MATRICES
DPP - 1

1. If A - B = C, where $A = \begin{bmatrix} 5 & 2 \\ 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 5 & -1 \end{bmatrix}$, then find sum of all element of matrix 'c'.

(A) -2 (B) -1 (C) 0 (D) 3

2. If $\begin{bmatrix} 16 & -10 \\ -6 & 8 \end{bmatrix} + B = I_2$, then B is equal to

(A) $\begin{bmatrix} -16 & 10 \\ 6 & -8 \end{bmatrix}$ (B) $\begin{bmatrix} -15 & 10 \\ 6 & -7 \end{bmatrix}$ (C) $\begin{bmatrix} -14 & 8 \\ 4 & -5 \end{bmatrix}$ (D) none of these

3. If the trace of matrix $A = \begin{pmatrix} x-2 & e^x & -\sin x \\ \cos(x^2) & x^2-x+3 & \ln|x| \\ 0 & \tan^{-1}x & x-7 \end{pmatrix}$ is zero, then x is equal to

(A) – 2 or 3 (B) – 3 or – 2 (C) – 3 or 2 (D) 2 or 3

4. T_r (A) of a 3 x 3 matrix A = (a_{ij}) is defined by the relation $T_r(A) = a_{11} + a_{22} + a_{33}$ (i.e. $T_r(A)$ is sum of the main diagonal elements). Which are of the following statement cannot always hold?
(A) $T_r(kA) = kT_r(A)$ (k is a scalar) (B) $T_r(A + B) = T_r(A) + T_r(B)$
(C) $T_r(I_3) = 3$ (D) $T_r(A^2) = (T_r(A))^2$

5. Identify the incorrect statement in respect of two square matrices A and B conformable for sum and product.
(A) $t_r(A + B) = t_r(A) + t_r(B)$ (B) $t_r(\alpha A) = \alpha\, t_r(A), \alpha \in R$
(C) $t_r(A^T) = t_r(A)$ (D*) $t_r(AB) \neq t_r(BA)$

6. Let $A = \begin{pmatrix} x^2 & 6 & 8 \\ 3 & y^2 & 9 \\ 4 & 5 & z^2 \end{pmatrix}$, $B = \begin{pmatrix} 2x & 3 & 5 \\ 2 & 2y & 6 \\ 1 & 4 & 2z-3 \end{pmatrix}$ be two matrices and if Tr. (A) = Tr. (B), then the value of (x + y + z) is equal to

(A) 0 (B) 1 (C) 2 (D) 3

[**Note :** Tr.(P) denotes trace of matrix P.]

7. For $\alpha, \beta, \gamma \in R$, let $A = \begin{bmatrix} \alpha^2 & 6 & 8 \\ 3 & \beta^2 & 9 \\ 4 & 5 & \gamma^2 \end{bmatrix}$ and $B = \begin{bmatrix} 2\alpha & 3 & 5 \\ 2 & 2\beta & 6 \\ 1 & 4 & 2\gamma-3 \end{bmatrix}$. If trace A = trace B, then the value of $(\alpha^{-1} + \beta^{-1} + \gamma^{-1})$ is equal to

(A) 4 (B) 3 (C) 2 (D) 1

8. For $\theta = \frac{3\pi}{5}$, let $B = [b_{ij}]$ be a square matrix of order 2 such that

$$b_{ij} = \begin{cases} \cos\theta, & i = j \\ \cos\left(\frac{j\pi}{2} + \theta\right), & i > j \\ \sin\left(\frac{j\pi}{2} - \theta\right), & i < j \end{cases}$$

The trace of matrix B^5 is equal to

(A) – 2 (B) –1 (C) 1 (D) 2

Integer Type

9. If $\begin{bmatrix} x & 1 & 2 \\ x-1 & 0 & y \end{bmatrix} + \begin{bmatrix} 2 & a & 2 \\ a-1 & 0 & a-2 \end{bmatrix} = \begin{bmatrix} 4 & 3 & 4 \\ 2 & 0 & 1 \end{bmatrix}$, then find the value of x + y + a.

10. If $X = \begin{bmatrix} 3 & a \\ 0 & 3 \end{bmatrix}$ and $X - \begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}$, then find the value a is-

MATRICES
DPP - 2

1. If $A = \begin{bmatrix} a & 1 \\ -1 & b \end{bmatrix}$ where *a* and *b* are real number. If A^2 is a null matrix then the product *ab* equals

(A) 0 (B) 1 (C) – 1 (D) ± 1

2. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ -1 & 1 \end{bmatrix}$, then number of distinct values of α for which $A^2 = B$ equals

(A) 0 (B) 1 (C) 2 (D) 3

3. Let A, B and C be three matrices of order 2×3, 3×1 and 2×3 respectively. Which one of the following statements is correct for the matrix $F = (C + A) B$?

