DATE
PAGE No.

# Chapter 7

## Matrices

Ex.

1. Find the orders of each of the following matrices.

a) $\begin{pmatrix} 5 & 8 \end{pmatrix}$

→ $1 \times 2$

b) $\begin{pmatrix} 2 \\ 5 \\ -8 \end{pmatrix}$

→ $3 \times 1$

c) $\begin{bmatrix} -1 & 5 & 9 \\ 4 & 0 & -3 \end{bmatrix}$ $\begin{bmatrix} 3 & 0 \\ -7 & 8 \end{bmatrix}$

→ $2 \times 2$

→

d) $\begin{bmatrix} -1 & 5 & 9 \\ 4 & 0 & -3 \end{bmatrix}$

→ $2 \times 3$

e) $\begin{bmatrix} 3 & 4 \\ -5 & 8 \\ 6 & -2 \end{bmatrix}$

→ $3 \times 2$

f) $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 5 \\ 6 & 8 & -7 \end{bmatrix}$

→ $3 \times 3$

2. State the type of matrix.

a) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

→ Null matrix

b) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ → Identity matrix

c) $\begin{bmatrix} 3 \\ -4 \end{bmatrix}$

→ Column matrix

d) $(-9 \quad 0 \quad 6)$

→ Row matrix

e) $\begin{bmatrix} 7 & 4 \\ 2 & 3 \\ -5 & 8 \end{bmatrix}$

→ Rectangular matrix

f) $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$

→ Square matrix

3. (a) If $A = \begin{bmatrix} 4 & -2 \\ -3 & 5 \end{bmatrix}$, list the elements of first row and the elements of second column.

→ First row = 4, -2
Second column = -2, 5

b) If $A = \begin{bmatrix} 3 & 4 & 3 \\ 7 & -6 & -1 \end{bmatrix}$, list the elements of second row and the elements of third column.

→ Second row = 7, -6, -1
Third column = 3, -1

c) If $A = \begin{bmatrix} 2 & 3 & -5 \\ -1 & 5 & 8 \end{bmatrix}$ find $a_{13}, a_{22}$ and $a_{23}$.

→ Soln, Here,

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 3 & -5 \\ -1 & 5 & 8 \end{bmatrix}$$

Now,
$a_{13} = -5$, $a_{22} = 5$ and $a_{23} = 8$

d) If $B = \begin{bmatrix} 7 & 6 \\ -5 & 3 \\ 0 & 2 \end{bmatrix}$ find $b_{12}, b_{21}$ and $b_{32}$.

→ Soln,

Here,

$$B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \\ b_{31} & b_{32} \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ -5 & 3 \\ 0 & 2 \end{bmatrix}$$

Now,

$b_{12} = 6$, $b_{21} = -5$ and $b_{32} = 2$.

4. (a) Construct a row matrix of order $1 \times 3$.

→ Soln, Here,

Order of matrix = $1 \times 3$, so

No. of rows = 1

No. of columns = 3

→

The required Row matrix = $(1\ 5\ 2)$

b) Construct a matrix of order 3×2.

→ Soln,

Here,

Order of matrix = 3×2, so

No. of rows = 3 & No. of columns = 2

Now,

The required 3×2 matrix = $\begin{bmatrix} 1 & 2 \\ -6 & 5 \\ 3 & 4 \end{bmatrix}$

c) Construct a 2×2 square matrix.

→ Soln,

Here,

Order of matrix = 2×2, so

No. of row = 2 & No. of columns = 2

Now,

The required square matrix = $\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$

d) Construct a square matrix of order 3.

→ Soln,
Here,
Order of Matrix = 3×3
No. of rows = 3 & No. of columns = 3
Now,
The required square matrix = $\begin{bmatrix} 1 & -8 & 3 \\ 4 & -2 & 6 \\ -7 & 5 & -9 \end{bmatrix}$

5. a) If $\begin{bmatrix} 2 & 3 \\ -1 & a-1 \end{bmatrix} = \begin{bmatrix} b+2 & 3 \\ -1 & 1 \end{bmatrix}$; find a & b.

