Review Exercise 1

Q.1 Select the correct answer in each of the following.

(i) The order of matrix $\begin{bmatrix} 2 & 1 \end{bmatrix}$ is….

(a) 2-by-1 **(b)** 1-by-2
(c) 1-by-1 **(d)** 2-by-2

(ii) $\begin{bmatrix} \sqrt{2} & 0 \\ 0 & \sqrt{2} \end{bmatrix}$ is called …matrix.

(a) Zero **(b)** Unit
(c) Scalar **(d)** Singular

(iii) Which is order of a square matrix?

(a) 2-by-2 **(b)** 1-by-2
(c) 2-by-1 **(d)** 3-by-2

(iv) Order of transpose of $\begin{bmatrix} 2 & 1 \\ 0 & 1 \\ 3 & 2 \end{bmatrix}$ is…

(a) 3-by-2 **(b)** 2-by-3
(c) 1-by-3 **(d)** 3-by-1

(v) Adjoint of $\begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}$ is…

(a) $\begin{bmatrix} -1 & -2 \\ 0 & 1 \end{bmatrix}$ **(b)** $\begin{bmatrix} 1 & -2 \\ 0 & -1 \end{bmatrix}$

(c) $\begin{bmatrix} -1 & 2 \\ 0 & -1 \end{bmatrix}$ **(d)** $\begin{bmatrix} -1 & 0 \\ 2 & 1 \end{bmatrix}$

(vi) Product of $\begin{bmatrix} x & y \end{bmatrix}\begin{bmatrix} 2 \\ -1 \end{bmatrix}$ is…

(a) $\begin{bmatrix} 2x+y \end{bmatrix}$ **(b)** $\begin{bmatrix} x-2y \end{bmatrix}$

(c) $\begin{bmatrix} 2x-y \end{bmatrix}$ **(d)** $\begin{bmatrix} x+2y \end{bmatrix}$

(vii) If $\begin{vmatrix} 2 & 6 \\ 3 & x \end{vmatrix}$ =0, then x is equal to…

(a) 9 **(b)** -6
(c) 6 **(d)** -9

(viii) If $X + \begin{bmatrix} -1 & -2 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then X is equal to…

(a) $\begin{bmatrix} 2 & 2 \\ 2 & 0 \end{bmatrix}$ **(b)** $\begin{bmatrix} 0 & 2 \\ 2 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ **(d)** $\begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$

ANSWER KEY

i	ii	iii	iv	v	vi	vii	viii
b	c	a	b	a	c	a	d

Q.2 Complete the follwoing:

(i) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ is called ... matrix.

(ii) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ is called ... matrix.

(iii) Additive inverse of $\begin{bmatrix} 1 & -2 \\ 0 & -1 \end{bmatrix}$ is....

(iv) In matrix multiplication, in gereral, AB ...BA.

(v) Matrix A+B may be found if order of A and B is...

(vi) A matrix is called ... matrix if number of rows and columns are equal.

ANSWER KEY

i	ii	iii	iv	v	vi
Null	Unit	$\begin{bmatrix} -1 & 2 \\ 0 & 1 \end{bmatrix}$	$\neq$	Same	Square

Q.3 If $\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$**, then find *a* and *b*.**

Solution: $\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$

$a+3=-3$
$a=-3-3$
$a=-6$

$b-1=2$
$b=2+1$
$b=3$ **Ans**

Q.4 If $A = \begin{bmatrix} 2 & 3 \\ 1 & 0 \end{bmatrix}, B\begin{bmatrix} 5 & -4 \\ -2 & -1 \end{bmatrix}$**, then find the following.**

(i) $2A+3B$

(ii) $-3A+2B$

(iii) $-3(A+2B)$

(iv) $\frac{2}{3}(2A-3B)$

Solution: (i)

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

$$= \begin{bmatrix} 4 & 6 \\ 2 & 0 \end{bmatrix} + \begin{bmatrix} 15 & -12 \\ -6 & -3 \end{bmatrix}$$

$$= \begin{bmatrix} 4+15 & 6-12 \\ 2-6 & 0-3 \end{bmatrix}$$

$$= \begin{bmatrix} 19 & -6 \\ -4 & -3 \end{bmatrix}$$ **Ans**

Solution: (ii)

