A **matrix** is a rectangular array of numbers enclosed by square brackets (plural of matrix is matrices).

The numbers in a matrix are called the **elements** (or members) of the matrix. The number of **rows** (horizontal) and **columns** (vertical) determine the **dimensions** of the matrix.

A matrix with ***m*** rows and ***n*** columns is called a matrix whose dimensions are ***m x n*** (rows before columns: RC Cola...).

We use capital letters for the name of a matrix and subscripts for the dimensions of the matrix.

A matrix with 2 rows and 3 columns may be written as:

$$A_{2x3}$$

Here are some examples of matrices:

$$\begin{bmatrix} 3 & -10 & \frac{1}{2} \end{bmatrix} \quad \begin{bmatrix} 6 \\ 2 \end{bmatrix} \quad \begin{bmatrix} 1 & -1 \\ 0 & 5 \end{bmatrix}$$

A_{1x3} B_{2x1} C_{2x2}

$$\begin{bmatrix} 9 & 1 & 0 \\ 0 & 3 & 2 \end{bmatrix}$$

D_{2x3}

What are the dimensions of the matrices listed above?

A **square matrix** is a matrix that has the same number of rows and columns.

A **zero matrix** is a matrix where all the elements are zeros.

Ex 1) Write a zero matrix with 2 rows and 4 columns. Name this matrix E.

$$E_{2x4} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Two matrices are equal if and only if (iff):
1) they have the same dimensions, and
2) the elements in all corresponding positions are equal.

For example:

$$\begin{bmatrix} 5 & 7 & \pi \\ \frac{7}{8} & \sqrt{2} & -10 \end{bmatrix} = \begin{bmatrix} 5 & 7 & \pi \\ \frac{7}{8} & \sqrt{2} & -10 \end{bmatrix}$$

Ex 2) Find the value of each variable (solve for x and y).

$$\begin{bmatrix} x+5 & -1 \\ 4 & 6 \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ 4 & 3y \end{bmatrix}$$

Since the matrices are equal, the elements in corresponding positions must be equal, therefore, we can solve as follows:

(I) $x+5=2$

$-5 \quad -5$

$x = -3$

(II) $\frac{3y}{3} = \frac{6}{3}$

$y=2$

An ***m x n*** matrix, where ***m*** and ***n*** are positive integers, is an array in for form that follows.
(We can also refer to the elements in a matrix by their row and column position using subscripts as shown below.)

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix}$$