①

Examples of Addition Matrices:

Ex-① If $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}_{2\times 2}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}_{2\times 2}$

Then $A + B = ?$

Sol:- Matrix A and B are conformable for addition because both matrices have same order or dimension (i.e 2×2)

$$\therefore A + B = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} + \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 1+5 & 2+6 \\ 3+7 & -4+8 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 8 \\ 10 & 4 \end{bmatrix}_{2\times 2}$$

Ex-② If $A = \begin{bmatrix} -3 & 2 \\ 5 & -7 \end{bmatrix}_{2\times 2}$ and $B = \begin{bmatrix} -8 & 9 \end{bmatrix}_{1\times 2}$

Then $A + B = ?$

Sol:- Matrix A and B are not conformable for addition, because both matrices have not same order or dimension (i.e A matrix is 2×2 and B matrix is 1×2 order or dimension)

Ex-③

If $A = \begin{bmatrix} 5 & 1 & 6 \\ 2 & 4 & 8 \\ 7 & 3 & 1 \end{bmatrix}_{3\times3}$ and $B = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 2 & 3 \\ 0 & 2 & 1 \end{bmatrix}_{3\times3}$

then find $A+B$.

Sol^n:- Matrix A and B are conformable for addition, because both matrices have same order or dimension (i.e 3×3).

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

$$= \begin{bmatrix} 5+2 & 1+3 & 6+4 \\ 2+1 & 4+2 & 8+3 \\ 7+0 & 3+2 & 1+1 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 4 & 10 \\ 3 & 6 & 11 \\ 7 & 5 & 2 \end{bmatrix}_{3\times3}$$

The commutative and associative laws can be stated as follows:

$A+B = B+A$ commutative law

Ex-① Given $A = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 2 \\ 3 & 4 \end{bmatrix}$ Then

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

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

$\therefore A+B = B+A$ Ans.

Associative law :- $(A+B)+C = A+(B+C)$

Proof :- Given $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$

$$C = \begin{bmatrix} 2 & 3 \\ 7 & 8 \end{bmatrix}$$

$$\therefore A+B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 1+5 & 2+6 \\ 3+7 & 4+8 \end{bmatrix} = \begin{bmatrix} 6 & 8 \\ 10 & 12 \end{bmatrix}$$

$$(A+B)+C = \begin{bmatrix} 6 & 8 \\ 10 & 12 \end{bmatrix} + \begin{bmatrix} 2 & 3 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 6+2 & 8+3 \\ 10+7 & 12+8 \end{bmatrix} = \begin{bmatrix} 8 & 11 \\ 17 & 20 \end{bmatrix}$$

$$(B+C) = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} + \begin{bmatrix} 2 & 3 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 5+2 & 6+3 \\ 7+7 & 8+8 \end{bmatrix} = \begin{bmatrix} 7 & 9 \\ 14 & 16 \end{bmatrix}$$

$$A+(B+C) = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} 7 & 9 \\ 14 & 16 \end{bmatrix} = \begin{bmatrix} 1+7 & 2+9 \\ 3+14 & 4+16 \end{bmatrix} = \begin{bmatrix} 8 & 11 \\ 17 & 20 \end{bmatrix}$$

$\therefore (A+B)+C = A+(B+C)$ ☺

Substraction for Matrices :- A and B matrices are said to conformable for Substraction, if and only if they have the same number of rows and columns (i.e they have the same order or dimension) then the Substraction of matrices A and B. It is written as $A-B$.

Ex-① If $A = \begin{bmatrix} 2 & 3 & -2 \\ 1 & 6 & 8 \end{bmatrix}_{2\times3}$ and $B = \begin{bmatrix} -1 & 7 & -2 \\ 3 & 5 & 4 \end{bmatrix}_{2\times3}$

Then $A - B = ?$

Sol^{n}:- Both matrices have same order i.e 2×3, so they are conformable for substraction

$$A - B = \begin{bmatrix} 2 & 3 & -2 \\ 1 & 6 & 8 \end{bmatrix} - \begin{bmatrix} -1 & 7 & -2 \\ 3 & 5 & 4 \end{bmatrix} = \begin{bmatrix} 2-(-1) & 3-7 & -2-(-2) \\ 1-3 & 6-5 & 8-4 \end{bmatrix}$$

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

Ex-2 If $A = \begin{bmatrix} 2 & 0 \\ 3 & 1 \\ 5 & 6 \end{bmatrix}_{3\times2}$ and $B = \begin{bmatrix} 4 & -7 \\ 6 & -9 \end{bmatrix}_{2\times2}$

then $A - B = ?$

Sol^{n}:- The matrices A and B are not conformable for substraction, because they have not same order (i.e the order of A matrix is 3×2 and the order B matrix is 2×2).