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3. Matrices

(Previous Year Questions Solutions from 2015-2025)

McQ's :

1.

If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to

(A) I

(B) 0

(C) I – A

(D) I + A

2.

If $A = [2 \ -3 \ 4]$, $B = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$, $X = [1 \ 2 \ 3]$ and $Y = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$, then AB + XY equals

(a) [28] (b) [24] (c) 28 (d) 24

3.

If $[x \ \ 1]\begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} = O$, then x equals

(a) 0 (b) –2 (c) –1 (d) 2

4.

If $A = [a_{ij}]$ is a square matrix of order 2 such that $a_{ij} = \begin{cases} 1, & when\ i \neq j \\ 0, & when\ i = j \end{cases}$, then A^2 is:

a) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$	b) $\begin{vmatrix} 1 & 1 \\ 0 & 0 \end{vmatrix}$
c) $\begin{vmatrix} 1 & 1 \\ 1 & 0 \end{vmatrix}$	d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

5.

If A is square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to:

a) A	b) I + A
c) I – A	d) I

6.

If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then value of a + b – c + 2d is:

a) 8	b) 10
c) 4	d) –8

7.

Given that matrices A and B are of order 3×n and m×5 respectively, then the order of matrix C = 5A +3B is:

a) 3×5	b) 5×3
c) 3×3	d) 5×5

8.

Given that $A = [a_{ij}]$ is a square matrix of order 3×3 and $|A| = -7$, then the value of $\sum_{i=1}^{3} a_{i2}A_{i2}$, where A_{ij} denotes the cofactor of element a_{ij} is:

a) 7	b) -7
c) 0	d) 49

9.

If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of k, a and b respectively are:

a) $-6, -12, -18$	b) $-6, -4, -9$
c) $-6, 4, 9$	d) $-6, 12, 18$

10.

Given that $A = \begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ and $A^2 = 3I$, then:

a) $1 + \alpha^2 + \beta\gamma = 0$	b) $1 - \alpha^2 - \beta\gamma = 0$
c) $3 - \alpha^2 - \beta\gamma = 0$	d) $3 + \alpha^2 + \beta\gamma = 0$

11.

If A and B are symmetric matrices of same order, then $\left(AB^T - 2BA^T\right)$ is a

(a) Skew symmetric matrix (b)Symmetric matrix

(c) Neither Symmetric matrix nor Skew symmetric matrix (d) Null matrix

12.

If $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$, then A^2 equals

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

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

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

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

2023 march :

1.

If $A = \begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix}$ and 2A + B is a null matrix, then B is equal to :

(a) $\begin{bmatrix} 6 & 8 \\ 10 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} -6 & -8 \\ -10 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 8 \\ 10 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & -8 \\ -10 & -3 \end{bmatrix}$

2.

If $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $(3I + 4A)(3I - 4A) = x^2I$, then the value(s) x is/are :

(a) $\pm\sqrt{7}$ (b) 0

(c) ± 5 (d) 25

3.

If $A = \begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix}$ and 2A + B is a null matrix, then B is equal to :

(a) $\begin{bmatrix} 6 & 8 \\ 10 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} -6 & -8 \\ -10 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 8 \\ 10 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & -8 \\ -10 & -3 \end{bmatrix}$

4.

If $\begin{bmatrix} 2 & 0 \\ 5 & 4 \end{bmatrix}$ = P + Q, where P is a symmetric and Q is a skew symmetric matrix, then Q is equal to

(A) $\begin{bmatrix} 2 & 5/2 \\ 5/2 & 4 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & -5/2 \\ 5/2 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 5/2 \\ -5/2 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 2 & -5/2 \\ 5/2 & 4 \end{bmatrix}$

5.

If A is a 2×3 matrix such that AB and AB' both are defined, then order of the matrix B is

(A) 2×2 (B) 2×1

(C) 3×2 (D) 3×3

6.

A and B are square matrices of same order. If $(A + B)^2 = A^2 + B^2$, then :

(a) $AB = BA$ (b) $AB = -BA$

(c) $AB = O$ (d) $BA = O$

7.

A and B are skew-symmetric matrices of same order. AB is symmetric, if :

(a) $AB = O$ (b) $AB = -BA$

(c) $AB = BA$ (d) $BA = O$

8.

For what value of $x \in \left[0, \frac{\pi}{2}\right]$, is $A + A' = \sqrt{3}\ I$, where $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$?

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$

(c) 0 (d) $\frac{\pi}{2}$

9.

If $x\begin{bmatrix} 1 \\ 2 \end{bmatrix} + y\begin{bmatrix} 2 \\ 5 \end{bmatrix} = \begin{bmatrix} 4 \\ 9 \end{bmatrix}$, then :

(a) $x = 1,\ y = 2$ (b) $x = 2,\ y = 1$

(c) $x = 1,\ y = -1$ (d) $x = 3,\ y = 2$

10.

If $A=\begin{bmatrix}1 & 0\\ 0 & 0\end{bmatrix}$ and $B=\begin{bmatrix}1 & 1\\ 0 & 0\end{bmatrix}$, then $B'A'$ is equal to :

(a) $\begin{bmatrix}1 & 1\\ 0 & 0\end{bmatrix}$

(b) $\begin{bmatrix}1 & 0\\ 1 & 0\end{bmatrix}$

(c) $\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$

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

11.

If $A=\begin{bmatrix}1 & 4 & x\\ z & 2 & y\\ -3 & -1 & 3\end{bmatrix}$ is a symmetric matrix, then the value of $x + y + z$ is :

(a) 10 (b) 6

(c) 8 (d) 0

If $A=\begin{bmatrix}1 & 4 & x\\ z & 2 & y\\ -3 & -1 & 3\end{bmatrix}$ is a symmetric matrix, then the value of $x + y + z$ is :

(a) 10 (b) 6

(c) 8 (d) 0

12.

If A is a square matrix and $A^2 = A$, then $(I + A)^2 - 3A$ is equal to :

(a) I (b) A

(c) 2A (d) 3 I

13.

The product $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ is equal to :

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

(c) $\begin{bmatrix} a^2+b^2 & 0 \\ a^2+b^2 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$

14.

If a matrix A = [1 2 3], then the matrix AA′ (where A′ is the transpose of A) is :

(a) 14 (b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ (d) [14]

15.

If $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$, then the value of $(2x + y - z)$ is :

(a) 1 (b) 2

(c) 3 (d) 5

16.

If A is a 3×4 matrix and B is a matrix such that A′B and AB′ are both defined, then the order of the matrix B is :

(a) 3×4 (b) 3×3

(c) 4×4 (d) 4×3

17.

If for a square matrix A, $A^2 - A + I = O$, then A^{-1} equals

(a) A (b) A + I

(c) I – A (d) A – I

18.

If $A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $A = B^2$, then x equals

(a) ± 1 (b) -1

(c) 1 (d) 2

19.

If $A = [a_{ij}]$ is a square matrix of order 2 such that $a_{ij} = \begin{cases} 1, & \text{when } i \neq j \\ 0, & \text{when } i = j \end{cases}$, then A^2 is

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

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

20.

If $A = \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and $A = A^T$, where A^T is the transpose of the matrix A, then

(a) $x = 0, y = 5$ (b) $x = y$

(c) $x + y = 5$ (d) $x = 5, y = 0$

21.

If matrix $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $A^2 = kA$, then the value of k is :

(a) 1 (b) – 2 (c) 2 (d) – 1

22.

It is given that $X\begin{bmatrix}3 & 2\\ 1 & -1\end{bmatrix} = \begin{bmatrix}4 & 1\\ 2 & 3\end{bmatrix}$. Then matrix X is :

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

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

23.

