9.2 Systems of Linear Equations

To solve Systems of Linear Equations we will use the method of ***Elimination*** first learned (usually) in Grade 10, but we will extend the ideas to techniques required for systems in $\mathbb{R}^3$. Before getting to those techniques, it may be useful to recall what is meant by "linear equation".

Solving a System of Linear Equations

Consider the system $\left(\text{in } \mathbb{R}^2\right)$

$$\begin{aligned} ax + by &= c \\ dx + ey &= f \end{aligned}$$

Note: This system (two equations in 2 unknowns) is either:

Pictures:

Example 9.2.1

Solve the system

$$3x + 2y = 5$$
$$-6x - 4y = -10$$

Note: We will be using what we call **Elementary Row Operations** to solve our systems of equations. An **ERO** allows us to construct an **equivalent system** which is "easy" to solve.

ERO's are:

- Interchanging rows
- Multiplying/Dividing rows by a constant
- Adding/Subtracting one row from another

Definition 9.2.1 (*note that this is a basic definition*)

A **parameter** is a measurable factor which defines a "particular" mathematical object.

For example, in the function $f(x) = a(x-h)^2 + k$,

Example 9.2.2

Solve the system

$$2x + y - 2z = 1$$
$$x + 2y - 5z = 2$$

Note that the two equations to the left represent **planes** and solving the system is equivalent to finding the intersection of the two planes.

Example 9.2.3

Solve the system

$$2x + y - z = 6$$
$$x - y + 2z = -1$$
$$3x + 2y + 3z = 5$$

Goal: Using **ERO's** we want to construct an equivalent system which looks like:

Notes: 1) If after using ERO's our system has a row which looks like:

2) If after using ERO's we have a row which looks like:

Class/Homework for Section 9.2

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