

MISSION NDA MATHEMATICS

COMPLETE TOPICWISE QUESTIONS

MATRICES

- If $A(\alpha, \beta) = \begin{bmatrix} \cos \alpha & \sin \alpha & 0 \\ -\sin \alpha & \cos \alpha & 0 \\ 0 & 0 & e^\beta \end{bmatrix}$, then $A(\alpha, \beta)^{-1}$ is equal to
 - $A(-\alpha, -\beta)$
 - $A(-\alpha, \beta)$
 - $A(\alpha, -\beta)$
 - $A(\alpha, \beta)$
- If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is to be the square root of a two-rowed unit matrix, then α, β and γ should satisfy the relation
 - $1 + \alpha^2 + \beta\gamma = 0$
 - $1 - \alpha^2 - \beta\gamma = 0$
 - $1 - \alpha^2 + \beta\gamma = 0$
 - $\alpha^2 + \beta\gamma - 1 = 0$
- If $A = \begin{bmatrix} 2 & 14 & 7 \\ 0 & \sin 2x & \cos 2x \\ 0 & \cos 2x & \sin 2x \end{bmatrix}$, then $|A|$ equals
 - $\cos 2x$
 - 2
 - $-2\cos 4x$
 - $\sin 4x$
- If A is a matrix such that $A^2 + A + 2I = 0$, then which of the following is not true?
 - A is symmetric
 - A is non-singular
 - $A \neq 0$
 - $A^{-1} = -\frac{1}{2}(A + I)$
- If $E(\theta) = \begin{bmatrix} \cos^2 \theta & \cos \theta \sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta \end{bmatrix}$ and θ and ϕ differ by an odd multiple of $\pi/2$, then $E(\theta)E(\phi)$ is
 - a null matrix
 - a unit matrix
 - a diagonal matrix
 - none of these
- If $A = [a_{ij}]$ is a 4×4 matrix and C_{ij} is the cofactor of the element a_{ij} in $|A|$, then the expression $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{14}C_{14}$ is equal to
 - 0
 - 1
 - 1
 - $|A|$
- If $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ and $B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$, then $|AB|$ equals
 - A^3
 - B^2
 - 1
 - none of these



8. If A and B are square matrices of the same order such that $A^2 = A, B^2 = B, AB = BA = O$, then
- (a) $(A - B)^2 = B - A$ (b) $(A - B)^2 = A - B$
 (c) $(A + B)^2 = A + B$ (d) none of these
9. If $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, then x equals
- (a) 2 (b) $-(1/2)$
 (c) 1 (d) $1/2$
10. The equations $2x + y = 4, 3x + 2y = 2$ and $x + y = -2$ have
- (a) no solution (b) one solution
 (c) two solutions (d) infinitely many solutions
11. If $A = \begin{bmatrix} 5 & 3 \\ 14 & 11 \end{bmatrix}$, then $13A^{-1}$ equals
- (a) A (b) $2A$
 (c) $\text{adj}A$ (d) $(1/13)A$
12. If $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}, Q = PAP^T$ and $x = P^T Q^{2005} P$, then x is equal to
- (a) $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 4 + 2005\sqrt{3} & 6015 \\ 2005 & 4 - 2005\sqrt{3} \end{bmatrix}$
 (c) $\frac{1}{4} \begin{bmatrix} 2 + \sqrt{3} & 1 \\ -1 & 2 - \sqrt{3} \end{bmatrix}$ (d) $\frac{1}{4} \begin{bmatrix} 2005 & 2 - \sqrt{3} \\ 2 + \sqrt{3} & 2005 \end{bmatrix}$
13. If $f(x) = \begin{bmatrix} \sin x & \text{cosec} x & \tan x \\ \sec x & x \sin x & x \tan x \\ x^2 - 1 & \cos x & x^2 + 1 \end{bmatrix}$, then $\int_{-a}^a |f(x)| dx$ equals
- (a) 1 (b) -1
 (c) $2a$ (d) 0
14. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ are two matrices, then $A^2 = B$ is true for
- (a) $\alpha = -1$ (b) $\alpha = 1$
 (c) $\alpha = 4$ (d) no real value of α
15. Let $A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}$, then A^n equals
- (a) $\begin{bmatrix} 4^n & 0 & 0 \\ 0 & 4^{n-1} & 0 \\ 0 & 0 & 4^{n-2} \end{bmatrix}$ (b) $\begin{bmatrix} 2^{2n} & 0 & 0 \\ 0 & 2^{2n} & 0 \\ 0 & 0 & 2^{2n} \end{bmatrix}$



$$(c) \begin{bmatrix} 4^{n-1} & 0 & 0 \\ 0 & 4^{n-1} & 0 \\ 0 & 0 & 4^{n-1} \end{bmatrix}$$

$$(d) \begin{bmatrix} |A|^n & 0 & 0 \\ 0 & |A|^n & 0 \\ 0 & 0 & |A|^n \end{bmatrix}$$