If $\begin{bmatrix}3 & 2\\ 1 & x\end{bmatrix}\begin{bmatrix}x\\ 1\end{bmatrix} = \begin{bmatrix}14\\ 8\end{bmatrix}$, then x is :

(a) $\frac{16}{3}$ (b) -3

(c) -4 (d) 4

24.

In the matrix equation $\begin{bmatrix}x+y+z\\ x+z\\ y+2z\end{bmatrix} = \begin{bmatrix}3\\ 2\\ -1\end{bmatrix}$, the value of z is :

(a) 1 (b) 2

(c) -1 (d) -2

25.

If $\begin{bmatrix}x+y & x+2\\ 2x-y & 16\end{bmatrix} = \begin{bmatrix}8 & 5\\ 1 & 3y+1\end{bmatrix}$, then the values of x and y are :

(a) $x = 3, y = 5$ (b) $x = 5, y = 3$

(c) $x = 2, y = 7$ (d) $x = 7, y = 2$

26.

If $A=\begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix}$ and $B=\begin{bmatrix} -5 & 10 \\ -10 & -5 \end{bmatrix}$, then AB is :

(a) $\begin{bmatrix} -5 & 10 \\ 0 & -5 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & -5 \\ 25 & 10 \end{bmatrix}$

(c) $\begin{bmatrix} 10 & -25 \\ -5 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & 10 \\ 0 & -25 \end{bmatrix}$

27.

If A and B are two matrices such that AB = A and BA = B, then B^2 is equal to :

(a) B (b) A

(c) I (d) O

28.

If $A=\begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ is a symmetric matrix, then :

(a) $x = 0, y = 5$ (b) $x = 5, y = 0$

(c) $x = y$ (d) $x + y = 0$

29.

If $A=\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and $A + A' = I$, then the value of α is :

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

30.

If the matrix $\begin{bmatrix} 0 & 3 & 5 \\ k+1 & 0 & 4 \\ -5 & k & 0 \end{bmatrix}$ is a skew symmetric matrix, then the value of k is :

(a) 4 (b) 2

(c) -2 (d) -4

31.

If A is a 2×3 matrix and B is another matrix such that both $A'B$ and BA' are defined, then order of B is :

(a) 3×2 (b) 2×3

(c) 3×3 (d) 2×2

32.

In a 3×3 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = \frac{1}{2}|-3i + j|$, the element a_{31} is :

(a) -4 (b) 5

(c) 4 (d) 8

33.

If $2\begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$, then $2x - y$ is equal to :

(a) 3 (b) 13

(c) -3 (d) 0

Ans.

$$\begin{bmatrix} 2+y & 6 \\ 1 & 2x+2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$$

$\Rightarrow x = 3,\ y = 3$ $\qquad\qquad$ $\therefore\ x - y = 0$

34.

Assertion (A) : Matrix $A = \begin{bmatrix} 0 & -3 & 5 \\ 3 & 0 & -2 \\ -5 & 2 & 0 \end{bmatrix}$ is a skew-symmetric matrix.

Reason (R) : If $A' = -A$, then A is a skew-symmetric matrix.

35.

Suppose P and Q are two different matrices of order $3 \times n$ and $n \times p$, then the order of the matrix $P \times Q$ is?

(a) $3 \times p$ (b) $p \times 3$ (c) $n \times n$ (d) 3×3

2024March:

1 Mark MCQ's :

1.

If a matrix has 36 elements, the number of possible orders it can have, is :

(A) 13 (B) 3

(C) 5 (D) 9

2.

If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then the value of $\left(\frac{24}{x} + \frac{24}{y}\right)$ is :

(A) 7 (B) 6

(C) 8 (D) 18

3.

If A and B are two non-zero square matrices of same order such that $(A + B)^2 = A^2 + B^2$, then :

(A) $AB = O$ (B) $AB = -BA$

(C) $BA = O$ (D) $AB = BA$

4.

If matrices A and B are of order 1×3 and 3×1 respectively, then the order of $A'B'$ is :

(A) 1×1 (B) 3×1

(C) 1×3 (D) 3×3

5.

If the sum of all the elements of a 3×3 scalar matrix is 9, then the product of all its elements is :

(A) 0 (B) 9

(C) 27 (D) 729

6.

If $A = [a_{ij}]$ be a 3×3 matrix, where $a_{ij} = i - 3j$, then which of the following is ***false*** ?

(A) $a_{11} < 0$ (B) $a_{12} + a_{21} = -6$

(C) $a_{13} > a_{31}$ (D) $a_{31} = 0$

7.

If $F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $[F(x)]^2 = F(kx)$, then the value of k is :

(A) 1 (B) 2

(C) 0 (D) -2

8.

Assertion (A) : For any symmetric matrix A, $B'AB$ is a skew-symmetric matrix.

Reason (R) : A square matrix P is skew-symmetric if $P' = -P$.

9.

The number of all scalar matrices of order 3, with each entry -1, 0 or 1, is :

(A) 1 (B) 3

(C) 2 (D) 3^9

10.

If for the matrix $A = \begin{bmatrix} \tan x & 1 \\ -1 & \tan x \end{bmatrix}$, $A + A' = 2\sqrt{3}\, I$, then the value of $x \in \left[0, \frac{\pi}{2}\right]$ is :

(A) 0 (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

11.

If $A = [a_{ij}]$ is an identity matrix, then which of the following is true ?

(A) $a_{ij} = \begin{cases} 0, & \text{if } i = j \\ 1, & \text{if } i \neq j \end{cases}$

(B) $a_{ij} = 1, \forall\, i, j$

(C) $a_{ij} = 0, \forall\, i, j$

(D) $a_{ij} = \begin{cases} 0, & \text{if } i \neq j \\ 1, & \text{if } i = j \end{cases}$

12.

Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a square matrix such that adj A = A. Then, $(a + b + c + d)$ is equal to :

(A) 2a

(B) 2b

(C) 2c

(D) 0

13.

If A and B are two skew symmetric matrices, then (AB + BA) is :

(A) a skew symmetric matrix

(B) a symmetric matrix

(C) a null matrix

(D) an identity matrix

14.

If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A^{-1} is :

(A) $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$

(B) $30 \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$

(C) $\frac{1}{30} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

(D) $\frac{1}{30} \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$

15.

Assertion (A) : Every scalar matrix is a diagonal matrix.

Reason (R) : In a diagonal matrix, all the diagonal elements are 0.

16.

For any square matrix A, $(A - A')$ is always

(A) an identity matrix

(B) a null matrix

(C) a skew symmetric matrix

(D) a symmetric matrix

17.

If $\begin{bmatrix} a & c & 0 \\ b & d & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix, then the value of $a + 2b + 3c + 4d$ is :

(A) 0 (B) 5

(C) 10 (D) 25

18.

If $A = \begin{bmatrix} 2 & 1 \\ -4 & -2 \end{bmatrix}$, then the value of $I - A + A^2 - A^3 + \ldots$ is :

(A) $\begin{bmatrix} -1 & -1 \\ 4 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 1 \\ -4 & -1 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

19.

Given that $\begin{bmatrix} 1 & x \end{bmatrix} \begin{bmatrix} 4 & 0 \\ -2 & 0 \end{bmatrix} = 0$, the value of x is :

(A) -4 (B) -2

(C) 2 (D) 4

20.

If $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$ and $A^2 - kA - 5I = O$, then the value of k is :

(A) 3 (B) 5

(C) 7 (D) 9

21.

If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ and $A^2 + 7I = kA$, then the value of k is :

(A) 1 (B) 2

(C) 5 (D) 7

22.

Let $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$ and $B = \frac{1}{3}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & \lambda \end{bmatrix}$. If AB = I, then the value of λ is :

(A) $\frac{-9}{4}$ (B) -2

(C) $\frac{-3}{2}$ (D) 0

23.

If $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ -1 & 1 \end{bmatrix}$, then value of x for which $A^2 = B$ is :

(A) -2 (B) 2

(C) 2 or -2 (D) 4

24.