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

$$= \begin{bmatrix} -6 & -9 \\ -3 & 0 \end{bmatrix} + \begin{bmatrix} 10 & -8 \\ -4 & -2 \end{bmatrix}$$

$$= \begin{bmatrix} -6+10 & -9-8 \\ -3-4 & 0-2 \end{bmatrix}$$

$$=\begin{bmatrix}4 & -17\\ -7 & -2\end{bmatrix}\ \textbf{Ans}$$

Solution: (iii)

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

$$=-3\begin{bmatrix}2 & 3\\ 1 & 0\end{bmatrix}+\begin{bmatrix}10 & -8\\ -4 & -2\end{bmatrix}$$

$$=-3\begin{bmatrix}2+10 & 3-8\\ 1-4 & 0-2\end{bmatrix}$$

$$=\begin{bmatrix}12 & -5\\ -3 & -2\end{bmatrix}$$

$$=\begin{bmatrix}-36 & 15\\ 9 & 6\end{bmatrix}\ \textbf{Ans}$$

Solution: (iv) $\frac{2}{3}(2A-3B)$

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

$$=\frac{2}{3}\left(\begin{bmatrix}4 & 6\\ 2 & 0\end{bmatrix}-\begin{bmatrix}15 & -12\\ -6 & -3\end{bmatrix}\right)$$

$$=\frac{2}{3}\begin{bmatrix}4-15 & 6-(-12)\\ 22(-6) & 0-(-3)\end{bmatrix}$$

$$=\frac{2}{3}\begin{bmatrix}-11 & 6+12\\ 2+6 & 0+3\end{bmatrix}$$

$$=\frac{2}{3}\begin{bmatrix}-11 & 18\\ 8 & 3\end{bmatrix}$$

$$=\begin{bmatrix}-11\times\frac{2}{3} & 18\times\frac{2}{3}\\ 8\times\frac{2}{3} & 3\times\frac{2}{3}\end{bmatrix}$$

$$=\begin{bmatrix}\frac{-22}{3} & 12\\ \frac{16}{3} & 2\end{bmatrix}\ \textbf{Ans}$$

Q.5 Find the value of X, if

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

Solution: Given that

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

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

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

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

$$X=\begin{bmatrix}2 & -3\\ -4 & 1\end{bmatrix}\ \textbf{Ans}$$

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

then prove that

(i) $AB\neq BA$

(ii) $A(BC)=(AB)C$

Solution: Given that

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

(i) $AB\neq BA$

$$\text{L.H.S}=AB=\begin{bmatrix}0 & 1\\ 2 & -3\end{bmatrix}\begin{bmatrix}-3 & 4\\ 5 & -2\end{bmatrix}$$

$$=\begin{bmatrix}0\times(-3)+1\times5 & 0\times4+1\times(-2)\\ 2\times(-3)+(-3)\times5 & 2\times4+(-3)\times(-2)\end{bmatrix}$$

$$=\begin{bmatrix}0+5 & 0-2\\ -6-15 & 8+6\end{bmatrix}$$

$$=\begin{bmatrix}5 & -2\\ -21 & 14\end{bmatrix}\qquad\rightarrow(\text{i})$$

$$\text{R.H.S}=BA=\begin{bmatrix}-3 & 4\\ 5 & -2\end{bmatrix}\begin{bmatrix}0 & 1\\ 2 & -3\end{bmatrix}$$

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

$$=\begin{bmatrix}0+8 & -3-12\\ 0-4 & 5+6\end{bmatrix}$$

$$=\begin{bmatrix}8 & -15\\ -4 & 11\end{bmatrix}\qquad\rightarrow(\text{ii})$$

From (i) and (ii) , we get

$L.H.S \neq R.H.S$

$AB \neq BA$

Hence proved

(ii) $A(BC) = (AB)C$

Solution:

We cannot solve because matrix C is not given.