16. For any 2×2 matrix A , if $A(\text{adj}A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to

- (a) 20 (b) 100
(c) 10 (d) 0

17. If $\begin{bmatrix} \cos \frac{2\pi}{3} & -\sin \frac{2\pi}{3} \\ \sin \frac{2\pi}{3} & \cos \frac{2\pi}{3} \end{bmatrix}^k = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the least value of k equals ($k \neq 0$)

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

18. Which of the following is correct?

- (a) Every identity matrix is a scalar matrix.
(b) Every scalar matrix is an identity matrix.
(c) Every diagonal matrix is an identity matrix.
(d) A square matrix whose each element is 1 is an identity matrix.

19. The system of homogeneous equations

$$tx + (t+1)y + (t-1)z = 0, (t+1)x + ty + (t+2)z = 0$$

and $(t-1)x + (t+2)y + tz = 0$ has non-trivial solutions for

- (a) exactly three real values of t
(b) exactly two real values of t
(c) exactly one real value of t
(d) infinite number of values of t

20. If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ and $A(\text{adj}A) = k \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the value of k is

- (a) $\sin x \cos x$ (b) 1
(c) 2 (d) 3

21. If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then $\det[\text{adj}(\text{adj}A)]$ is

- (a) $(14)^4$ (b) $(14)^3$
(c) $(14)^2(14)^4$ (d) $(14)^1$

22. If A and B are square matrices and A^{-1} and B^{-1} of the same order exist, then the value of $(AB)^{-1}$ is



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

- (b) $A^{-1}B$
(d) $B^{-1}A^{-1}$

23. The system of equations $ax + by + cz = q - r$, $bx + cy + az = r - p$ and $cx + ay + bz = p - q$ is

- (a) consistent if $p = q = r$
(b) inconsistent if $a = b = c$, and p, q, r are distinct
(c) consistent if a, b, c are distinct and $a + b + c = 0$
(d) none of these

24. If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} is equal to

- (a) $-(3A^2 + 2A + 5I)$
(b) $3A^2 + 2A + 5$
(c) $3A^2 - 2A - 5$
(d) none of these

25. Given $2x - y + 2z = 2$, $x - 2y + z = -4$ and $x + y + \lambda z = 4$, then the value of λ such that the given system of equations has no solution is

- (a) 3
(b) 1
(c) 0
(d) -3

26. Assuming that the sums and products given below are defined, then which of the following is not true for matrices?

- (a) $(AB)' = B'A'$
(b) $A + B = B + A$
(c) $AB = AC$ does not imply $B = C$
(d) $AB = 0$ implies $A = 0$ or $B = 0$

27. Which of the following is not true?

- (a) $A^2 - B^2 = (A + B)(A - B)$
(b) $(A^T)^T = A$
(c) $(AB)^n = A^n B^n$, where A and B commute
(d) $(A - I)(I + A) = 0 \Leftrightarrow A^2 = I$

28. If in a square matrix $A = [a_{ij}]$, we find that $a_{ij} = a_{ji} \forall i, j$ then A is a

- (a) symmetric matrix
(b) diagonal matrix
(c) transpose matrix
(d) skew-symmetric matrix

29. If A is a non-singular square matrix of order n , then the rank of A is

- (a) equal to n
(b) less than n
(c) greater than n
(d) none of these

30. If A and B are square matrices of the order 3, such that $|A| = -1$ and $|B| = 3$, then the value of $|3AB|$ is

- (a) -9
(b) -81
(c) -27
(d) 81



31. If $A = \begin{bmatrix} 1 & 2 & x \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & y \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $AB = I_3$, then $x + y$ equals
 (a) 0 (b) -1
 (c) 2 (d) none of these
32. If $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $A^2 - kA - I_2 = 0$, then the value of k is
 (a) 4 (b) 2
 (c) 1 (d) -4
33. If A satisfies the equation $x^3 - 5x^2 + 4x + k = 0$, then A^{-1} exists if
 (a) $k \neq 1$ (b) $k \neq 2$
 (c) $k \neq -1$ (d) none of these
34. If matrix $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $|A^3| = 125$, then the value of α is
 (a) ± 3 (b) ± 2
 (c) ± 5 (d) 0
35. If A is a matrix of order 2×3 and AB is a matrix of order 2×5 , then B may be a
 (a) 3×5 matrix (b) 5×3 matrix
 (c) 3×2 matrix (d) 5×2 matrix
36. Let A and B be two square matrices such that $AB = A$ and $BA = B$, then $A^2 =$
 (a) B (b) A
 (c) I (d) 0
37. If $AB = A$ and $BA = A$, where A and B are square matrices, then
 (a) $B^2 = B$ and $A^2 = A$ (b) $B^2 \neq B$ and $A^2 = A$
 (c) $A^2 \neq A$ and $B^2 = B$ (d) $A^2 \neq A$ and $B^2 \neq B$
38. If A is an $m \times n$ matrix such that AB and BA are both defined, then B is an
 (a) $m \times n$ matrix (b) $n \times m$ matrix
 (c) $n \times n$ matrix (d) $m \times m$ matrix
39. If the matrix $\begin{bmatrix} (x-a)^2 & (x-b)^2 & (x-c)^2 \\ (y-a)^2 & (y-b)^2 & (y-c)^2 \\ (z-a)^2 & (z-b)^2 & (z-c)^2 \end{bmatrix}$ is a zero matrix, then a, b, c, x, y, z are connected by
 (a) $a + b + c = 0, x + y + z = 0$ (b) $a + b + c = 0, x = y = z$
 (c) $a = b = c, x + y + z = 0$ (d) none of these