Find the matrix A^2, where $A = [a_{ij}]$ is a 2×2 matrix whose elements are given by a_{ij} = maximum (i, j) – minimum (i, j) :

(A) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

25.

If $A = \begin{bmatrix} a & c & -1 \\ b & 0 & 5 \\ 1 & -5 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then the value of $2a - (b + c)$ is :

(A) 0 (B) 1

(C) -10 (D) 10

26.

If $\begin{bmatrix} x & 2 & 0 \end{bmatrix} \begin{bmatrix} 5 \\ -1 \\ x \end{bmatrix} = \begin{bmatrix} 3 & 1 \end{bmatrix} \begin{bmatrix} -2 \\ x \end{bmatrix}$, then value of x is

(A) -1 (B) 0

(C) 1 (D) 2

27.

The product of matrix P and Q is equal to a diagonal matrix. If the order of matrix Q is 3×2, then order of matrix P is :

(A) 2×2 (B) 3×3

(C) 2×3 (D) 3×2

2025 March :

1 Mark MCQ's :

1.

If $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then A^{-1} is

(A) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

2.

Let $A = \begin{bmatrix} 1 & -2 & -1 \\ 0 & 4 & -1 \\ -3 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} -2 \\ -5 \\ -7 \end{bmatrix}$, $C = [9\ 8\ 7]$, which of the following is defined ?

(A) Only AB (B) Only AC

(C) Only BA (D) All AB, AC and BA

3.

If $A = \begin{bmatrix} 7 & 0 & x \\ 0 & 7 & 0 \\ 0 & 0 & y \end{bmatrix}$ is a scalar matrix, then y^x is equal to

(A) 0 (B) 1

(C) 7 (D) ± 7

4.

Let A be a matrix of order $m \times n$ and B is a matrix such that A^TB and BA^T are defined. Then, the order of B is :

(A) $m \times m$ (B) $n \times n$

(C) $m \times n$ (D) $n \times m$

5.

Let $A = [a_{ij}]$ be a square matrix of order 3 such that $a_{ij} = \hat{j} - 2\hat{i}$. Then which of the following is true ?

(A) $a_{12} > 0$ (B) all $a_{ij} < 0$

(C) $a_{13} + a_{31} = -6$ (D) $a_{23} > a_{32}$

6.

If $\begin{bmatrix} x+y & 3y \\ 3x & x+3 \end{bmatrix} = \begin{bmatrix} 9 & 4x+y \\ x+6 & y \end{bmatrix}$, then $(x-y) = ?$

(A) -7 (B) -3

(C) 3 (D) 7

5.

If $A = \begin{bmatrix} 1 & 12 & 4y \\ 6x & 5 & 2x \\ 8x & 4 & 6 \end{bmatrix}$ is a symmetric matrix, then $(2x + y)$ is

(A) -8 (B) 0

(C) 6 (D) 8

6.

Which of the following can be both a symmetric and skew-symmetric matrix ?

(A) Unit Matrix (B) Diagonal Matrix

(C) Null Matrix (D) Row Matrix

7.

Four friends Abhay, Bina, Chhaya and Devesh were asked to simplify $4\,AB + 3(AB + BA) - 4\,BA$, where A and B are both matrices of order 2×2. It is known that $A \neq B \neq I$ and $A^{-1} \neq B$.

Their answers are given as :

Abhay : $6\,AB$

Bina : $7\,AB - BA$

Chhaya : $8\,AB$

Devesh : $7\,BA - AB$

Who answered it correctly ?

(A) Abhay (B) Bina

(C) Chhaya (D) Devesh

8.

If A and B are square matrices of order m such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following is always correct ?

(A) $A = B$ (B) $AB = BA$

(C) $A = 0$ or $B = 0$ (D) $A = I$ or $B = I$

9.

Assertion (A) : $A = \text{diag}\,[3\ \ 5\ \ 2]$ is a scalar matrix of order 3×3.

Reason (R) : If a diagonal matrix has all non-zero elements equal, it is known as a scalar matrix.

10.

Which of the following can be both a symmetric and skew-symmetric matrix ?

(A) Unit Matrix (B) Diagonal Matrix

(C) Null Matrix (D) Row Matrix

11.

If A and B are square matrices of same order, then $(AB^T - BA^T)$ is a

(A) symmetric matrix (B) skew-symmetric matrix

(C) null matrix (D) unit matrix

12.

If A and B are square matrices of same order such that AB = A and BA = B, then $A^2 + B^2$ is equal to :

(A) A + B (B) BA

(C) 2 (A + B) (D) 2BA

13.

The matrix $\begin{bmatrix} 0 & 1 & -2 \\ -1 & 0 & -7 \\ 2 & 7 & 0 \end{bmatrix}$ is a :

(A) diagonal matrix (B) symmetric matrix

(C) skew symmetric matrix (D) scalar matrix

Ques on Paper code: 65/5/1,2,3 14.

If $A = \begin{bmatrix} 1 & 2 & 3 \\ -4 & 3 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 \\ -1 & 2 \\ 0 & 5 \end{bmatrix}$, then the correct statement is :

(A) Only AB is defined.

(B) Only BA is defined.

(C) AB and BA, both are defined.

(D) AB and BA, both are not defined.

15.

If A and B are two square matrices of the same order, then (A + B) (A – B) is equal to :

(A) $A^2 - AB + BA - B^2$ (B) $A^2 + AB - BA - B^2$

(C) $A^2 - AB - BA - B^2$ (D) $A^2 - B^2 + AB + BA$

16.

If a matrix A is both symmetric and skew-symmetric, then A is a :

(A) diagonal matrix (B) zero matrix

(C) non-singular matrix (D) scalar matrix

17.

Let A and B be two matrices of suitable orders. Then, which of the following is ***not*** correct ?

(A) $(A')' = A$ (B) $(kA)' = kA'$, k is a scalar

(C) $(A' + B')' = A + B$ (D) $(AB)' = A'B'$

18.

Let both AB' and $B'A$ be defined for matrices A and B. If order of A is $n \times m$, then the order of B is :

(A) $n \times n$ (B) $n \times m$

(C) $m \times m$ (D) $m \times n$

19.

If $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A is a/an :

(A) scalar matrix (B) identity matrix

(C) symmetric matrix (D) skew-symmetric matrix

20.

Sum of two skew-symmetric matrices of same order is always a/an :

(A) skew-symmetric matrix

(B) symmetric matrix

(C) null matrix

(D) identity matrix

21.

If $A = \begin{bmatrix} 0 & -3 & 8 \\ 3 & 0 & 5 \\ -8 & -5 & 0 \end{bmatrix}$, then A is a :

(A) null matrix (B) symmetric matrix

(C) skew-symmetric matrix (D) diagonal matrix

22.

If $A = \begin{bmatrix} 0 & 0 & -5 \\ 0 & 3 & 0 \\ 4\cdot3 & 0 & 0 \end{bmatrix}$, then A is a :

(A) skew-symmetric matrix (B) scalar matrix

(C) diagonal matrix (D) square matrix

Ques on Paper code: 65/7/1,2,3 23.

What is the total number of possible matrices of order 3 × 3 with each entry as $\sqrt{2}$ or $\sqrt{3}$?

(A) 9 (B) 512

(C) 615 (D) 64

24.

The matrix $A = \begin{bmatrix} \sqrt{3} & 0 & 0 \\ 0 & \sqrt{2} & 0 \\ 0 & 0 & \sqrt{5} \end{bmatrix}$ is a/an :

(A) scalar matrix (B) identity matrix

(C) null matrix (D) symmetric matrix

25.