→ Soln, Here,

$$\begin{bmatrix} 2 & 3 \\ -1 & a-1 \end{bmatrix} = \begin{bmatrix} b+2 & 3 \\ -1 & 1 \end{bmatrix}$$

As corresponding elements are equal,

$a-1 = +1$ | $b+2 = 3$
or, $a = 1+1$ | or, $b = 3-2$
∴ $a = 2$ | ∴ $b = 1$

∴ a & b are 2 & 1 respectively.

b) If $\begin{bmatrix} 6 & a+2 & 3 \\ -1 & 1 & 5 \end{bmatrix} = \begin{bmatrix} 6 & 3 & b-1 \\ -1 & c+3 & 5 \end{bmatrix}$

find a, b and c.

→ Soln,

Here,

$$\begin{bmatrix} 6 & a+2 & 3 \\ -1 & 1 & 5 \end{bmatrix} = \begin{bmatrix} 6 & 3 & b-1 \\ -1 & c+3 & 5 \end{bmatrix}$$

As corresponding elements are equal,

| | | |
|---|---|---|
| $a+2=3$ | $3=b-1$ | $5=c+3$ $1=c+3$ |
| or, $a=3-2$ | or, $3+1=b$ | or, $5-3=c$ or, $1-3=c$ |
| ∴ $a=1$ | or, $4=b$ | or, $2=c$ or, $-2=c$ |
| | ∴ $b=4$ | ∴ $c=2$ ∴ $c=-2$ |

∴ a, b, & c are 1, 4 and -2 respectively.

6 (a) Construct a 2×2 square matrix whose elements are given by $a_{ij} = i+j$.

→ Soln,

Let $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ be the required 2x2 matrix.

$a_{ij} = i + j$

$a_{11} = 1+1 = 2$

$a_{12} = 1+2 = 3$

$a_{21} = 2+1 = 3$

$a_{22} = 2+2 = 4$

$\therefore A = \begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix}$

b) Construct a 2X2 square matrix whose elements are given by $a_{ij} = ij$.

→ Soln,

Let $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ be the required 2x2 matrix.

$a_{ij} = ij$

$a_{11} = 1X1 = 1$ $\quad a_{12} = 1X2 = 2$

$a_{21} = 2X1 = 2$ $\quad a_{22} = 2X2 = 4$

$\therefore A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$

c) Construct a 2×2 square matrix whose elements are given by $a_{ij} = i + 2j$.

→ Soln

Let $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ be the required 2×2 matrix.

$a_{ij} = i + 2j$

$a_{11} = 1 + 2 \times 1$
$= 1 + 2$
$= 3$

$a_{12} = 1 + 2 \times 2$
$= 1 + 4$
$= 5$

$a_{21} = 2 + 2 \times 1$
$= 2 + 2$
$= 4$

$a_{22} = 2 + 2 \times 2$
$= 2 + 4$
$= 6$

$\therefore A = \begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}$

d) Construct a 2X2 square matrix whose elements are given by $a_{ij} = 2i - 3j$.

→ Soln,

Let $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ be the required 2X2 matrix.

$a_{ij} = 2i - 3j$

$a_{11} = 2 \times 1 - 3 \times 1$
$= 2 - 3$
$= -1$

$a_{12} = 2 \times 1 - 3 \times 2$
$= 2 - 6$
$= -4$

$a_{21} = 2 \times 2 - 3 \times 1$
$= 4 - 3$
$= 1$

$a_{22} = 2 \times 2 - 3 \times 2$
$= 4 - 6$
$= -2$

$\therefore A = \begin{bmatrix} -1 & -4 \\ 1 & -2 \end{bmatrix}$

# Matrices

Ex.

