When we have a set of linear equations, we say that we have a system of linear equations. In general this can have n unknowns and m equations.

$$\begin{cases} x+y+t=0 \\ x-y-t=2 \end{cases}$$

In this case n=3 and m=2, since we have 3 unknowns (x,y,t) and only 2 equations.

The most general way of writing a system is the following:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \ldots + a_{1n}x_n = b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + \ldots + a_{2n}x_n = b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + \ldots + a_{3n}x_n = b_3 \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ a_{m1}x_1 + a_{m2}x_2 + a_{m3}x_3 + \ldots + a_{mn}x_n = b_m \end{cases}$$

Where a are coefficients, x are the unknowns (there are n) and b are the constant terms (there are m). In general n and m are not the same number, being possible to find n>m or n<m.

It is important to notice that when the system has few unknowns, or, when n is small, the unknowns are usually named using different letters (x,y,t,z,…) instead of using the subscripts.

Also, if all the b terms are zero, the system is said to be homogeneous.

Systems of equations are also called equivalent systems if they have the same solutions.

An alternative way of writing systems of equations is by writing the coefficient matrix as follows:

$$\begin{pmatrix} a_{11} & a_{12} & \ldots & a_{1n} & b_1 \\ a_{21} & a_{22} & \ldots & a_{2n} & b_2 \\ \ldots & \ldots & \ldots & \ldots & \ldots \\ a_{m1} & a_{m2} & \ldots & a_{mn} & b_m \end{pmatrix}$$

(Normally we will have to re-write the system in a matrix form to be able to use the usual resolution methods).

In general we will classify the systems of equations depending on whether they have solutions or not, and if so, they can have a unique solution or infinite solutions.

The classification will be as follows:

1. INCOMPATIBLE system: It has no solution
2. COMPATIBLE system:
    - Compatible determinate (one unique Solution)
    - Compatible indeterminate (Infinite solutions)