If $\begin{bmatrix} 2x-1 & 3x \\ 0 & y^2-1 \end{bmatrix} = \begin{bmatrix} x+3 & 12 \\ 0 & 35 \end{bmatrix}$, then the value of $(x - y)$ is :

(A) 2 or 10 (B) – 2 or 10

(C) 2 or – 10 (D) – 2 or – 10

1Mark :

1.

Find the order of the matrix A such that

$$\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} A = \begin{bmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{bmatrix}.$$

2.

If $B = \begin{bmatrix} 1 & -5 \\ 0 & -3 \end{bmatrix}$ and $A + 2B = \begin{bmatrix} 0 & 4 \\ -7 & 5 \end{bmatrix}$, find the matrix A.

3.

If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & x \\ -2 & 2 & -1 \end{pmatrix}$ is a matric satisfying $AA' = 9I$, find x.

4.

If A is a matrix of order 3×2, then the order of the matrix A′ is _____ .

OR

A square matrix A is said to be skew-symmetric, if _____ .

5.

If $A = [1 \quad 0 \quad 4]$ and $B = \begin{bmatrix} 2 \\ 5 \\ 6 \end{bmatrix}$, find AB.

6.

If $\begin{bmatrix} 3 & -2 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ k \\ -5 \end{bmatrix} = O$, where O is the null matrix, then the value of k is

7.

Construct a 2×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = |(i)^2 - j|$.

8.

If $\begin{bmatrix} x+y & 7 \\ 9 & x-y \end{bmatrix} = \begin{bmatrix} 2 & 7 \\ 9 & 4 \end{bmatrix}$, then $x \cdot y =$ _____

9.

Find adj A, if $A = \begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$

10.

If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then find A^3.

11.

Find the cofactors of all the elements of $\begin{bmatrix} 1 & -2 \\ 4 & 3 \end{bmatrix}$.

12.

If $A + B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $A - 2B = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix}$, then $A =$ _____.

13.

If $\begin{bmatrix} 4 & x+2 \\ 2x-3 & x+1 \end{bmatrix}$ is a symmetric matrix, then find the value of x.

14.

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

Sol.

$$3A = \begin{bmatrix} 9 & 3 \\ 3 & 6 \end{bmatrix} \Rightarrow A = \begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$$

15.

$$\text{Find } x, \text{ if } \begin{bmatrix} x & -5 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = O$$

15.a 2025

$$\text{Find the value of x, if } \begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = O.$$

Sol.

$$\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$$

$$\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 7+2x \\ 12+x \\ 21+2x \end{bmatrix} = 0$$

$$x^2 + 16x + 28 = 0$$

$$\Rightarrow (x+14)(x+2) = 0$$

$$\Rightarrow x = -14, x = -2$$

prepared by : BALAJI KANCHI

16.

Write the element a_{23} of a 3×3 matrix $A = (a_{ij})$ whose elements a_{ij} are given by $a_{ij} = \frac{|i-j|}{2}$.

17.

Write a 3×3 skew symmetric matrix.

18.

If $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$, then find $(3A - B)$.

19.

Write the number of all possible matrices of order 2×2 with each entry 1, 2 or 3.

20.

If $A = \begin{pmatrix} 1 & -2 & 3 \\ -4 & 2 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{pmatrix}$ and $BA = (b_{ij})$, find $b_{21} + b_{32}$.

21.

Write the number of all possible matrices of order 2×3 with each entry 1 or 2.

22.

If $A = \begin{pmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{pmatrix}$, find α satisfying $0 < \alpha < \frac{\pi}{2}$ when $A + A^T = \sqrt{2}\, I_2$; where A^T is transpose of A.

23.

If $A = \begin{pmatrix} 0 & 3 \\ 2 & -5 \end{pmatrix}$ and $KA = \begin{pmatrix} 0 & 4a \\ -8 & 5b \end{pmatrix}$ find the values of k and a.

24.

If A is a square matrix such that $A^2 = I$, then find the simplified value of $(A - I)^3 + (A + I)^3 - 7A$.

25.

Matrix $A = \begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is given to be symmetric, find values of a and b.

26.

If $(2\ 1\ 3)\begin{pmatrix} -1 & 0 & -1 \\ -1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix} = A$, then write the order of matrix A.

27.

If $A = \begin{pmatrix} 3 & 5 \\ 7 & 9 \end{pmatrix}$ is written as A = P + Q, where P is a symmetric matrix and Q is skew symmetric matrix, then write the matrix P.

28.

Let A and B are matrices of order 3×2 and 2×4 respectively. Write the order of matrix (AB).

29.

If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & x \\ -2 & 2 & -1 \end{pmatrix}$ is a matric satisfying $AA' = 9I$, find x.

30.

If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $A^{-1} = kA$, then find the value of k.

31.

If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric, find the values of 'a' and 'b'.

32.

If A is a square matrix such that $A^2 = A$, then find $(2 + A)^3 - 19A$.

33.

If $A=\begin{bmatrix}-3 & 2\\ 1 & -1\end{bmatrix}$ and $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, find scalar k so that $A^2+I=kA$.

Sol.

$$A^2=\begin{bmatrix}11 & -8\\ -4 & 3\end{bmatrix}$$

$$A^2+I=kA \Rightarrow \begin{bmatrix}12 & -8\\ -4 & 4\end{bmatrix}=\begin{bmatrix}-3k & 2k\\ k & -k\end{bmatrix}$$

$$k=-4$$

2Mark :

1.

If the matrix $A=\begin{bmatrix}0 & 6-5x\\ x^2 & x+3\end{bmatrix}$ is symmetric, find the values of x.

2.

If $A=\begin{bmatrix}-3 & 2\\ 1 & -1\end{bmatrix}$ and $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, find scalar k so that $A^2+I=kA$.

3.

Express $A=\begin{bmatrix}4 & -3\\ 2 & -1\end{bmatrix}$ as a sum of a symmetric and a skew symmetric matrix.

4.

If A is a skew-symmetric matrix of order 3, then prove that det A = 0.

5.

For the matrix $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, verify that

(i) $(A + A')$ is a symmetric matrix.

(ii) $(A - A')$ is a skew-symmetric matrix.

6.

Find a matrix A such that $2A - 3B + 5C = O$, where $B = \begin{bmatrix} -2 & 2 & 0 \\ 3 & 1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 0 & -2 \\ 7 & 1 & 6 \end{bmatrix}$.

Sol.

$$2A - \begin{bmatrix} -6 & 6 & 0 \\ 9 & 3 & 12 \end{bmatrix} + \begin{bmatrix} 10 & 0 & -10 \\ 35 & 5 & 30 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\Rightarrow A = \begin{bmatrix} -8 & 3 & 5 \\ -13 & -1 & -9 \end{bmatrix}$$

7.

If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, then find $(A^2 - 5A)$.

Sol.

$$A^2 = \begin{bmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{bmatrix}$$

$$A^2 - 5A = \begin{bmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{bmatrix} - \begin{bmatrix} 10 & 0 & 5 \\ 10 & 5 & 15 \\ 5 & -5 & 0 \end{bmatrix} = \begin{bmatrix} -5 & -1 & -3 \\ -1 & -7 & -10 \\ -5 & 4 & -2 \end{bmatrix}$$

8.

Find a matrix A such that $2A - 3B + 5C = O$, where $B = \begin{bmatrix} -2 & 2 & 0 \\ 3 & 1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 0 & -2 \\ 7 & 1 & 6 \end{bmatrix}$.

9.

If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then find the values of k, a and b.

10.

If A and B are symmetric matrices, such that AB and BA are both defined, then prove that AB – BA is a skew symmetric matrix.

11.

Find the value of $(x - y)$ from the matrix equation

$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} -3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}.$$

Sol.

Getting $\begin{pmatrix} 2x+3 & 6 \\ 15 & 2y-4 \end{pmatrix} = \begin{pmatrix} 7 & 6 \\ 15 & 14 \end{pmatrix}$

$2x + 3 = 7$ and $2y - 4 = 14$

$\Rightarrow \quad x = 2, y = 9$

12.