1. Find the sum of the matrices in each of the following:

a) $A = (2 \quad 3 \quad 0)$, $B = (1 \quad 2 \quad 6)$

→ Soln, ~~Here~~,

$A = (2 \quad 3 \quad 0)$

$B = (1 \quad 2 \quad 6)$

Now,

$A + B =$

$$A + B = [2\ 3\ 0) + [1\ 2\ 6]$$
$$= [2+1 \quad 3+2 \quad 0+6)$$
$$= [3 \quad 5 \quad 6]$$

→

b) $A = \begin{bmatrix} -3 \\ 2 \\ 0 \end{bmatrix}$ and $B = \begin{bmatrix} 7 \\ 1 \\ 4 \end{bmatrix}$

→ Soln

$$A+B = \begin{bmatrix} -3 \\ 2 \\ 0 \end{bmatrix} + \begin{bmatrix} 7 \\ 1 \\ 4 \end{bmatrix}$$

$$= \begin{bmatrix} -3+7 \\ 2+1 \\ 0+4 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \\ 3 \\ 4 \end{bmatrix}$$

c) $P = \begin{bmatrix} -1 & 2 \\ 7 & 3 \end{bmatrix}$ and $Q = \begin{bmatrix} 9 & 3 \\ -2 & 5 \end{bmatrix}$

→ Soln.

$$P+Q = \begin{bmatrix} -1 & 2 \\ 7 & 3 \end{bmatrix} + \begin{bmatrix} 9 & 3 \\ -2 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} -1+9 & 2+3 \\ 7-2 & 3+5 \end{bmatrix}$$

$$= \begin{bmatrix} 8 & 5 \\ 5 & 8 \end{bmatrix}$$

d) $X = \begin{bmatrix} 2 & 3 \\ 5 & 4 \\ 0 & -3 \end{bmatrix}$, $Y = \begin{bmatrix} -1 & 1 \\ 3 & -2 \\ 6 & 2 \end{bmatrix}$

→ Soln

$$X+Y = \begin{bmatrix} 2 & 3 \\ 5 & 4 \\ 0 & -3 \end{bmatrix} + \begin{bmatrix} -1 & 1 \\ 3 & -2 \\ 6 & 2 \end{bmatrix}$$

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

$$= \begin{bmatrix} 1 & 4 \\ 8 & 2 \\ 6 & -1 \end{bmatrix}$$

2. Redude the following matrices into single matrix.

a) $\begin{bmatrix} 5 & 6 & 4 \\ 3 & 2 & 0 \end{bmatrix} + \begin{bmatrix} -2 & 3 & 5 \\ 0 & 5 & 2 \end{bmatrix}$

→ Soln;

$$\begin{bmatrix} 5 & 6 & 4 \\ 3 & 2 & 0 \end{bmatrix} + \begin{bmatrix} -2 & 3 & 5 \\ 0 & 5 & 2 \end{bmatrix}$$

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

$$= \begin{bmatrix} 3 & 9 & 9 \\ 3 & 7 & 2 \end{bmatrix}$$

b) $\begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix} + \begin{bmatrix} -7 & 8 \\ 2 & -5 \end{bmatrix}$

⇒ Soln;

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

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

$$= \begin{bmatrix} -6 & 10 \\ 6 & 1 \end{bmatrix}$$

c) $\begin{bmatrix} 7 & 3 \\ -4 & 6 \\ 3 & 9 \end{bmatrix} + \begin{bmatrix} -8 & 0 \\ 2 & -4 \\ -1 & 5 \end{bmatrix}$

→ Soln,

$$\begin{bmatrix} 7 & 3 \\ -4 & 6 \\ 3 & 9 \end{bmatrix} + \begin{bmatrix} -8 & 0 \\ 2 & -4 \\ -1 & 5 \end{bmatrix}$$

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

$$= \begin{bmatrix} -1 & 3 \\ -2 & 2 \\ 2 & 14 \end{bmatrix}$$

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

→ Soln

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

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

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

3. Find the differences A-B in each of the following:

a) $A = (5 \quad 8 \quad 3), B = (2 \quad 5 \quad 1)$

→ Soln,

$$A - B = (5 \quad 8 \quad 3) - (2 \quad 5 \quad 1)$$
$$= (5-2 \quad 8-5 \quad 3-1)$$
$$= (3 \quad 3 \quad 2)$$

b) $A = \begin{bmatrix} 7 \\ 8 \\ -1 \end{bmatrix}, B = \begin{bmatrix} 5 \\ 4 \\ 0 \end{bmatrix}$

