

Exercise 1.3

Q.1 Which of the following are conformable for addition?

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

$$C = \begin{bmatrix} 1 & 0 \\ 2 & -1 \\ 1 & -2 \end{bmatrix}, \quad D = \begin{bmatrix} 2+1 \\ 3 \end{bmatrix}$$

$$E = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}, \quad F = \begin{bmatrix} 3 & 2 \\ 1+1 & -4 \\ 3+2 & 2+1 \end{bmatrix}$$

Solution:

In the above matrices following matrices are suitable for addition.

- (i) A and E are conformable for addition because their order is same and both are square matrix.
- (ii) B and D are conformable for addition because the order is same i.e. they have two rows and 1 Columns and both are rectangular matrices.
- (iii) C and F are conformable for addition because their order is same i.e. they have three 3 rows and 2 columns and they are a rectangular matrix.

Q.2 Find the additive inverse of the following matrices:

$$(1) \quad A = \begin{bmatrix} 2 & 4 \\ -2 & 1 \end{bmatrix}$$

Solution:

Additive inverse of a matrix is negative matrix.

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

$$-A = -\begin{bmatrix} 2 & 4 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} (-1) \times 2 & (-1) 4 \\ (-1)(-2) & (-1) 1 \end{bmatrix}$$

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

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

$$\text{Solution: } B = \begin{bmatrix} 1 & 0 & -1 \\ 2 & -1 & 3 \\ 3 & -2 & 1 \end{bmatrix}$$

Its additive inverse is

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

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

$$(3) \quad C = \begin{bmatrix} 4 \\ -2 \end{bmatrix}$$

$$\text{Solution: } C = \begin{bmatrix} 4 \\ -2 \end{bmatrix}$$

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

The additive inverse is

$$-C = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$

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

$$\text{Solution: } D = \begin{bmatrix} 1 & 0 \\ -3 & -2 \\ 2 & 1 \end{bmatrix}$$

The additive inverse is

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

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

$$(5) \quad E = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\text{Solution: } E = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

The additive inverse of the given matrix is:

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

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

$$(6) \quad F = \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{2} \end{bmatrix}$$

$$\text{Solution: } F = \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{2} \end{bmatrix}$$

Its additive inverse is

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

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

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

Q.3 If $A = \begin{bmatrix} -1 & 2 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$,
 $C = [1 \ -1 \ 2]$, $D = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 2 \end{bmatrix}$,
then find.

$$(i) \quad A + \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

$$\text{Solution: } A + \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

$$\text{As } A = \begin{bmatrix} -1 & 2 \\ 2 & 1 \end{bmatrix}$$

$$\text{So, } A + \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 2 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

The order of matrix A and the given matrix order is same. So, they can be added easily.

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

$$(ii) \quad B + \begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

$$\text{Solution: } B + \begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

$$\text{As } B = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$\text{So, } B + \begin{bmatrix} -2 \\ 3 \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix} + \begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

The order of both above matrices are same, so, they can be easily added.

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

(iii) $C + [-2 \ 1 \ 3]$

Solution: $C + [-2 \ 1 \ 3]$

$$\text{As } C = \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$$

$$\text{So, } C + [-2 \ 1 \ 3]$$

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

Their orders are same so they can be added

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

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

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

(iv) $D + \begin{bmatrix} 0 & 1 & 0 \\ 2 & 0 & 1 \end{bmatrix}$

Solution: $D + \begin{bmatrix} 0 & 1 & 0 \\ 2 & 0 & 1 \end{bmatrix}$

$$\text{As } D = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 2 \end{bmatrix}$$

$$\text{So, } D + \begin{bmatrix} 0 & 1 & 0 \\ 2 & 0 & 1 \end{bmatrix}$$

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

Their orders are same. So, they can be added.

