**System of Linear Equations**

**A system of linear equations** is a set of two or more linear equations involving the same set of variables. The goal is to find values for the variables that satisfy all equations simultaneously.

General form of a linear equation

A linear equation in two variable (x,y) can be written as

where a1, b1,c1 are constants.

For a system with n variables(x1,x2,….,xn) the system consists of n equations.

**Types of solutions to a system of linear equations**

* Unique solutions (consistent and independent)

There is exactly one solution that satisfies all equations. Graphically the lines intersect at exactly one point

* No solution (inconsistent)

The system is inconsistent if the equations represent parallel line that never intersect.

* Infinite solutions (consistent and dependent)

If the equations represent the same line (they are multiples of each other) there are infinitely many solutions. The system is dependent meaning one equation can be derived from the other.

Solving a system of linear equations

1. **Substitution method** – solve one equation for one variable and substitute that into the other equations. This reduces the system to fewer variables making it easier to solve.
2. **Elimination (Addition) method**- multiply equations if necessary to make the coefficients of one variable the same then add or subtract the equations to eliminate that variable.
3. **Matrix Method (linear algebra)** represents the system as a matrix equations

Where A is the matrix of coefficients

X is the column vectors of unknown

B is the column vector of constant

1. **Gaussian Elimination** – convert the system of equations into an upper triangular matrix using row operations.
2. **Cramer’s rule-** This is a formula for solving system of linear equations with as many equations as unknowns using determinants. It is applicable only when the coefficient matrix is square and non- singular.