Algebra of Matrices Ex 5.3 Q3(i)

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

Since order of A is 2×2 and order of B is 2×3,
So AB is possible but BA is not possible order of AB is 2×3.

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

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

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

$$AB = \begin{bmatrix} -3 & -4 & 1 \\ 8 & 13 & 9 \end{bmatrix}$$

Hence,

$$AB = \begin{bmatrix} -3 & -4 & 1 \\ 8 & 13 & 9 \end{bmatrix}$$

BA does not exits

Algebra of Matrices Ex 5.3 Q3(ii)

Here, $A = \begin{bmatrix} 3 & 2 \\ -1 & 0 \\ -1 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix}$

Order of A $= 3 \times 2$ and order of B $= 2 \times 3$ So,
AB and BA Both exits and order of AB $= 3 \times 3$ and order of BA $= 2 \times 2$

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

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

$$= \begin{bmatrix} 12+0 & 15+2 & 18+4 \\ -4+0 & -5+0 & -6+0 \\ -4+0 & -5+0 & -6+2 \end{bmatrix}$$

$$= \begin{bmatrix} 12 & 17 & 22 \\ -4 & -5 & -6 \\ -4 & -4 & -4 \end{bmatrix}$$

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

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

$$= \begin{bmatrix} 12-5-6 & 8+0+6 \\ 0-1-2 & 0+0+2 \end{bmatrix}$$

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

Hence,

$$AB = \begin{bmatrix} 12 & 17 & 22 \\ -4 & -5 & -6 \\ -4 & -4 & -4 \end{bmatrix}, BA = \begin{bmatrix} 1 & 14 \\ -3 & 2 \end{bmatrix}$$

Algebra of Matrices Ex 5.3 Q3(iii)

Here,

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

Order of A = 1×4 and order of B=4×1 So,
AB and BA both exist and order of AB = 1×1 and order of BA=4×4, So

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

$$= \left[(1)(0) + (-1)(1) + (2)(3) + (3)(2) \right]$$

$$= \left[0 - 1 + 6 + 6 \right]$$

$$AB = [11]$$

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

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

$$BA = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & -1 & 2 & 3 \\ 3 & -3 & 6 & 9 \\ 2 & -2 & 4 & 6 \end{bmatrix}$$

Hence,

$$AB = [11]$$

$$BA = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & -1 & 2 & 3 \\ 3 & -3 & 6 & 9 \\ 2 & -2 & 4 & 6 \end{bmatrix}$$

Algebra of Matrices Ex 5.3 Q3(iv)

$$\begin{bmatrix} a & b \end{bmatrix} \begin{bmatrix} c \\ d \end{bmatrix} + \begin{bmatrix} a & b & c & d \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

$$= \left[ac + bd \right] + \left[a^2 + b^2 + c^2 + d^2 \right]$$

$$= \left[ac + bd = a^2 + b^2 + c^2 + d^2 \right]$$

Hence,

$$\begin{bmatrix} a & b \end{bmatrix} \begin{bmatrix} c \\ d \end{bmatrix} + \begin{bmatrix} a & b & c & d \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

$$= \left[ac + bd + a^2 + b^2 + c^2 + d^2 \right]$$

*********** END **********