(A) The order of F is 3×3 and the number of entries is 9.
(B) The order of F is 2×1 and the number of entries is 2.
(C) Matrix F is not defined.
(D) Order of F is 2×3 and the number of entries is 6.

4. Let $A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}$. If C_1 and C_2 are column matrices such that $AC_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $AC_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ then $C_1 + C_2$ is equal to

(A) $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$ (B) $\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix}$ (C) $\begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$ (D) $\begin{pmatrix} -1 \\ 1 \\ -1 \end{pmatrix}$

5. If a, b, c are 3 real numbers satisfying the matrix equation, $[a\ b\ c]\begin{bmatrix} 3 & 4 & 1 \\ 3 & 2 & 3 \\ 2 & 0 & 2 \end{bmatrix} = [3\ 0\ 1]$, then $(2a + b - c)$ equals

(A) –3 (B) 2 (C) 4 (D) –1

6. Let $A = \begin{bmatrix} 4\sec^2\theta & 1 & 0 \\ 0 & 3\tan^2\theta & 1 \\ 0 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} \cot^2\theta & 2 & 0 \\ 1 & 3\operatorname{cosec}^2\theta & 1 \\ 1 & 1 & 4 \end{bmatrix}$, then minimum value of tr(AB) is

(A) 19 (B) 25 (C) 29 (D) 32

7. Let $A = \begin{pmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{pmatrix}$. If $A^n = \begin{pmatrix} 1 & 0 \\ 50 & 1 \end{pmatrix}$, then value of n is

(A) 10 (B) 50 (C) 100 (D) 200

8. A square matrix P of order 3 satisfies $P^2 = I - P$, where I is an identity matrix of order 3, then P^6 is equal to

(A) $5I - 6P$ (B) $4I - 7P$ (C) $5I - 7P$ (D) $5I - 8P$

Integer Type

9. Let $A = [m\ n]_{1\times 2}$, $B = \begin{bmatrix} m \\ n \end{bmatrix}_{2\times 1}$ and $C = [25]_{1\times 1}$ be three matrices such that AB = C, where m and n are integers, then the number of ordered pairs of (m, n) are

10. A square matrix M of order 3 satisfies $M^2 = I - M$, where I is an identity matrix of order 3. If $M^n = 5I - 8M$, then n is equal to

MATRICES
DPP - 3

1. If A= $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, then AA^T equals-

(A) $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ (B) $\begin{bmatrix} \cos^2\theta & \sin^2\theta \\ \sin^2\theta & \cos^2\theta \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

2. If A = $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$, B = $\begin{bmatrix} 3 & 4 \\ 2 & 1 \\ 1 & 3 \end{bmatrix}$, then (AB)′ equals-

(A) $\begin{bmatrix} 16 & 22 \\ 23 & 31 \end{bmatrix}$ (B) $\begin{bmatrix} 16 & 23 \\ 22 & 31 \end{bmatrix}$ (C) $\begin{bmatrix} 22 & 31 \\ 16 & 30 \end{bmatrix}$ (D) $\begin{bmatrix} 23 & 16 \\ 31 & 20 \end{bmatrix}$

3. If A = $\begin{bmatrix} a & b \\ b & a \end{bmatrix}$, then $|A + A^T|$ equals -

(A) $4(a^2 - b^2)$ (B) $2(a^2 - b^2)$ (C) $a^2 - b^2$ (D) 4 ab

4. If A is symmetric matrix and B is a skew- symmetric matrix, then for $n \in N$, false statement is -
(A) A^n is symmetric
(B) A^n is symmetric only when n is even
(C) B^n is skew symmetric when n is odd
(D) B^n is symmetric when n is even

5. If M = $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $M^2 - \lambda M - I_2 = 0$, then λ equals -

(A) −2 (B) 2 (C) −4 (D) 4

6. If A is any skew- symmetric matrix of odd orders, then |A| equals -
(A) −1 (B) 0 (C) 1 (D) None

7. If A = $\begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then for every positive integer n, A^n is equal to -

(A) $\begin{bmatrix} 1+2n & 4n \\ n & 1+2n \end{bmatrix}$ (B) $\begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$ (C) $\begin{bmatrix} 1-2n & 4n \\ n & 1+2n \end{bmatrix}$ (D) None of these

8. If A = $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $(aI_2 + bA)^2 = A$, then -

(A) $a = b = \sqrt{2}$ (B) $a = b = 1/\sqrt{2}$ (C) $a = b = \sqrt{3}$ (D) $a = b = 1/\sqrt{3}$

Multiple Correct

9. If A is idempotent and A + B = I, then which of the following is true?
(A) B is idempotent (B) AB = 0 (C) BA = 0 (D) none of these

10. Let A be a square matrix. Then which of the following is a symmetric matrix -
(A) A + A′ (B) AA′ (C) A′A (D) A − A′

MATRICES
DPP - 4

1. If A= $\begin{pmatrix} 2 & -1 \\ -7 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 4 & 1 \\ 7 & 2 \end{pmatrix}$ then which statement is true?

