



Algebra of Matrices Ex 5.3 Q3(i)

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

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 .

$$\begin{aligned} AB &= \begin{bmatrix} 1 & -2 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix} \\ &= \begin{bmatrix} (1)(1) + (-2)(2) & (1)(2) + (-2)(3) & (1)(3) + (-2)(1) \\ (2)(1) + (3)(2) & (2)(2) + (3)(3) & (2)(3) + (3)(1) \end{bmatrix} \\ &= \begin{bmatrix} 1-4 & 2-6 & 3-2 \\ 2+6 & 4+9 & 6+3 \end{bmatrix} \\ AB &= \begin{bmatrix} -3 & -4 & 1 \\ 8 & 13 & 9 \end{bmatrix} \end{aligned}$$

Hence,

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

BA does not exists

Algebra of Matrices Ex 5.3 Q3(ii)

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

Order of A = 3×2 and order of B = 2×3 So,

AB and BA Both exists and order of AB = 3×3 and order of BA = 2×2

$$\begin{aligned} AB &= \begin{bmatrix} 3 & 2 \\ -1 & 0 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix} \\ &= \begin{bmatrix} (3)(4) + (2)(0) & (3)(5) + (2)(1) & (3)(6) + (2)(2) \\ (-1)(4) + (0)(0) & (-1)(5) + (0)(1) & (-1)(6) + (0)(2) \\ (-1)(4) + (1)(0) & (-1)(5) + (1)(1) & (-1)(6) + (1)(2) \end{bmatrix} \\ &= \begin{bmatrix} 12+0 & 15+2 & 18+4 \\ -4+0 & -5+0 & -6+0 \\ -4+0 & -5+0 & -6+2 \end{bmatrix} \\ &= \begin{bmatrix} 12 & 17 & 22 \\ -4 & -5 & -6 \\ -4 & -4 & -4 \end{bmatrix} \\ BA &= \begin{bmatrix} 4 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 3 & 2 \\ -1 & 0 \\ -1 & 1 \end{bmatrix} \\ &= \begin{bmatrix} (4)(3) + (5)(-1) + (6)(-1) & (4)(2) + (5)(0) + (6)(1) \\ (0)(3) + (1)(-1) + (2)(-1) & (0)(2) + (1)(0) + (2)(1) \end{bmatrix} \\ &= \begin{bmatrix} 12-5-6 & 8+0+6 \\ 0-1-2 & 0+0+2 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 14 \\ -3 & 2 \end{bmatrix} \end{aligned}$$

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 $A = 1 \times 4$ and order of $B = 4 \times 1$ So,

AB and BA both exist and order of $AB = 1 \times 1$ and order of $BA = 4 \times 4$, So

$$\begin{aligned} AB &= \begin{bmatrix} 1 & -1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 3 \\ 2 \end{bmatrix} \\ &= [(1)(0) + (-1)(1) + (2)(3) + (3)(2)] \\ &= [0 - 1 + 6 + 6] \\ AB &= [11] \\ BA &= \begin{bmatrix} 0 \\ 1 \\ 3 \\ 2 \end{bmatrix} \begin{bmatrix} 1 & -1 & 2 & 3 \end{bmatrix} \end{aligned}$$

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

Hence,

$$\begin{aligned} AB &= [11] \\ BA &= \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & -1 & 2 & 3 \\ 3 & -3 & 6 & 9 \\ 2 & -2 & 4 & 6 \end{bmatrix} \end{aligned}$$

Algebra of Matrices Ex 5.3 Q3(iv)

$$\begin{aligned} \begin{bmatrix} a & b \end{bmatrix} \begin{bmatrix} c \\ d \end{bmatrix} + \begin{bmatrix} a & b & c & d \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} \\ = [ac + bd] + [a^2 + b^2 + c^2 + d^2] \\ = [ac + bd + a^2 + b^2 + c^2 + d^2] \end{aligned}$$

Hence,

$$\begin{aligned} \begin{bmatrix} a & b \end{bmatrix} \begin{bmatrix} c \\ d \end{bmatrix} + \begin{bmatrix} a & b & c & d \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} \\ = [ac + bd + a^2 + b^2 + c^2 + d^2] \end{aligned}$$

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