If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric, find the values of 'a' and 'b'.

13.

If $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$, then write the value of $(x+y)$.

Sol.

$$\begin{bmatrix}2+y & 6\\ 1 & 2x+2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$$

$\Rightarrow x = 3,\ y = 3$ $\qquad\qquad$ $\therefore\ x - y = 0$

14.

If $A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$, verify that $A^2 - 4A - 5I = 0$.

15.

If matrix A = (1, 2, 3), write AA', where A' is the transpose of matrix A.

16.

If $A=\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$, then for what value of α is A an identity matrix?

17.

If $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}\begin{bmatrix}3 & 1\\ 2 & 5\end{bmatrix}=\begin{bmatrix}7 & 11\\ k & 23\end{bmatrix}$, then write the value of k.

18.

If $[2x\ \ 3]\begin{bmatrix}1 & 2\\ -3 & 0\end{bmatrix}\begin{bmatrix}x\\ 3\end{bmatrix}=O$, find x

19.

Write the element a_{12} of the matrix $A = [a_{ij}]_{2\times 2}$, whose elements a_{ij} are given by $a_{ij} = e^{2ix}\sin jx$.

20.

Find the value of (x + y) from the following matrix equation :

$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$$

21.

Find the values of x and y from the following matrix equation :

$$2\begin{pmatrix} x & 5 \\ 7 & y-3 \end{pmatrix} + \begin{pmatrix} 3 & -4 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 7 & 6 \\ 15 & 14 \end{pmatrix}$$

22. 2025

If $A = \begin{bmatrix} 1 & -1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 3 & 4 \\ 0 & 5 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$, are three matrices, then find ABC.

Sol.

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

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

$$= [-15]$$

prepared by : BALAJI KANCHI

23. 2025

If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, then show that $A^2 - 4A + 7I = 0$.

Sol.

$$A^2 = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 12 \\ -4 & 1 \end{bmatrix}.$$

$$\text{L.H.S.} = A^2 - 4A + 7I = \begin{bmatrix} 1 & 12 \\ -4 & 1 \end{bmatrix} - \begin{bmatrix} 8 & 12 \\ -4 & 8 \end{bmatrix} + \begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = O = \text{R.H.S.}$$

24.

If $\begin{bmatrix} 3 & -1 \\ 0 & 1 \\ 2 & -3 \end{bmatrix} A = \begin{bmatrix} 2 \\ -5 \\ -17 \end{bmatrix}$, then find matrix A.

Sol.

$$\text{Let } A = \begin{bmatrix} x \\ y \end{bmatrix} \Rightarrow \begin{bmatrix} 3 & -1 \\ 0 & 1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ -5 \\ -17 \end{bmatrix}$$

$$\Rightarrow 3x - y = 2, y = -5 \text{ and}$$

$$\Rightarrow x = -1$$

prepared by : BALAJI KANCHI

Put the values in $2x - 3y = -17$, L.H.S. $= 2(-1) - 3(-5) \neq -17 =$ R.H.S.

$\therefore$ The matrix 'A' does not exist.

25.

If $A = \begin{bmatrix} 1 & 0 \\ -1 & 5 \end{bmatrix}$, then find the value of K if $A^2 = 6A + KI_2$, where I_2 is identity matrix.

Sol.

$$A^2 = 6A + KI_2 \Rightarrow \begin{bmatrix} 1 & 0 \\ -6 & 25 \end{bmatrix} = \begin{bmatrix} 6+K & 0 \\ -6 & 30+K \end{bmatrix}$$

$$\Rightarrow 6 + K = 1 \Rightarrow K = -5 \text{ , also satisfies } 30 + K = 25.$$

prepared by : BALAJI KANCHI

26. 2023

Express the matrix $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix.

Sol.

$$\textbf{Symmetric} = \frac{1}{2}(A + A') = \begin{bmatrix} 3 & -\frac{3}{2} \\ -\frac{3}{2} & -1 \end{bmatrix}$$

$$\textbf{Skew-Symmetric} = \frac{1}{2}(A - A') = \begin{bmatrix} 0 & -\frac{5}{2} \\ \frac{5}{2} & 0 \end{bmatrix}$$

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

27.

Express $A = \begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix}$ as a sum of a symmetric and a skew symmetric matrix.

Sol.

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

$$P = \frac{A + A^T}{2} = \frac{1}{2}\begin{bmatrix} 8 & -1 \\ -1 & -2 \end{bmatrix}$$

$$Q = \frac{A - A^T}{2} = \frac{1}{2}\begin{bmatrix} 0 & -5 \\ 5 & 0 \end{bmatrix}$$

Now, $A = P + Q$

$$P + Q = \frac{1}{2}\begin{bmatrix} 8 & -6 \\ 4 & -2 \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix} = A$$

28.

If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, show that $(A - 2I)(A - 3I) = 0$.

Sol.

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

$$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = O$$

29.

If $A = \begin{bmatrix} -3 & 6 \\ -2 & 4 \end{bmatrix}$, then show that $A^3 = A$.

Sol.

$$A^2 = \begin{bmatrix} -3 & 6 \\ -2 & 4 \end{bmatrix}\begin{bmatrix} -3 & 6 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -3 & 6 \\ -2 & 4 \end{bmatrix} = A$$

$$\Rightarrow A^3 = A^2 \cdot A = A \cdot A = A^2 = A$$

30.

If $A = \begin{bmatrix} 3 & 9 & 0 \\ 1 & 8 & -2 \\ 7 & 5 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 & 2 \\ 7 & 1 & 4 \\ 2 & 2 & 6 \end{bmatrix}$, then find the matrix $B'A'$.

Sol.

$$B'A' = \begin{bmatrix} 4 & 7 & 2 \\ 0 & 1 & 2 \\ 2 & 4 & 6 \end{bmatrix}\begin{bmatrix} 3 & 1 & 7 \\ 9 & 8 & 5 \\ 0 & -2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 75 & 56 & 71 \\ 9 & 4 & 13 \\ 42 & 22 & 58 \end{bmatrix}$$

31.

For the matrix $A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$, find $(A + A')$ and verify that it is a symmetric matrix.

Sol.

$$A + A' = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix} + \begin{bmatrix} 2 & 5 \\ 3 & 7 \end{bmatrix} = \begin{bmatrix} 4 & 8 \\ 8 & 14 \end{bmatrix}$$

$$(A + A')' = \begin{bmatrix} 4 & 8 \\ 8 & 14 \end{bmatrix} = A + A' \qquad \text{So } A + A' \text{ is symmetric}$$

32.

Find the value of $(x - y)$ from the matrix equation

$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} -3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}.$$

Sol.

$$\begin{bmatrix} 2x-3 & 6 \\ 15 & 2y-4 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$$

$\Rightarrow 2x - 3 = 7$ and $2y - 4 = 14$

$\Rightarrow x = 5,\ y = 9 \Rightarrow x - y = -4$

33.

For what value of x is $\begin{bmatrix} 1 & 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 1 \\ 1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 0 \\ 2 \\ x \end{bmatrix} = 0$?

Sol.

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

$\Rightarrow \quad [4 + 2x + 2x] = O \Rightarrow x = -1$

34.

If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric,

find the values of 'a' and 'b'.

Sol.

$a = -2,\ b = 3$

35.

If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & x \\ -2 & 2 & -1 \end{pmatrix}$ is a matric satisfying $AA' = 9I$, find x.

Ans.

$A' = \begin{pmatrix} 1 & 2 & -2 \\ 2 & 1 & 2 \\ 2 & x & -1 \end{pmatrix}$ and getting $x = -2$

35.

Matrix $A = \begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is given to be symmetric, find values of a and b.

