UNIT : 1

* Basics ideas about Matrices :-

$$A \quad \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ a_{14} \\ \vdots \\ a_n \end{bmatrix}$$

$\longleftrightarrow$ Row

$\updownarrow$ column

→ I is Number of Row then Multiplie by Number of column like 3 x 3
No Row : No column

* Examples :-

* find out the order of following matiere

1) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \Rightarrow A = \begin{Bmatrix} 2 \text{ Row} \\ 3 \text{ column} \end{Bmatrix} \Rightarrow A = 2$

2) $A = \begin{bmatrix} 1 & 2 \\ 4 & 5 \\ 6 & 7 \end{bmatrix} \Rightarrow$ 3 Row, 2 column $\Rightarrow A = 3 \times 2$

3) $A = \begin{bmatrix} 1 & 9 & 4 \\ 7 & 8 & 8 \\ 5 & 6 & 0 \end{bmatrix} \Rightarrow$ 3 Row, 3 column $\Rightarrow A = 3 \times 3$

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4) $A = \begin{bmatrix} -1 & 4 & 5 \\ 6 & 8 & -7 \end{bmatrix} \Rightarrow$ 2 Row, 3 column $\Rightarrow$ $A = 2 \times 3$

5) $A = \begin{bmatrix} -1 \\ 8 \\ 9 \\ 6 \end{bmatrix} \Rightarrow$ 4 Row, 1 column $\Rightarrow$ $A = 4 \times 1$

6) $A = \begin{bmatrix} 9 & 8 & 7 & 6 \end{bmatrix} \Rightarrow$ 1 Row, 4 column $\Rightarrow$ $A = 1 \times 4$

7) $A = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \end{bmatrix} \Rightarrow$ 1 Row, 5 column $\Rightarrow$ $A = 1 \times 5$

8) $A = \begin{bmatrix} 9 & 4 & 7 & 1 & 0 \\ 8 & 6 & 8 & 0 & 0 \end{bmatrix} \Rightarrow$ 2 Row, 5 column $\Rightarrow$ $A = 2 \times 5$

* **Addition of Two Matrices :-**

1) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ $B = \begin{bmatrix} 0 & 0 & 0 \\ 8 & 9 & 2 \end{bmatrix}$

$A + B = \underset{2 \times 3}{\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}} + \underset{2 \times 3}{\begin{bmatrix} 0 & 0 & 0 \\ 8 & 9 & 2 \end{bmatrix}}$

$= \underset{2 \times 3}{\begin{bmatrix} 1 & 2 & 3 \\ 12 & 14 & 8 \end{bmatrix}}$

Conditions :-

1) Supose we have Two Matrices Namly A and B
(A and B should be Must in Capital)
and Then we can add Two Matrices A and B only if the Order of A is same as the Order of B.
→ Order of A and B Must be same. like row and column of A is 2 x 3 so B is Must be same like A.

Find out the addition of Matrices :-

1) $A = \begin{bmatrix} 1 \\ 9 \\ 8 \end{bmatrix}$ $B = \begin{bmatrix} 7 & 8 & 6 \end{bmatrix}$

⇒ Matrices is Not possible because of order A and B is not same that's why Matrices of Addition is not possible.

2) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 0 & 8 & 0 \end{bmatrix}$. $B = \begin{bmatrix} 9 & 8 & 1 \\ 9 & 5 & 0 \\ -1 & -1 & 2 \end{bmatrix}$

$$A + B = \underset{3 \times 3}{\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 0 & 8 & 0 \end{bmatrix}} + \underset{3 \times 3}{\begin{bmatrix} 9 & 8 & 1 \\ 4 & 5 & 0 \\ -1 & -1 & 2 \end{bmatrix}}$$

$$A + B = \begin{bmatrix} 1 & 4 & 8 \\ 9 & 5 & 7 \end{bmatrix}_{2\times 3} + \begin{bmatrix} 7 & 8 & 6 \\ 4 & 0 & 0 \end{bmatrix}_{2\times 3}$$