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

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

(v) $2A$

Solution: $2A$

$$\text{As } A = \begin{bmatrix} -1 & 2 \\ 2 & 1 \end{bmatrix}$$

$$\text{So, } 2A$$

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

(vi) $(-1)B$

Solution: $(-1)B$

$$\text{As } B = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$\text{So, } (-1)B$$

$$= (-1) \times \begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} (-1) \times 1 \\ (-1) \times (-1) \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

(vii) $(-2)C$

Solution: $(-2)C$

$$\text{As } C = \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$$

$$\text{So, } (-2)C$$

$$= (-2) \times \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$$

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

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

(viii) $3D$

Solution: $3D$

$$\text{As } D = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 2 \end{bmatrix}$$

$$\text{So, } 3D$$

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

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

$$= \begin{bmatrix} 3 & 6 & 9 \\ -3 & 0 & 6 \end{bmatrix}$$

(ix) $3C$

Solution: $3C$

$$\text{As } C = \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$$

So, $3C$

$$\begin{aligned} &= (3) \times \begin{bmatrix} 1 & -1 & 2 \end{bmatrix} \\ &= [3 \times 1 \quad 3 \times -1 \quad 3 \times 2] \\ &= [3 \quad -3 \quad 6] \end{aligned}$$

Q.4 Perform the indicated operations and simplify the following:

$$(i) \left(\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix} \right) + \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

$$\text{Solution: } \left(\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix} \right) + \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

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

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

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

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

$$(ii) \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \left(\begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix} - \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \right)$$

Solution:

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

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

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

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

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

$$(iii) [2 \ 3 \ 1] + ([1 \ 0 \ 2] - [2 \ 2 \ 2])$$

Solution:

$$= [2 \ 3 \ 1] + [1-2 \ 0-2 \ 2-2]$$

$$= [2 \ 3 \ 1] + [-1 \ -2 \ 0]$$

$$= [2-1 \ 3-2 \ 1-0]$$

$$= [1 \ 1 \ 1]$$

$$(iv) \begin{bmatrix} 1 & 2 & 3 \\ -1 & -1 & -1 \\ 0 & 1 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$$

Solution:

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

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

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

$$(v) \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 0 & -2 \\ -2 & -1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$$

Solution:

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

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

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

(vi) $\left(\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix} \right) + \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

Solution:

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

$$\begin{aligned} &= \begin{bmatrix} 0 & 2 & 3 \\ 2 & 1 & 4 \\ 2 & 0 & 2 \end{bmatrix} \\ &\quad A+C = C+A \\ &\quad \text{Hence proved} \\ &\quad \text{L.H.S} = \text{R.H.S} \end{aligned}$$

Q.5 For the matrices $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix}$,

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

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

verify the following rules:

(i) $A + C = C + A$

Solutions:

$$\text{L.H.S} = A+C$$

$$\text{R.H.S} = C+A$$

$$\text{LHS} = A+C$$

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

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

$$\text{RHS} = C+A$$

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

(ii) $A + B = B + A$

Solution: $A + B = B + A$

$$\text{L.H.S} = \text{A}+\text{B}$$

$$\text{R.H.S} = \text{B}+\text{A}$$

$$\text{LHS} = \text{A}+\text{B}$$

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

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

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

$$\text{RHS} = \text{B}+\text{A}$$

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

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

$$\begin{bmatrix} 2 & 1 & 4 \\ 4 & 1 & 3 \\ 6 & 0 & 3 \end{bmatrix}$$

$$A+B=B+A$$

Hence proved

$$\text{L.H.S} = \text{R.H.S}$$

(iii) $B + C = C + B$

Solution: $B + C = C + B$

$$\text{L.H.S} = \text{B}+\text{C}$$

$$\text{R.H.S} = \text{C}+\text{B}$$

$$\text{L.H.S} = \text{B}+\text{C}$$

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

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

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

R.H.S = C+B

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

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

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

L.H.S = R.H.S
B+C=C+B
Hence proved

(iv) $A+(B+A)=2A+B$

Solution: $A+(B+A)=2A+B$

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

R.H.S = 2A+B

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

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

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

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

R.H.S = 2A+B

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

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

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

L.H.S = R.H.S
 $A+(B+A)=2A+B$
Hence proved

(v) $(C-B)+A=C+(A+B)$

Solution: $(C-B)+A=C+(A+B)$

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

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

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

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

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

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

RHS = C+(A-B)

