Addition & Subtraction of Matrices

$A = 3, \quad B = 5$

$$A + B = 3 + 5 = 8 //$$

Matrix Addition

Rule 1: If we need to add two (or) More Matrices means that will have the same order. $(m = n)$

Rule 2: While adding two matrices only element by element addition is possible.

In general $A = [a_{ij}]_{m \times n}$ & $B = [b_{ij}]_{m \times n}$ then the matrix solution for the addition of A & B will be

$$A + B \longrightarrow C_{ij} = [c_{ij}]_{m \times n}$$

$$A = \begin{bmatrix} 3 & -1 \\ 2 & 6 \end{bmatrix}_{2 \times 2}, \quad B = \begin{bmatrix} 1 & 0 \\ 6 & 7 \end{bmatrix}_{2 \times 2} \quad \& \quad C = \begin{bmatrix} 6 & 12 \\ -1 & -2 \end{bmatrix}, \quad D = \begin{bmatrix} 1 & 0 \\ 3 & 2 \\ 6 & 4 \end{bmatrix}$$

$$A + B = \begin{bmatrix} 3 & -1 \\ 2 & 6 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 6 & 7 \end{bmatrix} = \begin{bmatrix} 3+1 & -1+0 \\ 2+6 & 6+7 \end{bmatrix} = \begin{bmatrix} 4 & -1 \\ 8 & 13 \end{bmatrix}_{2 \times 2}$$

$A + D$ (or) $B + D$ (or) $C + D \longrightarrow$ That is not a valid operation

order of $A = B = C = 2 \times 2$, but order of D is 3×2

$$A = \begin{bmatrix} 6 & 3 \\ 2 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$B - A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 6 & 3 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 1-6 & 0-3 \\ 0-2 & 0-1 \end{bmatrix} = \begin{bmatrix} -5 & -3 \\ -2 & -1 \end{bmatrix}$$

$$A - B = \begin{bmatrix} 6 & 3 \\ 2 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 6-1 & 3-0 \\ 2-0 & 1-1 \end{bmatrix} = \begin{bmatrix} 5 & 3 \\ 2 & 0 \end{bmatrix}$$

$$A + B = \begin{bmatrix} 6 & 3 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 6+1 & 3+0 \\ 2+0 & 1+1 \end{bmatrix} = \begin{bmatrix} 7 & 3 \\ 2 & 2 \end{bmatrix}$$

$$B + A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 6 & 3 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 1+6 & 0+3 \\ 0+2 & 1+1 \end{bmatrix} = \begin{bmatrix} 7 & 3 \\ 2 & 2 \end{bmatrix}$$

Properties (Addition & Subtraction of Matrices)

i) Matrix addition is always commutative $A+B = B+A$, But Matrix Subtraction is not commutative i.e $A-B \neq B-A$.

ii) Matrix addition is associative $A+(B+C) = (A+B)+C$

$$A = \begin{bmatrix} 3 & 0 \\ 2 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 2 \\ 6 & 2 \end{bmatrix}, \quad C = \begin{bmatrix} 6 & 0 \\ 2 & 1 \end{bmatrix}$$

$$B+C = \begin{bmatrix} 1+6 & 2+0 \\ 6+2 & 1+2 \end{bmatrix} = \begin{bmatrix} 7 & 2 \\ 8 & 3 \end{bmatrix}; \quad A+B = \begin{bmatrix} 3+1 & 0+2 \\ 2+6 & 2+1 \end{bmatrix} = \begin{bmatrix} 4 & 2 \\ 8 & 3 \end{bmatrix}$$

$$A+(B+C) = \begin{bmatrix} 3 & 0 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} 7 & 2 \\ 8 & 3 \end{bmatrix} = \begin{bmatrix} 10 & 2 \\ 10 & 4 \end{bmatrix}; \quad (A+B)+C = \begin{bmatrix} 4 & 2 \\ 8 & 3 \end{bmatrix} + \begin{bmatrix} 6 & 0 \\ 2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 10 & 2 \\ 10 & 4 \end{bmatrix}$$

iii) Cancellation law of matrix

$$A + B = A + C$$

where $B = C$ then only the cancellation law holds for the matrix.