$$= \begin{bmatrix} 8 & 12 & 14 \\ 13 & 5 & 7 \end{bmatrix}_{2\times 3}$$

4) $A = \begin{bmatrix} 9 \\ 8 \\ 7 \end{bmatrix}$ $B = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$

$$A + B = \begin{bmatrix} 9 \\ 8 \\ 7 \end{bmatrix}_{3\times 1} + \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}_{3\times 1}$$

$$= \begin{bmatrix} 8 \\ 9 \\ 7 \end{bmatrix}_{3\times 1}$$

5) $A = \begin{bmatrix} 8 \\ 0 \\ 4 \end{bmatrix}$ $B = \begin{bmatrix} -1 \\ 1 \\ 8 \end{bmatrix}$

$$A + B = \begin{bmatrix} 8 \\ 0 \\ 4 \end{bmatrix}_{3\times 1} + \begin{bmatrix} -1 \\ 1 \\ 8 \end{bmatrix}_{3\times 1}$$

$$= \begin{bmatrix} 7 \\ 1 \\ 12 \end{bmatrix} \quad 3\times 1$$

6) $A = \begin{bmatrix} -1 & -1 & 0 \end{bmatrix}$ $\quad B = \begin{bmatrix} 7 & 8 & 0 \end{bmatrix}$

$$A + B = \begin{bmatrix} -1 & -1 & 0 \end{bmatrix} + \begin{bmatrix} 7 & 8 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 7 & 0 \end{bmatrix} \quad 1\times 3$$

7) $A = \begin{bmatrix} 7 & 4 \\ 8 & 1 \\ 0 & 8 \end{bmatrix}$ $\quad B = \begin{bmatrix} 8 & 9 \\ 0 & 0 \\ 4 & 6 \end{bmatrix}$

$$A + B = \begin{bmatrix} 7 & 4 \\ 8 & 1 \\ 0 & 8 \end{bmatrix} + \begin{bmatrix} 8 & 9 \\ 0 & 0 \\ 4 & 6 \end{bmatrix}$$

$$= \begin{bmatrix} 15 & 13 \\ 8 & 1 \\ 4 & 14 \end{bmatrix} \quad 3\times 2$$

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8) $A = \begin{bmatrix} 1 & 9 & 8 \\ 4 & 5 & 6 \\ 0 & 0 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 9 & 8 & 0 \\ 0 & 0 & 4 \\ 5 & 0 & 0 \end{bmatrix}$

$C = \begin{bmatrix} 1 & 8 & 1 \\ 4 & 6 & 7 \\ 5 & 6 & 6 \end{bmatrix}$ $D = \begin{bmatrix} 0 & 0 & 0 \\ 8 & 1 & 0 \\ 0 & 0 & -8 \end{bmatrix}$

$= A + B + C + D =$

$$\begin{bmatrix} 1 & 9 & 8 \\ 4 & 5 & 6 \\ 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 9 & 8 & 0 \\ 0 & 0 & 4 \\ 5 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 8 & 1 \\ 4 & 6 & 7 \\ 5 & 6 & 6 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ 8 & 1 & 0 \\ 0 & 0 & -8 \end{bmatrix}$$

$$= \begin{bmatrix} 11 & 25 & 9 \\ 16 & 12 & 17 \\ 10 & 6 & -2 \end{bmatrix}_{3 \times 3}$$

Defination of Matrices :-

→ The system of $M \times n$ numbers arrange with the form of an order set of m defined line horizontal line called rows, and N vartical line calld columns is called an $m \times n$ matrices this order is called matrices.

$$\begin{matrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{matrix}$$

Rules :-

Matrics are genrally dinoted by capital Later.
Elements are genrally dinoted by corrospoonding smalls later.

Order of Matrics :

We say a Matrics A is of order $m \times n$ if the matrics A has "m" number of row and "n" numbers of column,

Example :-

$A = \begin{bmatrix} 1 & 8 & 9 \\ 7 & 6 & 4 \end{bmatrix}$, order of A = $\underline{2 \times 3}$

$A = \begin{bmatrix} 1 \\ 8 \\ 9 \\ 0 \end{bmatrix}$, order of A = $\underline{4 \times 1}$

$A = \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix}$ order of A = $\underline{1 \times 4}$

* Types of Matrix :-

1) Ractangular Matrics :-

→ Any $m \times n$ matrics where $m \neq n$ is called a Rectangular Matrics.
→ m value and n value is not same that's called Ractangular Matrics.