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

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

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

L.H.S = R.H.S

$(C-B)+A=C+(A-B)$

Hence proved

(vi) $2A+B=A+(A+B)$

Solution: $2A+B=A+(A+B)$

L.H.S = 2A+B

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

LHS = 2A+B

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

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

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

L.H.S = R.H.S
2A+B=A+(A+B)
Hence proved

(vii) $(C-B)-A = (C-A)-B$

Solution: $(C-B)-A = (C-A)-B$

$$\text{L.H.S} = (C-B)-A$$

$$\text{R.H.S} = (C-A)-B$$

$$\text{LHS} = (C-B)-A$$

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

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

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

$$\text{RHS} = (C-A)-B$$

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

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

L.H.S = R.H.S
 $(C-B)-A = (C-A)-B$
Hence proved

(viii) $(A+B)+C = A+(B+C)$

Solution: $(A+B)+C = A+(B+C)$

$$\text{L.H.S} = (A+B)+C$$

$$\text{R.H.S} = A+(B+C)$$

$$\text{LHS} = (A+B)+C$$

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

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

$$\begin{bmatrix} 1 & 1 & 4 \\ 4 & -1 & 6 \\ 5 & 1 & 5 \end{bmatrix}$$

$$\text{R.H.S} = A+(B+C)$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & -1 & 0 \end{bmatrix} + \left(\begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ 3 & 1 & 3 \end{bmatrix} + \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 3 \\ 1 & 1 & 2 \end{bmatrix} \right)$$

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

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

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

(ix) $A+(B-C)=(A-C)+B$

Solution: $A+(B-C)=(A-C)+B$

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

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

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

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

RHS = $(A-C)+B$

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

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

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

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

L.H.S = R.H.S
 $A+(B-C)=(A-C)+B$
Hence proved

(x) $2A+2B=2(A+B)$

Solution: $2A+2B=2(A+B)$

L.H.S = $2A+2B$

R.H.S = $2(A+B)$

L.H.S = $2A+2B$

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

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

$$= \begin{bmatrix} 4 & 2 & 8 \\ 8 & 2 & 6 \\ 8 & 0 & 6 \end{bmatrix}$$

RHS = $2(A+B)$

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

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

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

$$= \begin{bmatrix} 4 & 2 & 8 \\ 8 & 2 & 6 \\ 8 & 0 & 6 \end{bmatrix}$$

L.H.S = R.H.S

$2A+2B=2(A+B)$

Hence proved

Q.6 If $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 7 \\ -3 & 8 \end{bmatrix}$

find:

(i) $3A-2B$

Solution: $3A-2B$

$$3A-2B = 3 \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix} - 2 \begin{bmatrix} 0 & 7 \\ -3 & 8 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & -6 \\ 9 & 12 \end{bmatrix} - \begin{bmatrix} 0 & 14 \\ -6 & 16 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & -20 \\ 15 & -4 \end{bmatrix}$$

(ii) $2A^t - 3B^t$

Solution: $2A^t - 3B^t$

When we take transpose of any matrix we change rows into columns or columns into rows.

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

$$B^t = \begin{bmatrix} 0 & -3 \\ 7 & 8 \end{bmatrix}$$

$$\begin{aligned} 2A^t - 3B^t &= 2 \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix} - 3 \begin{bmatrix} 0 & -3 \\ 7 & 8 \end{bmatrix} \\ &= \begin{bmatrix} 2 & 6 \\ -4 & 8 \end{bmatrix} - \begin{bmatrix} 0 & -9 \\ 21 & 24 \end{bmatrix} \\ &= \begin{bmatrix} 2 & 15 \\ -25 & -16 \end{bmatrix} \end{aligned}$$

Q.7 If

$$2 \begin{bmatrix} 2 & 4 \\ -3 & a \end{bmatrix} + 3 \begin{bmatrix} 1 & b \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix}$$

Solution:

$$\begin{aligned} 2 \begin{bmatrix} 2 & 4 \\ -3 & a \end{bmatrix} + 3 \begin{bmatrix} 1 & b \\ 8 & -4 \end{bmatrix} &= \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 4 & 8 \\ -6 & 2a \end{bmatrix} + \begin{bmatrix} 3 & 3b \\ 24 & -12 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 7 & 8+3b \\ 18 & 2a+(-12) \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 18 & 1 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} 8+3b &= 10 \quad \text{(i)} \\ 2a-12 &= 1 \quad \text{(ii)} \end{aligned}$$

By solving equation (ii) we get the value of a

$$2a-12=1$$

$$2a=1+12$$

$$2a=13$$

$$a=\frac{13}{2}$$

By solving equation (i) we get the value of b

$$8+3b=10$$

$$3b=10-8$$

$$3b=2$$

$$b=\frac{2}{3}$$

Q.8 If $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ **and** $B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$

