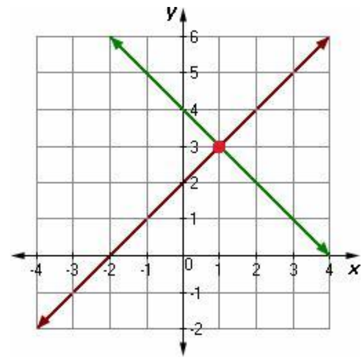
Lesson 9 – *Systems of Linear Equations-Solving using the Elimination Method*



When neither equations have one variable isolated (ie. either y=____ or x=____) we can use the Elimination method to solve the a system of linear equations.

Remember, the goal is to have an equation with one variable only in order to solve for that variable (either x or y).

Therefore, in order to use the elimination method we must have the oppposite coefficient for one variable (ie same number one positive and one negative). Then we can add the two (transformed) equations together and eliminate one variable.

Ex. $\boldsymbol{x_C - 5y_C = 1}$ $\boldsymbol{-3x_D + 10y_D = 2}$

Since the coefficient of $\boldsymbol{x_C}$ is **1** and the coefficient of $\boldsymbol{x_D}$ is **-3**, then we can simply multiply the first equation by **3** and eliminate $\boldsymbol{x}$ **:**

$$3(\boldsymbol{x_C - 5y_C = 1}) \quad \rightarrow \quad \boldsymbol{3x - 15y = 3}$$

Note: You must multiply ALL of the equation by 3.

Therefore we add the two equations :

$$\begin{array}{r} \boldsymbol{3x - 15y = 3} \\ \underline{\underline{\boldsymbol{-3x + 10y = 2}}} \\ \boldsymbol{-5y = 5} \end{array}$$

Now solve for $\boldsymbol{y}$: $\boldsymbol{y = -1}$

Using either of the original equations find $\boldsymbol{x}$ given the value of $\boldsymbol{y}$ just found:

$$\boldsymbol{x_C - 5y_C = 1}$$

$$\boldsymbol{x_C - 5(-1) = 1}$$

$$\boldsymbol{x_C + 5 = 1}$$

$$\boldsymbol{x_C = -4}$$

Check using the other equation:

$$-3x_D + 10y_D = 2$$
$$-3(-4) + 10(-1) = 2?$$
$$12 - 10 = 2$$
$$2 = 2 \quad \surd$$

Therefore the solution to this system is $(\mathbf{-4, -1})$

For some systems we may need to transform both equations. The choice as to which variable to eliminate is yours.

Ex. $\quad 5x_C + 3y_C = -3 \qquad\qquad 3x_D + 2y_D = -1$

In this case we could choose either variable to eliminate. If we choose to eliminate $\boldsymbol{x}$ we could multiply the first equation by 3 and the second by -5, thereby having 15 and -15 as coefficients of $\boldsymbol{x}$**.** If we choose to eliminate $\boldsymbol{y}$ we could multiply the first equation by 2 and the second by -3, to get 6 and -6 as coefficients of $\boldsymbol{y}$**.**

If we choose the to eliminate $\boldsymbol{y}$**:**

$$2(5x_C + 3y_C = -3) \qquad\qquad -3(3x_D + 2y_D = -1)$$
$$10x_C + 6y_C = -6 \qquad\qquad -9x_D - 6y_D = 3$$

We then add the two transformed equations:

$$10x_C + 6y_C = -6$$
$$\underline{\underline{-9x_D - 6y_D = 3}}$$
$$x \qquad = -3$$

Using either of the original equations find $\boldsymbol{x}$ given the value of $\boldsymbol{y}$ just found:

$$5x_C + 3y_C = -3$$

$$5(-3) + 3y_C = -3$$

$$-15 + 3y_C = -3$$

$$3y_C = 12$$

$$y = 4$$

Therefore the solution to this system is $(\mathbf{-3,\ 4})$