Example:

$A = \begin{bmatrix} 1 & 8 & 9 \\ 7 & 6 & 4 \end{bmatrix}$ Order of $A = \underline{2 \times 3}$

$A = \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix}$ order of $A = \underline{1 \times 4}$

$A = \begin{bmatrix} 1 & 1 & 1 & 2 \\ 1 & 4 & 2 & 5 \\ 1 & 1 & 1 & 2 \end{bmatrix}$ $A = \underline{3 \times 4}$

$A = \begin{bmatrix} 1 \\ 8 \\ -7 \end{bmatrix}$ $A = \underline{3 \times 1}$

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2) Column matrics :-

→ a matrics A is said to be column matrics if the matrics A has only 1 column.

Example :

$A = \begin{bmatrix} 1 \\ 8 \end{bmatrix} \rightarrow A = \underline{2 \times 1}$

$A = \begin{bmatrix} 1 \\ -1 \\ 1 \\ 2 \end{bmatrix} \rightarrow A = \underline{4 \times}$

$A = \begin{bmatrix} 1 \\ 4 \\ 9 \end{bmatrix} \rightarrow A = \underline{3 \times 1}$

3) Row Matrics :-

a Matrics A is said to be row matrics if the matrics A has only 1 row.

Example :

$A = [1 \; 9 \; 4 \; 2] \rightarrow A = \underline{1 \times 4}$

$A = [1 \; 2 \; 3] \rightarrow A = \underline{1 \times 3}$

$A = [2 \; 5 \; 6 \; 7 \; 8] \rightarrow A = \underline{1 \times 5}$

$A = [2 \; 3] \rightarrow A = \underline{1 \times 2}$

4) Square Matrix :-

→ We say a matrix A is of type square m if the matrix number of rows and column both are equal is called square matrics.

→ Example :

$$A = \begin{bmatrix} 1 & 9 \\ 4 & 4 \end{bmatrix} \rightarrow A = \underline{2 \times 2}$$

$$A = \begin{bmatrix} 1 & 2 & 5 \\ 4 & 3 & 6 \\ 9 & 4 & 7 \end{bmatrix} \rightarrow A = \underline{3 \times 3}$$

$$A = \begin{bmatrix} 5 & 7 \\ 2 & 4 \end{bmatrix} \rightarrow A = \underline{2 \times 2}$$

$$A = \begin{bmatrix} 1 & 9 & 4 & 2 \\ 5 & 8 & 4 & 2 \\ 4 & 1 & 2 & 3 \\ 9 & 4 & 6 & 2 \end{bmatrix} \rightarrow A = \underline{4 \times 4}$$

5) Diagonal Matrics :-

→ It is a square Matrics in which all non ~~digit~~ diagonal elements are 0 (zero)

Example :-

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \rightarrow A = \underline{3 \times 3}$$

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \rightarrow A = \underline{2 \times 2}$$

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \rightarrow A = \underline{3 \times 3}$$

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \rightarrow A = \underline{3 \times 3}$$

6) Zero Null Matrix :-

→ A matrix is said to be zero matrix if every elements of matrix is zero.

→ Example:-

1) $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

4) $\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ 5) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ 6) $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

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7) Scalar Matrix :

→ A Daigonal matrix in which all Daigonal elements all are equal it's call a scalar Matrix.

→ In a Scalar Matrix Daigonal values are equal (same).

→ Example :

1) $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ 2) $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ 3) $\begin{bmatrix} -2 & 0 & 0 & 0 \\ 0 & -2 & 0 & 0 \\ 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & -2 \end{bmatrix}$

4) $\begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix}$ 5) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

8) Identity Or Units Matrix :-

→ A scalar matrix, in which all daigonal elements are equal to 1 it's called Identity or Units Matrix.

