneously

a + b = 10

a - b = 4

N/B

- (1) Let the first equation be equation (1) and the second one be equation (2).
- (2) Ensure that the second letters or the unknown variables of each of the

equations (i.e. the b in 'this case) are of the same value.

- (3) Ensure also that one of the signs is positive while the other is negative.
- (4) When all these conditions have been satisfied, the two equations are added up.

$$\frac{\text{Solution}}{a + b = 10 - \text{---equation (1)}}$$
$$a - b = 4 - \text{----equation (2)}$$

Since each b has the same value as the other one, and we have both the positive as well as the negative signs being available, we add them together.

i.e.

a + b =10 -----equation (1)

+<u>a - b = 4</u>-----equation (2)

<u>2a = 14</u>

**1 |** P a g e

N/B: When positive b is added to negative b, we get 0 for which there is no need to indicate.

In order to find the value of b, substitute or put a = 7 into either equation (1) or equation (2).

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Substituting a = 7 into eqn. (1)
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$$\Rightarrow$$
 a + b = 10

$$\therefore$$
 7 + b = 10

 $\Rightarrow b = 10 - 7 = 3 \Rightarrow b = 3.$ 

N/B: The values a = 7 and b = 3 when substituted into either equation (1) or equation (2) must satisfy or balance it.

i.e. a + b = 10 -----eqn (1)  $\Rightarrow 7 + 3 = 10$   $\Rightarrow 10 = 10.$ Also a - b = 4-----eqn (2)  $\Rightarrow 7 - 3 = 4$   $\Rightarrow 4 = 4.$ (Q2) Solve the following equations simultaneously x + y = 3 and x - y = -1.<u>Soln</u> Let x + y = 3 .....eqn (1) And x - y = -1..... eqn (2)

Adding the two equations up

$$\Rightarrow x + y = 3$$

$$+ x - y = -1$$

$$2x = 2$$

$$\therefore 2x = 2 \Rightarrow x = 2/2 = 1$$

 $\therefore 2 \ x = 2 \Rightarrow x = 2/2 = 1.$ Substitute x = 1 into eqn (1) to find the value of y i.e.  $x + y = 3 \Rightarrow 1 + y = 3,$  $\Rightarrow y = 3 - 1 \Rightarrow y = 2.$ 

The values of x and y which satisfy simultaneously the two given equations are

x = 1 and y = 2.

N/B: The above method used is referred to as the elimination method.

The same question could have been solved, using the substitution method, which is illustrated next:

$$x + y = 3 \dots \text{eqn } (1)$$

$$x - y = -1 \dots \text{eqn } (2)$$
From eqn (1) ,  $x + y = 3$ 

$$\Rightarrow x = 3 - y$$
. Substitute  $x = 3 - y$  into eqn (2)
i.e  $x - y = -1 \Rightarrow$ 

$$(3 - y) - y = -1, \Rightarrow 3 - y - y = -1,$$

$$\therefore 3 - 2y = -1 \Rightarrow -2y = -1 - 3,$$

$$\Rightarrow -2y = -4 \Rightarrow \frac{-2y}{-2} = \frac{-4}{-2'},$$

$$\Rightarrow y = 2.$$

Substitute y = 2 into eqn (1) to find x, i.e.  $x + y = 3 \Rightarrow x + 2 = 3$ ,  $\Rightarrow x = 3 - 2$   $\Rightarrow x = 1$ . (Q3) Solve the following equations simultaneously: p + 2q = 12 p - q = 3Soln

Let p + 2q = 12 .....eqn (1) and p - q = 3 .....eqn (2)

N/B: Considering these two equations, the values of q are not the same, or equal.

- In order to make them equal, 2 is used to multiply through eqn. 2 (i.e p - q = 3)

- Multiplying through eqn (2) by 2

 $\Rightarrow 2 \times p - 2 \times q = 2 \times 3$ 

 $\therefore 2p - 2q = 6$  .....eqn (3)

After multiplying through an equation with any number, it changes into another equation

-For this reason, eqn (2) changes into eqn (3) after using 2 to multiply through it.

- We now consider equation (1) and equation (3)

i.e.

p + 2q = 12 .....eqn(1)

Since each q has the same value as the other one, with both the negative and positive signs being present, we add them up.

i.e. p + 2q = 12+ 2p - 2q = 6  $\frac{3p = -18}{3p = 18}$   $3p = 18 \Rightarrow p = \frac{18}{3} = 6$ . Substitute p = 6 into eqn (2) i.e. p - q = 3,  $\Rightarrow 6 - q = 3$ ,  $\therefore 6 - 3 = q \Rightarrow q = 3$ .

The required answer is p = 6 and q = 3.