

Matrices

A system of mn numbers (real or complex) arranged in rectangular array in m horizontal lines (called rows) and n vertical lines (called columns) is called an $m \times n$ matrix and to be read as m by n matrix.

An $m \times n$ matrix is usually written as

$$\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1m} \\ a_{21} & a_{22} & \dots & a_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix}$$

The symbol a_{ij} represents any entry a_{ij} lies in the i th row (from left) and j th column (from top).

Types of Matrices:

1) Row Matrix:

If a matrix has only one row and any number of columns is called row matrix.

e.g. $[4 \ 5 \ 6]$ is a row matrix of order 1×3 .

2) Column Matrix:

If a matrix has only one column and any number of rows is called column matrix.

e.g. $\begin{bmatrix} 2 \\ 5 \\ 6 \\ 7 \end{bmatrix}$ is a column matrix of order 4×1

3) Square Matrix:

A matrix is said to be a square matrix, if it has number of rows equal to number of columns.

e.g.
$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$
 is a square matrix of order 3.

4) Diagonal Matrix:

A square matrix is called diagonal matrix, if all its non-diagonal elements are zero.

e.g.
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 6 \end{bmatrix}$$
 is a diagonal matrix.

5) Scalar Matrix:

A diagonal matrix is called scalar matrix, if all the non-diagonal elements are equal to zero and all the diagonal elements are equal to a scalar say k .

e.g.
$$\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$
 is a scalar matrix.

6) Unit or Identity Matrix:

A square matrix is said to be unit or identity matrix, if all the diagonal elements are equal to unity and non-diagonal elements are zero.

e.g.
$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 etc. are unit matrices.

7) Null Matrix or Zero Matrix:

A matrix is said to be null matrix or zero matrix, if all the elements are zero.

e.g. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, $\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$, $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ etc. are null matrices.

8) Horizontal Matrix:

A matrix is said to be horizontal matrix, if the number of columns are more than the number of rows.

e.g. $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$ is a horizontal matrix.

9) Vertical Matrix:

A matrix is said to be vertical matrix, if the number of rows are more than number of columns.

e.g. $\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ is a vertical matrix.

10) Sub-Matrix:

A matrix which is obtained from a given matrix by deleting any number of rows or columns is called a sub-matrix of the given matrix.

e.g. $\begin{bmatrix} 1 & 2 & 5 \\ 6 & 7 & 8 \end{bmatrix}$ is a sub-matrix of $\begin{bmatrix} 1 & 2 & 5 \\ 6 & 7 & 8 \\ 3 & 5 & 6 \end{bmatrix}$