Q.7 **If** $A = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix}$ **and** $B = \begin{bmatrix} 2 & 4 \\ -3 & -5 \end{bmatrix}$, **then verify that**

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

(ii) $(AB)^{-1} = B^{-1}A^{-1}$

Solution: Given that

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

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

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

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

$= \begin{bmatrix} 6-6 & 12-10 \\ 2+3 & 4+5 \end{bmatrix}$

$= \begin{bmatrix} 0 & 2 \\ 5 & 9 \end{bmatrix}$

L.H.S=$(AB)^t = \begin{bmatrix} 0 & 2 \\ 5 & 9 \end{bmatrix}^t$

$= \begin{bmatrix} 0 & 5 \\ 2 & 9 \end{bmatrix} \quad \rightarrow (i)$

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

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

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

R.H.S=$B^t A^t = \begin{bmatrix} 2 & -3 \\ 4 & -5 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 2 & -1 \end{bmatrix}$

$= \begin{bmatrix} 2\times3+(-3)\times2 & 2(1)+(-3)(-1) \\ 4\times3+(-5)\times2 & 4(1)+(-5)(-1) \end{bmatrix}$

$= \begin{bmatrix} 6-6 & 2+3 \\ 12-10 & 4+5 \end{bmatrix}$

$= \begin{bmatrix} 0 & 5 \\ 2 & 9 \end{bmatrix} \quad \rightarrow (ii)$

From equal (i) and (ii) we get

L.H.S=R.H.S

$(AB)^t = B^t A^t$

Hence proved

(ii) $(AB)^{-1} = B^{-1}A^{-1}$

$|AB| = \begin{vmatrix} 0 & 2 \\ 5 & 9 \end{vmatrix}$

$= 0\times9 - 2\times5$

$= 0 - 10$

$= -10$ (Non singular)

Inverse exists

$Adj(AB) = \begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$

L.H.S=$(AB)^{-1} = \dfrac{1}{|AB|}Adj(AB)$

$= \dfrac{1}{-10}\begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$

$= \begin{bmatrix} \frac{9}{10} & \frac{-2}{-10} \\ \frac{-5}{-10} & \frac{0}{-10} \end{bmatrix}$

$= \begin{bmatrix} \frac{-9}{10} & \frac{1}{5} \\ \frac{1}{2} & 0 \end{bmatrix} \quad \rightarrow (i)$

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

$|B| = \begin{vmatrix} 2 & 4 \\ -3 & -5 \end{vmatrix}$

$= 2(-5) - 4\times(-3)$

$= -10 + 12$

$= 2$ (non singular)

$\therefore B^{-1}$ exists

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

$$B^{-1} = \frac{1}{|B|} AdjB$$

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

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

$$|A| = \begin{vmatrix} 3 & 2 \\ 1 & -1 \end{vmatrix}$$

$$= 3(-1) - 2 \times 1$$

$$= -3 - 2$$

$= -5$ (non singular)

$\therefore A^{-1}$ exists

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

$$A^{-1} = \frac{1}{|A|} \times AdjA$$

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

R.H.S$= B^{-1}A^{-1}$

$$= \left(\frac{1}{2}\begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix}\right) \times \left(\frac{1}{-5}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}\right)$$

$$= \frac{1}{2}\left(-\frac{1}{5}\right)\begin{bmatrix} -5 & -4 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

$$= -\frac{1}{10}\begin{bmatrix} -5(-1)+(-4)(-1) & -5(-2)+(-4)(3) \\ 3(-1)+2(-1) & 3(-2)+2(3) \end{bmatrix}$$

$$= -\frac{1}{10}\begin{bmatrix} 5+4 & 10-12 \\ -3-2 & -6+6 \end{bmatrix}$$

$$= -\frac{1}{10}\begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{9}{-10} & \frac{-2}{-10} \\ \frac{-5}{-10} & \frac{0}{-10} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{-9}{10} & \frac{1}{5} \\ \frac{1}{2} & 0 \end{bmatrix} \quad \rightarrow (\text{ii})$$

From equation (i) and (ii) we get

L.H.S =R.H.S

$$(AB)^{-1} = B^{-1}A^{-1}$$

Hence proved

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Report any mistake at freeilm786@gmail.com