(A) $AA^T = I$ (B) $BB^T = I$ (C) $AB \neq BA$ (D) $(AB)^T = I$

2. If A = $\begin{bmatrix} 1 & 2 & 3 \\ 5 & 0 & 4 \\ 2 & 6 & 7 \end{bmatrix}$ then adj A is equal to -

(A) $\begin{bmatrix} -24 & 4 & 8 \\ 4 & 1 & 2 \\ 8 & 11 & -11 \end{bmatrix}$ (B) $\begin{bmatrix} -24 & 4 & 8 \\ 4 & 1 & 11 \\ 30 & -2 & -10 \end{bmatrix}$ (C) $\begin{bmatrix} -24 & 4 & 8 \\ -27 & 1 & 11 \\ 30 & -2 & -10 \end{bmatrix}$ (D) None of these

3. If A = $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ then adj (adj A) =

(A) $\begin{bmatrix} -18 & 36 & -54 \\ 36 & -54 & 18 \\ -54 & 18 & -36 \end{bmatrix}$ (B) $-\begin{bmatrix} 18 & 36 & 54 \\ 36 & 54 & 18 \\ 54 & 18 & 36 \end{bmatrix}$ (C) $18\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ (D) None of these

4. If k $\begin{bmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{bmatrix}$ is an orthogonal matrix then k is equal to -

(A) 1 (B) 1/2 (C) 1/3 (D) None of these

5. If A is a square matrix of order n, then the value of |adj A| is-

(A) $|A|^{n-1}$ (B) $|A|^n$ (C) $|A|^{n+1}$ (D) $|A|^{n+2}$

6. $(\text{adj } A^T) - (\text{adj } A)^T$ equals-

(A) 2 |A| (B) 2 |A| I (C) zero matrix (D) Unit matrix

7. If A = $\begin{bmatrix} 4 & 2 \\ 3 & 3 \end{bmatrix}$, then adj (adj A) is equal to-

(A) $\begin{bmatrix} 3 & -2 \\ -3 & 4 \end{bmatrix}$ (B) $\begin{bmatrix} 4 & 2 \\ 3 & 3 \end{bmatrix}$ (C) $6\begin{bmatrix} 4 & 2 \\ 3 & 3 \end{bmatrix}$ (D) None of these

8. Which of the following is a nilpotent matrix

(A) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ (C) $\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

Integer Type

9. If A = $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 3 & 1 \\ 2 & 1 & 2 \end{bmatrix}$, then find the value of λ where A (adj A) = $-\lambda I_3$

10. Let A= $\begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$ where $0 \leq \theta < 2\pi$, if $|A| \in [a, b]$ then find a + b.

MATRICES
DPP - 5

1. If A = $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ then A^{-n} is equal to-

(A) $\begin{bmatrix} 1 & 0 \\ n & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 \\ -n & -1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ -n & 1 \end{bmatrix}$ (D) None of these

2. If A = $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, A^{-1} is given by

(A) –A (B) A^T (C) $-A^T$ (D) A

3. If an idempotent matrix is also skew symmetric then it must be
(A) an involutary matrix (B) an identity matrix
(C) an orthogonal matrix (D) a null matrix.

4. If A = $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$, $A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & c \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$, then

(A) a = 1, c = – 1 (B) a = 2, c = $-\frac{1}{2}$ (C) a = – 1, c = 1 (D) a = $\frac{1}{2}$, c = $\frac{1}{2}$

5. If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ =
(A) 0 (B) $A^2 + B^2$ (C) $A^2 + 2AB + B^2$ (D) A + B

6. Number of real values of λ for which the matrix $A = \begin{bmatrix} \lambda-1 & \lambda & \lambda+1 \\ 2 & -1 & 3 \\ \lambda+3 & \lambda-2 & \lambda+7 \end{bmatrix}$ has no inverse

(A) 0 (B) 1 (C) 2 (D) infinite

7. Let A = $\begin{bmatrix} 4x+1 & 5-2x \\ 2-2x & x-2 \end{bmatrix}$. The largest entry of A^{-1} as $x \to \infty$ is

(A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{4}{7}$ (D) $\frac{8}{7}$

8. If $\begin{bmatrix} \frac{1}{4} & 0 \\ x & \frac{1}{4} \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ -a & 2 \end{bmatrix}^{-2}$, then the value of $\frac{a}{x}$ is equal to

(A) $\frac{1}{2}$ (B) 2 (C) 4 (D) $\frac{1}{4}$

Integer Type

9. Let A be a 3 × 3 matrix whose entries are all integers. If A is invertible and all entries of A^{-1} are integers then find sum of all possible values of det.A

10. Number of skew-symmetric matrices of order 3 whose elements are 0, 0, 0, 1, –1, 2, –2, 3, –3 is