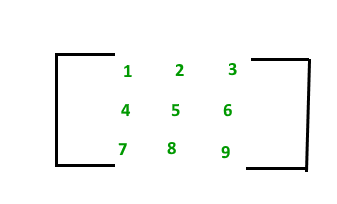
***Introduction to Matrix***

A **matrix** represents a collection of numbers arranged in order of rows and columns. It is necessary to enclose the elements of a matrix in parentheses or brackets.  
  
A matrix with 9 elements is shown below:  
  
The above Matrix M has 3 rows and 3 columns. Each element of matrix [M] can be referred to by its row and column number. For example, a23 = 6  
  
**Order of a Matrix :** The order of a matrix is defined in terms of its number of rows and columns.

Order of a matrix = No. of rows × No. of columns

Therefore, Matrix [M] is a matrix of order 3 × 3.

**Transpose of a Matrix**

The transpose [M]T of an **m x n** matrix [M] is the n x m matrix obtained by interchanging the rows and columns of [M].  
  
Transpose of a matrix A is defined as:

if A= [aij] mxn:

then AT = [bij] nxm where bij = aji

For Example, transpose of matrix M, MT will be:

M = 1 2 3

4 5 6

7 8 9

**MT**  = 1 4 7

2 5 8

3 6 9

**Properties of transpose of a matrix:**

* (AT)T = A
* (A+B)T = AT + BT
* (AB)T = BTAT

**Properties of Matrix addition and multiplication:**

1. A+B = B+A (Commutative)
2. (A+B)+C = A+ (B+C) (Associative)
3. AB ≠ BA (Not Commutative)
4. (AB) C = A (BC) (Associative)
5. A (B+C) = AB+AC (Distributive)

**Terminologies**

* **Square Matrix:** A square Matrix has as many rows as it has columns. i.e. no of rows = no of columns.
* **Symmetric matrix:** A square matrix is said to be symmetric if the transpose of original matrix is equal to its original matrix. i.e. (AT) = A.
* **Skew-symmetric:** A skew-symmetric (or antisymmetric or antimetric[1]) matrix is a square matrix whose transpose equals its negative.i.e. (AT) = -A.
* **Diagonal Matrix:**A diagonal matrix is a matrix in which the entries outside the main diagonal are all zero. The term usually refers to square matrices.
* **Identity Matrix:**A square matrix in which all the elements of the principal diagonal are ones and all other elements are zeros.Identity matrix is denoted as I.
* **Orthogonal Matrix:** A matrix is said to be orthogonal if AAT = ATA = I.
* **Idemponent Matrix:** A matrix is said to be idemponent if A2 = A.
* **Involutary Matrix:** A matrix is said to be Involutary if A2 = I.
* **Singular Matrix**: A square matrix is said to be singular matrix if its determinant is zero i.e. |A|=0
* **Nonsingular Matrix**: A square matrix is said to be non-singular matrix if its determinant is non-zero.

**Note**: Every Square Matrix can uniquely be expressed as the sum of a symmetrix matrix and skew symmetric matrix. A = 1/2 (AT + A) + 1/2 (A - AT).  
  
  
**Trace of a matrix:** trace of a matrix is denoted as tr(A) which is used only for square matrix and equals the sum of the diagonal elements of the matrix. For example:  
