OBJECTIVE

1 .The order of matrix $[2 \quad 1]$ is ....

(a) 2-by-1 (b) 1-by-2

(c) 1-by-1 (d) 2-by-2

2. $\begin{bmatrix} \sqrt{2} & 0 \\ 0 & \sqrt{2} \end{bmatrix}$ is called .... Matrix.

(a) zero (b) unit

(c) scalar (d) singular

3. Which is order of a square matrix ?

(a) 2-by-2 (b) 1-by-2

(c) 2-by-1 (d) 3-by-2

4. Which is order of a rectangular matrix?
(a) 2-by-2 (b) 4-by-4
(c) 2-by-1 (d) 3-by-3

5. 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

6. 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) $\begin{bmatrix} -1 & 0 \\ 2 & 1 \end{bmatrix}$

7. If $\begin{vmatrix} 2 & 6 \\ 3 & x \end{vmatrix} = 0$, then x is equal to:
(a) 9 (b) −6
(c) 6 (d) −9

8. Product of $[x \quad y] \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ is ....
(a) $[2x+y]$ (b) $[x-2y]$
(c) $[2x-y]$ (d) $[x+2y]$

9. 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) $\begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$

10. The idea of a matrices was given by:__
(a) Arthur Cayley (b) Dr. Aslam
(c) Dr. Ali (d) Dr. Khalid

11. The matrix $M = [2 \ -1 \ 7]$ is a---- matrix.
(a) Row (b) Column
(c) Square (d) Null

12. The matrix $N = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$ is a ____ matrix.
(a) Row (b) Column
(c) Square (d) Null

13. The matrix $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}$ is a __ matrix.
(a) Rectangular (b) Square
(c) Row (d) Column

14. The matrix $B = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & -2 \\ 0 & 1 & 3 \end{bmatrix}$ is a __ matrix.
(a) Rectangular (b) Square
(c) Row (d) Column

15. If A is a matrix then its transpose is denoted by:
(a) A^c (b) A^t
(c) A (d) $(A^t)^t$

16. If $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ then $-A =$ _______
(a) $\begin{bmatrix} -1 & 2 \\ -3 & -4 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -2 \\ -3 & -4 \end{bmatrix}$
(c) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (d) $\begin{bmatrix} -1 & 2 \\ 3 & -4 \end{bmatrix}$