→ Example :

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

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* Transpose of Matrix :-

→ The Matrix of from any given matrix A by changing it's row into it's corrosponding column it's called the transpose Matrix it's is dinoted by a (A'). If (A) is an m × n matrix, then (A') will be an n × m matrix.

→ In simple way changin Row into column and column in to row.

→ Here's an example :-

1) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times3} \Rightarrow A' = \begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}_{3\times2}$

2) $A = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}_{3\times1} \Rightarrow A' = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}_{1\times3}$

3) $A = \begin{bmatrix} 1 & 5 & 4 \\ 3 & 2 & 9 \\ 1 & 5 & 6 \\ 8 & 6 & 7 \end{bmatrix}_{4\times3} \Rightarrow A' = \begin{bmatrix} 1 & 3 & 1 & 8 \\ 5 & 2 & 5 & 6 \\ 4 & 9 & 6 & 7 \end{bmatrix}_{3\times4}$

* Find the transpose cost following matrices.

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Example :-

1) $A = \begin{bmatrix} 1 & 8 & 9 & 4 \end{bmatrix}_{1\times4} \Rightarrow A' = \begin{bmatrix} 1 \\ 8 \\ 9 \\ 4 \end{bmatrix}_{4\times1}$

2) $A = \begin{bmatrix} 1 \\ -1 \\ 8 \end{bmatrix}_{3\times1} \Rightarrow A' = \begin{bmatrix} 1 & -1 & 8 \end{bmatrix}_{1\times3}$

3) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times3} \Rightarrow A' = \begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}_{3\times2}$

4) $A = \begin{bmatrix} 9 & 8 \\ 7 & 6 \\ 3 & 4 \end{bmatrix}_{3\times2} \Rightarrow A' = \begin{bmatrix} 9 & 7 & 3 \\ 8 & 6 & 4 \end{bmatrix}_{2\times3}$

5) $A = \begin{bmatrix} 1 & -1 & 8 & 4 & 9 \end{bmatrix}_{1\times5} \Rightarrow A' = \begin{bmatrix} 1 \\ -1 \\ 8 \\ 4 \\ 9 \end{bmatrix}_{5\times1}$

6) $A = \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix}_{1\times4} \Rightarrow A' = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}_{4\times1}$

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7) $A = \begin{bmatrix} 1 & -18 & 0 & 4 \end{bmatrix}_{1\times4} \Rightarrow A' = \begin{bmatrix} 1 \\ -18 \\ 0 \\ 4 \end{bmatrix}_{4\times1}$

8) $A = \begin{bmatrix} 9 \\ 8 \\ 0 \end{bmatrix}_{3\times1} \Rightarrow A' = \begin{bmatrix} 9 & 8 & 0 \end{bmatrix}_{1\times3}$

9) $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}_{3\times3} \Rightarrow A' = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}_{3\times3}$

10) $A = \begin{bmatrix} 7 & 8 & 4 \\ 5 & 9 & 8 \end{bmatrix}_{2\times3} \Rightarrow A' = \begin{bmatrix} 7 & 5 \\ 8 & 9 \\ 4 & 8 \end{bmatrix}_{3\times2}$

* Matrix Operations :-

1) Addition of Two Matrices :- Or Substraction

→ The addition or substraction of Two Matrices is possible only when This matrices have the same order.

→ That is Matrices must have the same number of row & column.

→ The sum of difference of Matrices this often by adding or substracting element of the given matrices

Example of Addition :-

1) $A = \begin{bmatrix} 1 & 2 \\ 3 & 9 \end{bmatrix}_{2\times 2}$ & $B = \begin{bmatrix} 9 & 8 \\ 7 & 4 \end{bmatrix}_{2\times 2}$

Ans : $A + B = \begin{bmatrix} 10 & 10 \\ 10 & 13 \end{bmatrix}_{2\times 2}$

2) $A = \begin{bmatrix} 9 & 8 & 7 & 4 \end{bmatrix}_{1\times 4}$ & $B = \begin{bmatrix} 7 & 8 & 9 & 4 \end{bmatrix}$