→ Soln,

$$A - B = \begin{bmatrix} 7 \\ 8 \\ -1 \end{bmatrix} - \begin{bmatrix} 5 \\ 4 \\ 0 \end{bmatrix}$$
$$= \begin{bmatrix} 7-5 \\ 8-4 \\ -1-0 \end{bmatrix}$$
$$= \begin{bmatrix} 2 \\ 4 \\ -1 \end{bmatrix}$$

c) $A = \begin{bmatrix} 3 & 4 \\ 5 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 3 \\ 6 & -2 \end{bmatrix}$

→ Soln,

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

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

$$= \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$$

d) $A = \begin{bmatrix} 3 & -2 & 0 \\ 1 & 4 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & 4 \\ 2 & 7 & -1 \end{bmatrix}$

→ Soln,

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

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

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

4. Reduce the following matrices into single matrix.

a) $\begin{bmatrix} 4 & 3 \\ -1 & 5 \end{bmatrix} - \begin{bmatrix} 0 & 2 \\ 1 & 3 \end{bmatrix}$

→ Soln;

$$\begin{bmatrix} 4 & 3 \\ -1 & 5 \end{bmatrix} - \begin{bmatrix} 0 & 2 \\ 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 4-0 & 3-2 \\ -1-1 & 5-3 \end{bmatrix}$$

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

b) $\begin{bmatrix} 1 & 2 & 3 \\ 8 & 7 & 6 \end{bmatrix} - \begin{bmatrix} 0 & 3 & 2 \\ 5 & -1 & 4 \end{bmatrix}$

→ Soln;

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

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

$$= \begin{bmatrix} 1 & -1 & 1 \\ 3 & 8 & 2 \end{bmatrix}$$

→

5. a) If $A=\begin{bmatrix}3 & 4\\ 5 & 8\end{bmatrix}$, $B=\begin{bmatrix}8 & 3\\ 7 & 1\end{bmatrix}$

i) find $A+B$, $B+A$ and verify that $A+B=B+A$.

-) Soln,

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

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

$$=\begin{bmatrix}11 & 7\\ 12 & 9\end{bmatrix}$$

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

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

$$=\begin{bmatrix}11 & 7\\ 12 & 9\end{bmatrix}$$

To verify, $A+B=B+A$

$\therefore \begin{bmatrix}11 & 7\\ 12 & 9\end{bmatrix}=\begin{bmatrix}11 & 7\\ 12 & 9\end{bmatrix}$

Verified

5(ii) Find A-B, B-A and verify that A-B ≠ B-A.

→ Soln,

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

$$= \begin{bmatrix} 3-8 & 4-3 \\ 5-7 & 8-1 \end{bmatrix}$$

$$= \begin{bmatrix} -5 & 1 \\ -2 & 7 \end{bmatrix}$$

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

$$= \begin{bmatrix} 8-3 & 3-4 \\ 7-5 & 1-8 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & -1 \\ 2 & -7 \end{bmatrix}$$

To verify,

$$A-B \neq B-A$$

$$\therefore \begin{bmatrix} -5 & 1 \\ -2 & 7 \end{bmatrix} \neq \begin{bmatrix} 5 & -1 \\ 2 & -7 \end{bmatrix}$$

Verified #

5(b) If $A = \begin{bmatrix} 1 & 2 & 5 \\ 7 & 0 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 6 \\ 3 & 2 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 2 & 6 \\ -1 & 0 & 5 \end{bmatrix}$; find A+B+C and A-B+C.