17. A square matrix is symmetric if _____
(a) $A^t = A$ (b) $A^c = A$
(c) $(A^t)^t = -A^t$ (d) None

18. A square matrix is skew-symmetric if:
(a) $A^t = -A$ (b) $A^c = -A$
(c) $(A^t)^t = -A^t$ (d) None

19. The matrix $C = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is a __ matrix.
(a) Diagonal (b) Scalar

(c) Identity (d) Zero

20. The matrix $A=\begin{bmatrix}2&0&0\\0&2&0\\0&0&2\end{bmatrix}$ is a__matrix.

(a) Diagonal (b) Scalar
(c) Identity (d) Zero

21. The matrix $A=\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$ is a ___ matrix.

(a) Diagonal (b) Identity
(c) Zero (d) None

22. The scalar matrix and identity matrix are ____ matrices.

(a) Diagonal (b) Rectangular
(c) Zero (d) None

23. Every diagonal matrix is not a ___ matrix.

(a) Scalar (b) Identity
(c) Scalar or identity (d) None

24. If A, B are two matrices and A^t, B^t are their respective transpose, then:

(a) $(AB)^t = B^t A^t$ (b) $(AB)^t = A^t B^t$
(c) $A^t B^t = AB$ (d) None

25. If $A=\begin{bmatrix}a&b\\c&d\end{bmatrix}$ then the determinant of A is:

(a) ad – bc (b) bc – ad
(c) ad + bc (d) bc + ad

26. A square matrix A is called singular if

(a) $|A| \neq 0$ (b) $|A| = 0$
(c) $A = 0$ (d) $A^t = 0$

27. A square matrix A is called non-singular if:

(a) $|A| = 0$ (b) $A = 0$
(c) $|A| \neq 0$ (d) $A^t = 0$

28. Inverse of identity matrix is ___ matrix.

(a) Identity (b) Zero
(c) Rectangular (d) None

29. $AA^{-1} = A^{-1}A =$ _____

(a) Identity matrix
(b) Rectangular matrix
(c) Zero matrix (d) none

30. $(AB)^{-1} =$ ____

(a) $A^{-1}B^{-1}$ (b) $B^{-1}A^{-1}$
(c) BA (d) AB

31. Additive inverse 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) $\begin{bmatrix}1&-2\\0&-1\end{bmatrix}$

Answer Key

1	b	2	c	3	a	4	c	5	d
6	a	7	a	8	c	9	d	10	a
11	a	12	b	13	a	14	b	15	b
16	a	17	a	18	a	19	a	20	b
21	b	22	a	23	c	24	a	25	a
26	b	27	c	28	a	29	a	30	b
31	a								

2. **Complete the following:**

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

Null / Zero matrix

ii. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ is called ……. Matrix.

Identity /Unit matrix

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

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

iv. In matrix multiplication, in general, AB …… BA.

$\neq$

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

Same

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

Square

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.**

Ans. $\Rightarrow$ $a + 3 = -3$ ……(I)

$b - 1 = 2$ ……..(II)

From (I) $a = -3 - 3$

$a = -6$

From (II) $b = 2 + 1$

$b = 3$

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

Ans.

(i) 2A + 3B

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

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

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

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

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

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

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

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

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

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

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

$$= \begin{bmatrix} 2+10 & 3-8 \\ 1-4 & 0-2 \end{bmatrix} = \begin{bmatrix} 12 & -5 \\ -3 & -2 \end{bmatrix}$$

$$-3(A+2B) = -3\begin{bmatrix} 12 & -5 \\ -3 & -2 \end{bmatrix} = \begin{bmatrix} -36 & 15 \\ -9 & 6 \end{bmatrix}$$

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

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

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

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

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

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

$$= \begin{bmatrix} \frac{-22}{3} & \frac{36}{3} \\ \frac{16}{3} & \frac{6}{3} \end{bmatrix} = \begin{bmatrix} \frac{-22}{3} & 12 \\ \frac{16}{3} & 2 \end{bmatrix}$$

5. Find the value of x, if

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

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

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

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

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

i) $AB \neq BA$

Ans. $AB \neq BA$

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

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

$$= \begin{bmatrix} 5 & -2 \\ -21 & 14 \end{bmatrix}$$

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

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

$$= \begin{bmatrix} 8 & -15 \\ -4 & 11 \end{bmatrix}$$

$$AB \neq BA$$

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

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

L.H.S $= (AB)^t$

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

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

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

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

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

R.H.S $= B^t A^t$

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

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

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

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

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

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

L.H.S = R.H.S

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

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

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

L.H.S = $(AB)^{-1}$

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

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

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

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

$$(AB)^{-1}=\frac{1}{|AB|}\text{Adj}\,AB$$

$$|AB|=\begin{vmatrix} 0 & 2 \\ 5 & 9 \end{vmatrix}=0(9)-5(2)=-10\neq 0$$

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

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

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

$$|A|=3(-1)-1(2)=-3-2=-5\neq 0$$

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

$$A^{-1}=\frac{1}{|A|}\text{Adj}A=\frac{1}{-5}\begin{bmatrix} -1 & -2 \\ -1 & 3 \end{bmatrix}$$

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

$$|B|=2(-5)-(-3)(4)$$

$$=-10+12=2\neq 0$$

$$B^{-1}=\frac{1}{|B|}\text{Adj}B$$

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

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

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

$$=\frac{-1}{10}\begin{bmatrix} 5+4 & 10-12 \\ -3-2 & -6+6 \end{bmatrix}=\frac{1}{-10}\begin{bmatrix} 9 & -2 \\ -5 & 0 \end{bmatrix}$$

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

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

L.H.S = R.H.S.

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