Sol.

$2b = 3$ and $3a = -2$

$b = \frac{3}{2}$ and $a = -\frac{2}{3}$

5 Mark :

1.

Let $A=\begin{pmatrix}2 & -1\\ 3 & 4\end{pmatrix}$, $B=\begin{pmatrix}5 & 2\\ 7 & 4\end{pmatrix}$, $C=\begin{pmatrix}2 & 5\\ 3 & 8\end{pmatrix}$, find a matrix D such that $CD - AB = O$.

2.

Express the matrix $B=\begin{bmatrix}2 & -2 & -4\\ -1 & 3 & 4\\ 1 & -2 & -3\end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix.

3.

If $F(x)=\begin{bmatrix}\cos x & -\sin x & 0\\ \sin x & \cos x & 0\\ 0 & 0 & 1\end{bmatrix}$, show that $F(x)\,F(y) = F(x+y)$.

3.b 2023

If $f(\alpha)=\begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}$, prove that $f(\alpha)\cdot f(-\beta) = f(\alpha-\beta)$

Sol.

$$\text{LHS} = f(\alpha)f(-\beta)=\begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}\cos\beta & \sin\beta & 0\\ -\sin\beta & \cos\beta & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$=\begin{bmatrix}\cos\alpha\cos\beta+\sin\alpha\sin\beta & \cos\alpha\sin\beta-\sin\alpha\cos\beta & 0\\ \sin\alpha\cos\beta-\cos\alpha\sin\beta & \sin\alpha\sin\beta+\cos\alpha\cos\beta & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$=\begin{bmatrix}\cos(\alpha-\beta) & -\sin(\alpha-\beta) & 0\\ \sin(\alpha-\beta) & \cos(\alpha-\beta) & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$= f(\alpha-\beta) = \text{RHS}$$

prepared by : BALAJI KANCHI

4.2023

If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, then show that $A^3 - 6A^2 + 7A + 2I = O$.

Sol.

getting, $A^2 = \begin{bmatrix} 5 & 0 & 8 \\ 2 & 4 & 5 \\ 8 & 0 & 13 \end{bmatrix}$

getting, $A^3 = \begin{bmatrix} 21 & 0 & 34 \\ 12 & 8 & 23 \\ 34 & 0 & 55 \end{bmatrix}$

$\therefore A^3 - 6A^2 + 7A + 2I =$

$$\begin{bmatrix} 21 & 0 & 34 \\ 12 & 8 & 23 \\ 34 & 0 & 55 \end{bmatrix} - \begin{bmatrix} 30 & 0 & 48 \\ 12 & 24 & 30 \\ 48 & 0 & 78 \end{bmatrix} + \begin{bmatrix} 7 & 0 & 14 \\ 0 & 14 & 7 \\ 14 & 0 & 21 \end{bmatrix} + \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = O$$

prepared by : BALAJI KANCHI

4.b

If $A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{pmatrix}$ and $A^3 - 6A^2 + 7A + kI_3 = O$ find k.

Sol.

For getting $A^2 = \begin{pmatrix} 5 & 0 & 8 \\ 2 & 4 & 5 \\ 8 & 0 & 13 \end{pmatrix}$

For getting $A^3 = \begin{pmatrix} 21 & 0 & 34 \\ 12 & 8 & 23 \\ 34 & 0 & 55 \end{pmatrix}$

Simplifying $A^3 - 6A^2 + 7A + kI_3$ as $\begin{pmatrix} k-2 & 0 & 0 \\ 0 & k-2 & 0 \\ 0 & 0 & k-2 \end{pmatrix}$

Equating $\begin{pmatrix} k-2 & 0 & 0 \\ 0 & k-2 & 0 \\ 0 & 0 & k-2 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

$\Rightarrow \quad k - 2 = 0$

$k = 2$

4.b

If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^3 - 23A - 40I = O$.

Sol.

Getting $A^2 = \begin{bmatrix} 19 & 4 & 8 \\ 1 & 12 & 8 \\ 14 & 6 & 15 \end{bmatrix}$

Getting $A^3 = \begin{bmatrix} 63 & 46 & 69 \\ 69 & -6 & 23 \\ 92 & 46 & 63 \end{bmatrix}$

$A^3 - 23A - 40I =$

$$\begin{bmatrix} 63 & 46 & 69 \\ 69 & -6 & 23 \\ 92 & 46 & 63 \end{bmatrix} - \begin{bmatrix} 23 & 46 & 69 \\ 69 & -46 & 23 \\ 92 & 46 & 23 \end{bmatrix} - \begin{bmatrix} 40 & 0 & 0 \\ 0 & 40 & 0 \\ 0 & 0 & 40 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = O$$

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5.

If $A = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2, show that

$$I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$$

6.

Find the values of x, y, z if the matrix $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ satisfy the equation

$A'A = I$.

7.

Let $A = \begin{bmatrix} 3 & 2 & 5 \\ 4 & 1 & 3 \\ 0 & 6 & 7 \end{bmatrix}$. Express A as sum of two matrices such that one is symmetric and the other is skew symmetric.

8.

Express the matrix $A = \begin{bmatrix} 2 & 4 & -6 \\ 7 & 3 & 5 \\ 1 & -2 & 4 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix.

9.

If $A=\begin{bmatrix}1 & -1\\ 2 & -1\end{bmatrix}$ and $B=\begin{bmatrix}a & 1\\ b & -1\end{bmatrix}$ and $(A+B)^2 = A^2 + B^2$, then find the values of a and b.

Sol.

$$A^2=\begin{bmatrix}1 & -1\\ 2 & -1\end{bmatrix}\begin{bmatrix}1 & -1\\ 2 & -1\end{bmatrix}=\begin{bmatrix}-1 & 0\\ 0 & -1\end{bmatrix},\ B^2=\begin{bmatrix}a & 1\\ b & -1\end{bmatrix}\begin{bmatrix}a & 1\\ b & -1\end{bmatrix}=\begin{bmatrix}a^2+b & a-1\\ b(a-1) & b+1\end{bmatrix}$$

$$(A+B)^2=\begin{pmatrix}1+a & 0\\ 2+b & -2\end{pmatrix}\begin{pmatrix}1+a & 0\\ 2+b & -2\end{pmatrix}\begin{pmatrix}(1+a)^2 & 0\\ (2+b)(1+a)-2(2+b) & 4\end{pmatrix} \quad \text{..... (i)}$$

$$A^2+B^2=\begin{pmatrix}a^2+b-1 & a-1\\ b(a-1) & b\end{pmatrix} \quad \text{.....(ii)}$$

Equating (i) and (ii), we get $b=4, a=1$

10.

If $A=\begin{pmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{pmatrix}$ find $A^2 - 5A + 4I$ and hence find a matrix X such that $A^2-5A+4I+X=O$

Sol.

$$\text{Getting } A^2=\begin{pmatrix}5 & -1 & 2\\ 9 & -2 & 5\\ 0 & -1 & -2\end{pmatrix}$$

$$A^2-5A+4I=\begin{pmatrix}5 & -1 & 2\\ 9 & -2 & 5\\ 0 & -1 & -2\end{pmatrix}+\begin{pmatrix}-10 & 0 & -5\\ -10 & -5 & -15\\ -5 & 5 & 0\end{pmatrix}+\begin{pmatrix}4 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 4\end{pmatrix}$$

$$= \begin{pmatrix} -1 & -1 & -3 \\ -1 & -3 & -10 \\ -5 & 4 & 2 \end{pmatrix}$$

$$\therefore \ X = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & 10 \\ 5 & -4 & -2 \end{pmatrix}$$

11.

If $A = \begin{pmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{pmatrix}$, find $A^2 - 5A + 16I$.

12.

If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$, then calculate AC, BC and (A + B) C. Also verify that (A + B) C = AC + BC.

13.

