OPERATIONS WITH MATRICES

(I) Addition

If Matrix A and B have same size or order

$$A + B = [a_{ij}] + [b_{ij}] = [a_{ij} + b_{ij}] = [c_{ij}]$$

Example 01: find the sum $\begin{bmatrix} 2 & 3 & 4 \\ 6 & 0 & -1 \end{bmatrix}$ & $\begin{bmatrix} 0 & 3 & -2 \\ -1 & 1 & 2 \end{bmatrix}$

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 6 & 0 & -1 \end{bmatrix}_{2\times 3} ; \quad B = \begin{bmatrix} 0 & 3 & -2 \\ -1 & 1 & 2 \end{bmatrix}_{2\times 3}$$

$$A + B = \begin{bmatrix} 2+0 & 3+3 & 4+(-2) \\ 6+(-1) & 0+1 & -1+2 \end{bmatrix} = \begin{bmatrix} 2 & 6 & 2 \\ 5 & 1 & 1 \end{bmatrix} = [c_{ij}]$$

(II) Subtraction

If Matrix A and B have same size or order

$$A - B = [a_{ij}] - [b_{ij}] = [a_{ij} - b_{ij}] = [c_{ij}]$$

Example 02:

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 6 & 0 & -1 \end{bmatrix} ; \quad B = \begin{bmatrix} 0 & 3 & -2 \\ -1 & 1 & 2 \end{bmatrix}$$

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

$$= \begin{bmatrix} 2-0 & 3-3 & 4-(-2) \\ 6-(-1) & 0-1 & -1-2 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 0 & 6 \\ 7 & -1 & -3 \end{bmatrix} = [c_{ij}]$$

(3)

Multiplication of two matrixes:

If A and B are two matrices, the product of AB is defined as

Number of columns of A is equal to number of row B

$A_{2\times3}$; $B_{3\times2}$

AB ⇒ A: 2×3, B: 3×2 (same) then AB possible

$A_{2\times3}$; $B_{2\times3}$

A: 2×3, B: 2×3 ✗ — AB ≠ Not possible

Q:1 (a) A+B (b) A − B (c) 3A (d) 5A − 2B

where $A = \begin{bmatrix} 2 & 1 & 1 \\ -1 & -1 & 4 \end{bmatrix}_{2\times3}$; $B = \begin{bmatrix} 2 & -3 & 4 \\ -3 & 1 & -2 \end{bmatrix}_{2\times3}$

KD = Scalar

Sol: (K)A → scalar

(c) K = 3 ⇒ 3A = ?

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

$$= \begin{bmatrix} 6 & 3 & 3 \\ -3 & -3 & 12 \end{bmatrix}$$

5) $A - 2B = ?$

$$5\begin{bmatrix} 3 & 1 & 1 \\ -1 & -1 & 4 \end{bmatrix} - 2\begin{bmatrix} 2 & -1 & 4 \\ -3 & 1 & -2 \end{bmatrix} = \begin{bmatrix} 10 & 5 & 5 \\ -5 & -5 & 20 \end{bmatrix} - \begin{bmatrix} 4 & -6 & 8 \\ -6 & 8 & -4 \end{bmatrix}$$

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

$$= \begin{bmatrix} 6 & 11 & -3 \\ 1 & -7 & 24 \end{bmatrix}$$

a) $AB = ?$

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

A: 3×2

B: 3×3

AB is not possible.

b)

$$A = \begin{bmatrix} -1 & 3 \\ 4 & -5 \\ 0 & 1 \end{bmatrix}_{3\times 2}; \quad B = \begin{bmatrix} 1 & 2 \\ 0 & 7 \end{bmatrix}_{2\times 2}$$

A: 3×2

B: 2×2

$$AB = \begin{bmatrix} -1 & 3 \\ 4 & -5 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 0 & 7 \end{bmatrix} = \begin{bmatrix} -1(1)+3(0) & -1(2)+3(7) \\ 4(1)+-5(0) & 4(2)+-5(7) \\ 0(1)+1(0) & 0(2)+1(7) \end{bmatrix}$$

$$= \begin{bmatrix} -1+0 & -2+21 \\ 4+0 & 8-35 \\ 0+0 & 0+14 \end{bmatrix} = \begin{bmatrix} -1 & 19 \\ 4 & -27 \\ 0 & 14 \end{bmatrix}$$