$A + B = \begin{bmatrix} 9 & 8 & 7 & 4 \end{bmatrix} + \begin{bmatrix} 7 & 8 & 9 & 4 \end{bmatrix}$

Ans = $A + B = \begin{bmatrix} 16 & 16 & 16 & 8 \end{bmatrix}_{2\times 4}$

3) $A = \begin{bmatrix} 9 & 8 \end{bmatrix}_{1\times 2}$ & $B = \begin{bmatrix} -1 & -1 \end{bmatrix}_{1\times 2}$

$A + B = \begin{bmatrix} 9 & 8 \end{bmatrix} + \begin{bmatrix} -1 & -1 \end{bmatrix}$

Ans = $A + B = \begin{bmatrix} 8 & 7 \end{bmatrix}_{1\times 2}$

Example of Subtraction :-

1) $A = \begin{bmatrix} 1 & 2 \\ 3 & 9 \end{bmatrix}$ & $B = \begin{bmatrix} 9 & 8 \\ 7 & 4 \end{bmatrix}$

$A - B = \begin{bmatrix} 1 & 2 \\ 3 & 9 \end{bmatrix} - \begin{bmatrix} 9 & 8 \\ 7 & 4 \end{bmatrix}$

Ans : $A - B = \begin{bmatrix} -8 & -6 \\ -4 & 5 \end{bmatrix}_{2 \times 2}$

2) $A = \begin{bmatrix} 9 & 8 & 7 & 4 \end{bmatrix}$ & $B = \begin{bmatrix} 7 & 8 & 9 & 4 \end{bmatrix}$

$A - B = \begin{bmatrix} 9 & 8 & 7 & 4 \end{bmatrix} - \begin{bmatrix} 7 & 8 & 9 & 4 \end{bmatrix}$

Ans : $A - B = \begin{bmatrix} 2 & 0 & -2 & 0 \end{bmatrix}_{1 \times 4}$

3) $A = \begin{bmatrix} 9 & 8 \end{bmatrix}$ & $B = \begin{bmatrix} -1 & -1 \end{bmatrix}$

$A - B = \begin{bmatrix} 9 & 8 \end{bmatrix} - \begin{bmatrix} -1 & -1 \end{bmatrix}$

Ans = $A - B \begin{bmatrix} 10 & 9 \end{bmatrix}_{1 \times 2}$

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* Matrix Multiplication :-

→ Part 1 : Scalar Multiplication :

Explination

if $A = [a_{ij}]$

$1 \leq i \leq n$

$1 \leq j \leq n$

$$\begin{matrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & a_{n3} & & a_{nn} \end{matrix}$$

if $A = [a_{ij}]$ is any Matrix of order $m \times n$ and K is any scalar then the Multiplication KA this often by simply multipliying each element of A by the scalar KA that is $KA = [Ka_{ij}]$.

Example :

1) Let $A = \begin{bmatrix} 2 & 4 \\ 6 & 8 \end{bmatrix}$ then $5A = \begin{bmatrix} 10 & 20 \\ 30 & 40 \end{bmatrix}$

2) Let $A = \begin{bmatrix} 2 & 4 \\ 6 & 8 \end{bmatrix}$ then $2A = \begin{bmatrix} 4 & 8 \\ 12 & 16 \end{bmatrix}$

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Part 2: Matrix Multiplication.

In order to multiply 2 Matrices, the number of columns in the first (1) Matrix must equal to (=) the number of rows in the second (2) Matrix.

Order: $A_{m \times p}$ $B_{q \times r}$
Row column row column

$p = q$ (must be same).

* Order is $AB_{m \times r}$ (Last matrix Order)

Let AB A matrix of order $m \times p$ and B a matrix of order $p \times r$ then the multiplication of 2 matrices A and B is possible and the final Order of the matrix AB is $m \times r$.

Example:

1) Let $A = \begin{bmatrix} 2 & 4 & 6 \\ 1 & 0 & 0 \end{bmatrix}_{2\times 3}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}_{3 \times 2}$

then multiplication of AB can be done in the following way.