If $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$ and $A^2 - \lambda A + \mu I = O$, then find the values of λ and μ.

14.

If $A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{pmatrix}$ and $A^3 - 6A^2 + 7A + kI_3 = O$ find k.

15.

Let $A = \begin{pmatrix} 2 & -1 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} 5 & 2 \\ 7 & 4 \end{pmatrix}, C = \begin{pmatrix} 2 & 5 \\ 3 & 8 \end{pmatrix}$, find a matrix D such that $CD - AB = O$.

Sol.

Let $D = \begin{bmatrix} x & y \\ z & w \end{bmatrix}$

$$CD = AB \Rightarrow \begin{bmatrix} 2x+5z & 2y+5w \\ 3x+8z & 3y+8w \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 43 & 22 \end{bmatrix}$$

$2x + 5z = 3,\ 3x + 8z = 43;\ 2y + 5w = 0,\ 3y + 8w = 22.$

Solving, we get $x = -191,\ y = -110,\ z = 77,\ w = 44$

$$\therefore D = \begin{bmatrix} -191 & -110 \\ 77 & 44 \end{bmatrix}$$

16.a

Find matrix X so that $X \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix}$.

Sol.

Let $X = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

then, $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix}$

$$\Rightarrow \begin{pmatrix} a+4b & 2a+5b & 3a+6b \\ c+4d & 2c+5d & 3c+6d \end{pmatrix} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix}$$

equating and solving to get $a = 1,\ b = -2,\ c = 2,\ d = 0$

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

16.b

Find matrix X if : $X\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix}=\begin{pmatrix}-7 & -8 & -9\\ 2 & 4 & 6\\ 11 & 10 & 9\end{pmatrix}$

Sol.

So $\begin{pmatrix}a & b\\ c & d\\ e & f\end{pmatrix}\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix}=\begin{pmatrix}-7 & -8 & -9\\ 2 & 4 & 6\\ 11 & 10 & 9\end{pmatrix}$

$$\left.\begin{array}{lll} a+4b=-7 & c+4d=2 & e+4f=11\\ 2a+5b=-8 & 2c+5d=4 & 2e+5f=10 \end{array}\right\}$$

Solving we get

$a=1,\quad b=-2,\quad c=2,\quad d=0,\quad e=-5\quad f=4$

Thus $X=\begin{pmatrix}1 & -2\\ 2 & 0\\ -5 & 4\end{pmatrix}$

16.c

Find matrix A, if $\begin{pmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{pmatrix} A = \begin{pmatrix} -1 & -8 & -10 \\ 1 & -2 & -5 \\ 9 & 22 & 15 \end{pmatrix}$

Sol.

Clearly order of A is 2×3

Let $A = \begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix}$

So $\begin{pmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix} = \begin{pmatrix} -1 & -8 & -10 \\ 1 & -2 & -5 \\ 9 & 22 & 15 \end{pmatrix}$

gives

$2a - d = -1,\ 2b - e = -8,\ 2c - f = -10$

$a = 1,\ b = -2,\ c = -5$

$\Rightarrow \quad d = 3,\ e = 4,\ f = 0$

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

16.d

Find matrix A such that

$$\begin{pmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{pmatrix} A = \begin{pmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{pmatrix}$$

Sol.

Let $\begin{pmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{pmatrix}$

$$\Rightarrow \begin{pmatrix} 2a-c & 2b-d \\ a & b \\ -3a+4c & -3b+4d \end{pmatrix} = \begin{pmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{pmatrix}$$

$\Rightarrow$ $2a - c = -1, \quad 2b - d = -8$

$a = 1, \quad b = -2$

$-3a + 4c = 9, \quad -3b + 4d = 22$

Solving to get $a = 1, b = -2, c = 3, d = 4$

$$\therefore \quad A = \begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix}$$

16.e

If $X\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} = \begin{pmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{pmatrix}$, then find the matrix X.

16.d 2025

Let $A = \begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 4 & 2 \\ 12 & 16 & 8 \\ -6 & -8 & -4 \end{bmatrix}$ be two matrices. Then, find the matrix B if AB = C.

Sol.

Let $B = [x \;\; y \;\; z]$

$$AB = C \Rightarrow \begin{bmatrix} x & y & z \\ 4x & 4y & 4z \\ -2x & -2y & -2z \end{bmatrix} = \begin{bmatrix} 3 & 4 & 2 \\ 12 & 16 & 8 \\ -6 & -8 & -4 \end{bmatrix}$$ which gives $x = 3$, $y = 4$ and $z = 2$

$B = [3 \;\; 4 \;\; 2]$

prepared by : BALAJI KANCHI

17. 2023

If $f(\alpha) = \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$, prove that $f(\alpha) \cdot f(-\beta) = f(\alpha - \beta)$

18. 2023

(a) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, then show that $A^3 - 6A^2 + 7A + 2I = O$.

19. 2023

If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that $A^3 - 23A - 40I = O$.

20.

Write the matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ as a sum of a symmetric and a skew symmetric matrix.

21.

Let $A = \begin{pmatrix} 2 & 3 \\ -1 & 2 \end{pmatrix}$, then show that $A^2 - 4A + 7I = O$

Using this result calculate A^3 also.

2025 March :

1.

Let $A = \begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 4 & 2 \\ 12 & 16 & 8 \\ -6 & -8 & -4 \end{bmatrix}$ be two matrices. Then, find the matrix B if AB = C.

Word problems :

1. 2025

A shopkeeper sells 50 Chemistry, 60 Physics and 35 Maths books on day I and sells 40 Chemistry, 45 Physics and 50 Maths books on day II. If the selling price for each such subject book is ₹ 150 (Chemistry), ₹ 175 (Physics) and ₹ 180 (Maths), then find his total sale in two days, using matrix method. If cost price of all the books together is ₹ 35,000, what profit did he earn after the sale of two days ?

Sol.

Let $A = \begin{bmatrix} 50 & 60 & 35 \\ 40 & 45 & 50 \end{bmatrix}$ Day I / Day II, $B = \begin{bmatrix} 150 \\ 175 \\ 180 \end{bmatrix}$ **be the day wise sale and the selling price per subject, matrices respectively.**

$$\text{Total sales day wise} = \begin{bmatrix} 50 & 60 & 35 \\ 40 & 45 & 50 \end{bmatrix} \begin{bmatrix} 150 \\ 175 \\ 180 \end{bmatrix} = \begin{bmatrix} 24,300 \\ 22,875 \end{bmatrix} \begin{matrix} \text{Day I} \\ \text{Day II} \end{matrix}$$

Total sales in two days = ₹ 24,300 + ₹ 22,875 = ₹ 47,175

Profit = ₹ 47,175 – ₹ 35,000 = ₹ 12,175.

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2.

A trust fund has ₹ 35,000 is to be invested in two different types of bonds. The first bond pays 8% interest per annum which will be given to orphanage and second bond pays 10% interest per annum which will be given to an N.G.O. (Cancer Aid Society). Using matrix multiplication, determine how to divide ₹ 35,000 among two types of bonds if the trust fund obtains an annual total interest of ₹ 3,200. What are the values reflected in this question ?

Sol.

Let investment in first type of bonds be Rs x.

∴ Investment in 2nd type = Rs (35000 – x)

$$\begin{pmatrix} x \\ 35000-x \end{pmatrix}\begin{pmatrix} \frac{8}{100} \\ \frac{10}{100} \end{pmatrix} = (3200)$$

$$\Rightarrow \quad \frac{8}{100}x + (35000-x)\frac{10}{100} = 3200$$

$$\Rightarrow \qquad x = \text{Rs } 15000$$

$\therefore$ Investment in first = Rs 15000

and in 2nd = Rs 20000

3.