Then verify that

(i) $(A+B)^t = A^t + B^t$

Solution: $(A+B)^t = A^t + B^t$

$$\text{L.H.S} = (A+B)^t$$

$$\text{R.H.S} = A^t + B^t$$

To solve L.H.S

$$\text{L.H.S} = (A+B)^t$$

$$\begin{aligned} &= (A+B)^t = \left(\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} \right)^t \\ &= \begin{bmatrix} 2 & 3 \\ 2 & 1 \end{bmatrix} \end{aligned}$$

$$\text{R.H.S} = (A+B)^t = \begin{bmatrix} 2 & 2 \\ 3 & 1 \end{bmatrix}$$

To solve R.H.S

$$\text{R.H.S} = A^t + B^t$$

$$A^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$$

$$B^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

$$\text{RHS} = A^t + B^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

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

$$\text{L.H.S} = \text{R.H.S} \Rightarrow (A+B)^t = A^t + B^t$$

Hence Proved

(ii) $(A-B)^t = A^t - B^t$

Solution: $(A-B)^t = A^t - B^t$

$$\text{L.H.S} = (A-B)^t$$

$$\text{R.H.S} = A^t - B^t$$

$$\text{LHS} = (A-B)^t$$

$$\begin{aligned}
 (A - B)^t &= \left(\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} \right)^t \\
 &= \begin{bmatrix} 0 & 1 \\ -2 & 1 \end{bmatrix}^t \\
 (A - B)^t &= \begin{bmatrix} 0 & -2 \\ 1 & 1 \end{bmatrix} \\
 R.H.S &= A^t - B^t \\
 &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}^t - \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}^t \\
 &= \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix} \\
 &= \begin{bmatrix} 1-1 & 0-2 \\ 2-1 & 1-0 \end{bmatrix} \\
 &= \begin{bmatrix} 0 & -2 \\ 1 & 1 \end{bmatrix}
 \end{aligned}$$

L.H.S = R.H.S
 $(A-B)^t = A^t - B^t$
Hence proved

(iii) $A + A^t$ is a symmetric

Solution:

$A + A^t$ is a symmetric

To show that $A + A^t$ is symmetric, we will show that

$$\begin{aligned}
 (A + A^t)^t &= (A + A^t) \\
 A + A^t &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} 1+1 & 2+0 \\ 0+2 & 1+1 \end{bmatrix} \\
 A + A^t &= \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix} \\
 (A + A^t)^t &= \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}^t \\
 &= \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}
 \end{aligned}$$

$(A + A^t)^t = (A + A^t)$

Hence Proved

$A + A^t$ symmetric

(iv) $A - A^t$ is a skew symmetric

Solution: $A - A^t$

To show that $A - A^t$ is skew symmetric we will show that

$$\begin{aligned}
 (A - A^t)^t &= -(A - A^t) \\
 A - A^t &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} 1-1 & 2-0 \\ 0-2 & 1-1 \end{bmatrix} \\
 A - A^t &= \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix} \\
 (A - A^t)^t &= \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix}^t \\
 &= \begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix} \\
 &= \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix} \\
 (A - A^t)^t &= -(A - A^t)
 \end{aligned}$$

Hence proved

$A - A^t$ is a skew symmetric

(v) $B + B^t$ is a symmetric

Solution: $B + B^t$

To show that $B + B^t$ is symmetric we will show that

$$\begin{aligned}
 (B + B^t)^t &= (B + B^t) \\
 B + B^t &= \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} \\
 &= \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix} \\
 &= \begin{bmatrix} 1+1 & 1+2 \\ 2+1 & 0+0 \end{bmatrix} \\
 B + B^t &= \begin{bmatrix} 2 & 3 \\ 3 & 0 \end{bmatrix} \\
 (B + B^t)^t &= \begin{bmatrix} 2 & 3 \\ 3 & 0 \end{bmatrix}^t \\
 &= \begin{bmatrix} 2 & 3 \\ 3 & 0 \end{bmatrix} \\
 (B + B^t)^t &= (B + B^t)
 \end{aligned}$$

Hence proved
 $B + B^t$ is a symmetric

(vi) $B - B^t$ is a skew symmetric

Solution: $B - B^t$

To show that $B - B^t$ is skew symmetric, we will show that

$$(B - B^t)^t = -(B - B^t)$$

$$B - B^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} - \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}^t$$

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

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

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

$$(B - B^t)^t = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}^t$$

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

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

$$(B - B^t)^t = -(B - B^t)$$

Hence proved

$B - B^t$ is a skew symmetric.

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Report any mistake at freeilm786@gmail.com