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$$\begin{bmatrix} 2 & 4 & 6 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 2(1) + 4(0) + 6(1) & 2(0) + 4(1) + 6(1) \\ 1(1) + 0(0) + 0(1) & 1(0) + 0(1) + 0(1) \end{bmatrix}$$

Order	2 4 6	→	1 0 1
	1 0 0	→	1 0 1
	2 4 6	→	0 1 1
	1 0 0	→	0 1 1

Explination of this Matrix

$$\text{Ans} = \begin{bmatrix} 8 & 10 \\ 1 & 0 \end{bmatrix}_{2\times 2} \quad (m \times n)$$

2) Let $A = \begin{bmatrix} 8 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$

Find $AB = ?$

$$= \underset{2\times 3}{\begin{bmatrix} 8 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}} \underset{3\times 2}{\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}}$$

$$= \begin{bmatrix} 8(1) + 0(0) + 0(1) & 8(0) + 0(1) + 0(1) \\ 0(1) + 1(0) + 1(1) & 0(0) + 1(1) + 1(1) \end{bmatrix}$$

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$$= \begin{bmatrix} 8+0+0 & 0+0+0 \\ 0+0+1 & 0+1+1 \end{bmatrix}$$

$$\text{Ans} = \begin{bmatrix} 8 & 0 \\ 1 & 2 \end{bmatrix}_{2\times 2}$$

3) $A = \begin{bmatrix} 1 & 8 \\ 9 & 4 \\ 6 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$

$$= \begin{bmatrix} 1 & 8 \\ 9 & 4 \\ 6 & 1 \end{bmatrix}_{3\times 2} \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}_{2\times 2}$$

$$= \begin{bmatrix} 1(2)+8(2) & 1(2)+8(2) \\ 9(2)+4(2) & 9(2)+4(2) \\ 6(2)+1(2) & 6(2)+1(2) \end{bmatrix}$$

$$= \begin{bmatrix} 2+16 & 2+16 \\ 18+8 & 18+8 \\ 12+2 & 12+2 \end{bmatrix}$$

$$\text{Ans} = \begin{bmatrix} 18 & 18 \\ 26 & 26 \\ 14 & 14 \end{bmatrix}_{3\times 2} (m\times n)$$

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4) $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}_{2\times 2}$ $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}_{2\times 2}$

$= \begin{bmatrix} 1(1) + 0(3) & 1(2) + 0(4) \\ 0(1) + 1(3) & 0(2) + 1(4) \end{bmatrix}$

$= \begin{bmatrix} 1 + 0 & 2 + 0 \\ 0 + 3 & 0 + 4 \end{bmatrix}$

$= \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ 2×2

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5) $A = \begin{bmatrix} 1 & 0 \\ 8 & 4 \\ 9 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 4 \\ 8 & 6 \end{bmatrix}$

$\begin{bmatrix} 1 & 0 \\ 8 & 4 \\ 9 & 2 \end{bmatrix}_{3\times 2}$ $\begin{bmatrix} 1 & 4 \\ 8 & 6 \end{bmatrix}_{2\times 2}$

$= \begin{bmatrix} 1(1) + 0(8) & 1(4) + 0(6) \\ 8(1) + 4(8) & 8(4) + 4(6) \\ 9(1) + 2(8) & 9(4) + 2(6) \end{bmatrix}$

$$= \begin{bmatrix} 1 + 0 & 4 + 0 \\ 8 + 32 & 32 + 24 \\ 9 + 16 & 36 + 12 \end{bmatrix}$$