Also verify that A+(B+C) = (A+B)+C

→ Soln,

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

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

$$= \begin{bmatrix} 5 & 5 & 17 \\ 9 & 2 & 12 \end{bmatrix}$$

~~A-B+C~~

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

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

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

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

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

To verify, $A+(B+C) = (A+B)+C$

Now,

L.H.S $= A+(B+C)$

$$= \begin{bmatrix} 1 & 2 & 5 \\ 7 & 0 & 3 \end{bmatrix} + \left( \begin{bmatrix} 0 & 1 & 6 \\ 3 & 2 & 4 \end{bmatrix} + \begin{bmatrix} 4 & 2 & 6 \\ -1 & 0 & 5 \end{bmatrix} \right)$$

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

$$= \begin{bmatrix} 1 & 2 & 5 \\ 7 & 0 & 3 \end{bmatrix} + \begin{bmatrix} 4 & 3 & 12 \\ 2 & 2 & 9 \end{bmatrix}$$

$$= \begin{bmatrix} 1+4 & 2+3 & 5+12 \\ 7+2 & 0+2 & 3+9 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & 5 & 17 \\ 9 & 2 & 12 \end{bmatrix}$$

R.H.S $= (A+B)+C$

$$= \left( \begin{bmatrix} 1 & 2 & 5 \\ 7 & 0 & 3 \end{bmatrix} + \begin{bmatrix} 0 & 1 & 6 \\ 3 & 2 & 4 \end{bmatrix} \right) + \begin{bmatrix} 4 & 2 & 6 \\ -1 & 0 & 5 \end{bmatrix}$$

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

$$= \begin{bmatrix} 1 & 3 & 11 \\ 10 & 2 & 7 \end{bmatrix} + \begin{bmatrix} 4 & 2 & 6 \\ -1 & 0 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 1+4 & 3+2 & 11+6 \\ 10-1 & 2+0 & 7+5 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & 5 & 17 \\ 9 & 2 & 12 \end{bmatrix}$$

~~Since~~,

$\therefore$ L.H.S = R.H.S

Verified ≠

6 (a) If $A = (2\ 3\ 7)$, find $A^T$.

→ Soln,

$A = (2\ 3\ 7)$

$\therefore A^T = \begin{bmatrix} 2 \\ 3 \\ 7 \end{bmatrix}$

(b) If $B = \begin{bmatrix} 5 \\ 0 \\ -1 \end{bmatrix}$, find $B^T$.

→ Soln,

$B = \begin{bmatrix} 5 \\ 0 \\ -1 \end{bmatrix}$

$\therefore B^T = [5\ 0\ -1)$

c) If $A = \begin{bmatrix} 1 & 0 & 6 \\ 7 & 3 & -5 \end{bmatrix}$, find $A^T$.

→ Soln,

$$A = \begin{bmatrix} 1 & 0 & 6 \\ 7 & 3 & -5 \end{bmatrix}$$

$$\therefore A^T = \begin{bmatrix} 1 & 7 \\ 0 & 3 \\ 6 & -5 \end{bmatrix}$$

d) If $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ & $B = \begin{bmatrix} 0 & 4 \\ 3 & 2 \end{bmatrix}$, find $A^T$ and $B^T$. Also find (i) $A+A^T$ & $A-A^T$ (ii) $B+B^T$ & $B-B^T$.

→ Soln,

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

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

$$A^T = \begin{bmatrix} 1 & 3 \\ 2 & -4 \end{bmatrix}$$

$$B^T = \begin{bmatrix} 0 & 3 \\ 4 & 2 \end{bmatrix}$$

Now,

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

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

$$A - A^T = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} - \begin{bmatrix} 1 & 3 \\ 2 & -4 \end{bmatrix}$$

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

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

ii) $$B + B^T = \begin{bmatrix} 0 & 4 \\ 3 & 2 \end{bmatrix} + \begin{bmatrix} 0 & 3 \\ 4 & 2 \end{bmatrix}$$

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

$$= \begin{bmatrix} 0 & 7 \\ 7 & 4 \end{bmatrix}$$

$$B - B^T = \begin{bmatrix} 0 & 4 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} 0 & 3 \\ 4 & 2 \end{bmatrix}$$

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

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

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