In a parliament election, a political party hired a public relations firm to promote its candidates in three ways — telephone, house calls and letters. The cost per contact (in paise) is given in matrix A as

$$A = \begin{bmatrix} 140 \\ 200 \\ 150 \end{bmatrix} \begin{matrix} \text{Telephone} \\ \text{House Call} \\ \text{Letters} \end{matrix}$$

The number of contacts of each type made in two cities X and Y is given in the matrix B as

$$B = \begin{matrix} \text{Telephone} & \text{House Call} & \text{Letters} \\ \begin{bmatrix} 1000 & 500 & 5000 \\ 3000 & 1000 & 10000 \end{bmatrix} & \begin{matrix} \text{City X} \\ \text{City Y} \end{matrix} \end{matrix}$$

Find the total amount spent by the party in the two cities.

What should one consider before casting his/her vote — party's promotional activity or their social activities ?

Sol.

$$\text{Communication Matrix } A = \begin{pmatrix} 140 \\ 200 \\ 150 \end{pmatrix} \begin{matrix} \text{Telephone} \\ \text{House calls} \\ \text{Letters} \end{matrix}$$

$$\text{Cost Matrix } B = \begin{matrix} \text{Tele} & \text{House calls} & \text{Letters} \end{matrix} \begin{pmatrix} 1000 & 500 & 5000 \\ 3000 & 1000 & 10000 \end{pmatrix} \begin{matrix} \text{City x} \\ \text{City y} \end{matrix}$$

$$\therefore \text{ Total cost Matrix } = \begin{pmatrix} 1000 & 500 & 5000 \\ 3000 & 1000 & 10000 \end{pmatrix} \begin{pmatrix} 140 \\ 200 \\ 150 \end{pmatrix} = \begin{pmatrix} 990000 \\ 2120000 \end{pmatrix}$$

4.

Three schools A, B and C organized a mela for collecting funds for helping the rehabilitation of flood victims. They sold hand made fans, mats and plates from recycled material at a cost of ₹ 25, ₹ 100 and ₹ 50 each. The number of articles sold are given below :

School / Article	A	B	C
Hand-fans	40	25	35
Mats	50	40	50
Plates	20	30	40

Find the funds collected by each school separately by selling the above articles. Also find the total funds collected for the purpose.

Write one value generated by the above situation.

5.

Three schools X, Y and Z organized a fete (mela) for collecting funds for flood victims in which they sold hand-held fans, mats and toys made from recycled material, the sale price of each being ₹ 25, ₹ 100 and ₹ 50 respectively. The following table shows the number of articles of each type sold :

Article \ School	X	Y	Z
Hand-held fans	30	40	35
Mats	12	15	20
Toys	70	55	75

Using matrices, find the funds collected by each school by selling the above articles and the total funds collected. Also write any one value generated by the above situation.

Sol.

$$\begin{matrix} & HF. & M & P \\ A \\ B \\ C \end{matrix}\begin{pmatrix} 40 & 50 & 20 \\ 25 & 40 & 30 \\ 35 & 50 & 40 \end{pmatrix}\begin{pmatrix} 25 \\ 100 \\ 50 \end{pmatrix} = \begin{pmatrix} 7000 \\ 6125 \\ 7875 \end{pmatrix}$$

Funds collected by school A : Rs. 7000,

School B : Rs. 6125, School C : Rs. 7875

Total collected : Rs. 21000

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6.

There are 3 families A, B and C. The number of men, women and children in these families are as under :

	Men	Women	Children
Family A	2	3	1
Family B	2	1	3
Family C	4	2	6

Daily expenses of men, women and children are ₹ 200, ₹ 150 and ₹ 200 respectively. Only men and women earn and children do not. Using matrix multiplication, calculate the daily expenses of each family. What impact does more children in the family create on the society ?

7.

There are 2 families A and B. There are 4 men, 6 women and 2 children in family A, and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women, 1800 for children and 45 grams of proteins for men, 55 grams for women and 33 grams for children. Represent the above information using matrices. Using matrix multiplication, calculate the total requirement of calories and proteins for each of the 2 families. What awareness can you create among people about the balanced diet from this question ?

8.

Three schools A, B and C want to award their selected students for the values of Honesty, Regularity and Hard work. Each school decided to award a sum of ₹ 2,500, ₹ 3,100, ₹ 5,100 per student for the respective values. The number of students to be awarded by the three schools is given below in the table :

Values \ School	A	B	C
Honesty	3	4	6
Regularity	4	5	2
Hard work	6	3	4

Find the total money given in awards by the three schools separately, using matrices.

Apart from the above given values, suggest one more value which should be considered for giving award.

Sol.

$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{array}{c} \begin{array}{ccc} H & R & HW \end{array} \\ \begin{bmatrix} 3 & 4 & 6 \\ 4 & 5 & 3 \\ 6 & 2 & 4 \end{bmatrix} \end{array}\begin{bmatrix} 2500 \\ 3100 \\ 5100 \end{bmatrix}$$

$$= \begin{bmatrix} 50500 \\ 40800 \\ 41600 \end{bmatrix}$$

Hence money awarded by A = Rs. 50500

money awarded by B = Rs. 40800

money awarded by C = Rs. 41600

Respect for elders or Any relevant value

9.

To promote the making of toilets for women, an organisation tried to generate awareness through (i) house calls (ii) letters, and (iii) announcements. The cost for each mode per attempt is given below :

(i) ₹ 50

(ii) ₹ 20

(iii) ₹ 40

The number of attempts made in three villages X, Y, and Z are given below :

	(i)	(ii)	(iii)
X	400	300	100
Y	300	250	75
Z	500	400	150

Find the total cost incurred by the organisation for the three villages separately, using matrices.

Write one value generated by the organisation in the society.

10.

A trust caring for handicapped children gets ₹ 30,000 every month from its donors. The trust spends half of the funds received for medical and educational care of the children and for that it charges 2% of the spent amount from them, and deposits the balance amount in a private bank to get the money multiplied so that in future the trust goes on functioning regularly. What percent of interest should the trust get from the bank to get a total of ₹ 1,800 every month ?

Use matrix method, to find the rate of interest. Do you think people should donate to such trusts ?

11.

To promote the making of toilets for ladies (women) in villages, an N.G.O. hired an advertising agency for generating awareness for the cause through house calls, letters and announcements through speakers. The cost per mode of communication is given below :

Cost per visit/communication (in ₹)	House calls	Letters	Announcements (speakers)
	10	5	15

The number of contacts made were as follows in the three villages X, Y and Z :

Village	Houses visited	Letters dropped	Number of announcements
X	200	400	200
Y	350	600	300
Z	225	375	150

Find the total expenditure incurred by the N.G.O. for the three villages separately for making the community aware of the cause using matrices.

12.

To raise money for an orphanage, students of three schools A, B and C organised an exhibition in their locality, where they sold paper bags, scrap-books and pastel sheets made by them using recycled paper, at the rate of ₹ 20, ₹ 15 and ₹ 5 per unit respectively. School A sold 25 paper bags, 12 scrap-books and 34 pastel sheets. School B sold 22 paper bags, 15 scrap-books and 28 pastel sheets while School C sold 26 paper bags, 18 scrap-books and 36 pastel sheets. Using matrices, find the total amount raised by each school.

By such exhibition, which values are generated in the students ?

Sol.

$$\begin{matrix} A \\ B \\ C \end{matrix}\begin{pmatrix} 25 & 12 & 34 \\ 22 & 15 & 28 \\ 26 & 18 & 36 \end{pmatrix}\begin{pmatrix} 20 \\ 15 \\ 5 \end{pmatrix}$$

$$= \begin{pmatrix} 850 \\ 805 \\ 970 \end{pmatrix}$$

Any relevant value

Resource Materials by BALAJI KANCHI :

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Class XII Math Drive 2025-26 (Prepared by BALAJI KANCHI): Click here

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