Ans = $\begin{bmatrix} 1 & 4 \\ 40 & 56 \\ 25 & 48 \end{bmatrix}$ 3×2

(i) If

$A = \begin{bmatrix} 1 & 1 \\ -2 & 4 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 & 1 \\ -2 & 4 & -2 \end{bmatrix}$

$$\underset{3 \times 2}{\begin{bmatrix} 1 & 1 \\ -2 & 4 \\ 3 & 2 \end{bmatrix}} \quad \underset{2 \times 3}{\begin{bmatrix} 2 & 4 & 1 \\ -2 & 4 & -2 \end{bmatrix}}$$

$$= \begin{bmatrix} 1(2) + 1(-2) & 1(4) + 1(4) & 1(1) + 1(-2 \\ -2(2) + 4(-2) & -2(4) + 4(4) & -2(1) + 4(-2 \\ 3(2) + 2(-2) & 3(4) + 2(4) & 3(1) + 2(- \end{bmatrix}$$

$$= \begin{bmatrix} 2 + (-2) & 4 + 4 & 1 + (-2) \\ (-4) + (-8) & (-8) + 16 & (-2) + (-8) \\ 6 + (-4) & 12 + 8 & 3 + (-4) \end{bmatrix}$$

Ans = $\begin{bmatrix} 0 & 8 & -1 \\ -12 & 8 & -10 \\ 2 & 20 & -1 \end{bmatrix}$ 3×3

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7) $A = \begin{bmatrix} 2 & 4 & 5 \\ 2 & -1 & -1 \\ 3 & -1 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 3 & -2 & 4 \\ 2 & -2 & 1 \\ 4 & 5 & 2 \end{bmatrix}$

Find AB & BA

$$AB = \begin{bmatrix} 2 & 4 & 5 \\ 2 & -1 & -1 \\ 3 & -1 & 2 \end{bmatrix} \begin{bmatrix} 3 & -2 & 4 \\ 2 & -2 & 1 \\ 4 & 5 & 2 \end{bmatrix}$$

3×3 3×3

$$= \begin{bmatrix} 2(3)+4(2)+5(4) & 2(-2)+4(-2)+5(5) & 2(4)+4(1)+5(2) \\ 2(3)+-1(2)+-1(4) & 2(-2)+-1(-2)+-1(5) & 2(4)+-1(1)+-1(2) \\ 3(3)+-1(2)+2(4) & 3(-2)+-1(-2)+2(5) & 3(4)+-1(1)+2(2) \end{bmatrix}$$

$$= \begin{bmatrix} 6+8+20 & (-4)+(-8)+25 & 8+4+10 \\ 6+(-2)+(-4) & (-4)+(-2)+(-5) & 8+(-1)+(-2) \\ 9+(-2)+8 & (-6)+(-2)+10 & 12+(-1)+4 \end{bmatrix}$$

$B * A \quad B = \begin{bmatrix} 3 & -2 & 4 \\ 2 & -2 & 1 \\ 4 & 5 & 2 \end{bmatrix} \quad A = \begin{bmatrix} 2 & 4 & 5 \\ 2 & -1 & -1 \\ 3 & -1 & 2 \end{bmatrix}$

$$BA = \underset{3\times 3}{\begin{bmatrix} 3 & -2 & 4 \\ 2 & -2 & 1 \\ 4 & 5 & 2 \end{bmatrix}} \quad \underset{3\times 3}{\begin{bmatrix} 2 & 4 & 5 \\ 2 & -1 & -1 \\ 3 & -1 & 2 \end{bmatrix}}$$

$$= \begin{bmatrix} 3(2) + -2(2) + 4(3) & 3(4) + -2(-1) + 4(-1) & 3(5) + -2(-1) + 4(2) \\ 2(2) + -2(2) + 1(3) & 2(4) + -2(-1) + 1(-1) & 2(5) + -2(-1) + 1(2) \\ 4(2) + 5(2) + 2(3) & 4(4) + 5(-1) + 2(-1) & 4(5) + 5(-1) + 3(2) \end{bmatrix}$$

$$= \begin{bmatrix} 6 + (-4) + 12 & 12 + (-2) + (-4) & 15 + (-2) + 8 \\ 4 + (-4) + 3 & 8 + (-2) + (-1) & 10 + (-2) + 2 \\ 8 + 10 + 6 & 16 + (-5) + (-2) & 20 + (-5) + 6 \end{bmatrix}$$

$$Ans = \underset{3\times 3}{\begin{bmatrix} 14 & 6 & 21 \\ 3 & 5 & 10 \\ 24 & 9 & 21 \end{bmatrix}}$$