40. The value of x for which the matrix $A = \begin{bmatrix} 6 & x-2 \\ 3 & x \end{bmatrix}$ has no inverse is
 (a) -2 (b) 2
 (c) 0 (d) 3
41. If $\begin{bmatrix} x+y & 8 \\ 0 & x-y \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ -1 & 5 \end{bmatrix} + \begin{bmatrix} 3 & 5 \\ 1 & -2 \end{bmatrix}$, then (x, y) equals
 (a) (4, 1) (b) (1, 4)
 (c) (-4, -1) (d) (1, -4)
42. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then which one of the following holds for all $n \geq 1$, by the principle of mathematical induction?
 (a) $A^n = 2^{n-1}A - (n-1)I$ (b) $A^n = nA - (n-1)I$
 (c) $A^n = 2^{n-1}A + (n-1)I$ (d) $A^n = nA + (n-1)I$
43. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$, $n \in N$, then A^{4n} equals
 (a) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
 (c) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$
44. If A and B are symmetric matrices, then ABA is
 (a) symmetric (b) skew-symmetric
 (c) diagonal (d) triangular
45. If a, b, c are distinct and $\begin{bmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{bmatrix} = 0$, then
 (a) $abc = 1$ (b) $a + b + c = 0$
 (c) $a + b + c = 1$ (d) $ab + bc + ca = 0$
46. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 4 & -2 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 3 & 2 \\ -2 & 1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 7 & 8 \\ 9 & 0 \\ 6 & 5 \end{bmatrix}$, then $2A + 3B - C^T$ equals
 (a) $\begin{bmatrix} -3 & 6 & 2 \\ -6 & -1 & 19 \end{bmatrix}$ (b) $\begin{bmatrix} 3 & 6 & 2 \\ 6 & 1 & 19 \end{bmatrix}$
 (c) $\begin{bmatrix} 11 & 24 & 14 \\ 10 & 7 & 31 \end{bmatrix}$ (d) none of these
47. If $A^2 - A + I = 0$, then the inverse of A is
 (a) A (b) $A + I$
 (c) $I - A$ (d) $A - I$



48. If ω is a complex cube root of unity, and $A = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then A^{100} is equal to

- (a) A (b) $-A$
(c) 0 (d) none of these

49. If $A = \text{diagonal}(d_1, d_2, \dots, d_n)$, then A^n is

- (a) $\text{diag.}(d_1^{n-1}, d_2^{n-1}, \dots, d_n^{n-1})$ (b) A
(c) $\text{diag.}(d_1^n, d_2^n, \dots, d_n^n)$ (d) none of these

50. If $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 2 & 3 & 2 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = 0$, then the values of x are

- (a) $1, 8$ (b) $-1, 8$
(c) $-1, -8$ (d) $1, -8$

51. Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $(10) B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of A , then α is

- (a) -2 (b) -1
(c) 2 (d) 5

52. If $A^3 = 0$, then $I + A + A^2$ equals

- (a) $I - A$ (b) $(I - A)^{-1}$
(c) $(I + A)^{-1}$ (d) none of these

53. The inverse of a symmetric matrix is

- (a) symmetric (b) skew-symmetric
(c) diagonal (d) none of these

54. If $\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} A = \begin{bmatrix} -1 & -8 & -10 \\ 1 & -2 & -5 \\ 9 & 22 & 15 \end{bmatrix}$, then the matrix A is

- (a) $\begin{bmatrix} 1 & -2 & -5 \\ 3 & 4 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 3 \\ -2 & 4 \\ -5 & 0 \end{bmatrix}$
(c) $\begin{bmatrix} -1 & 2 & 5 \\ 3 & 4 & 0 \end{bmatrix}$ (d) none of these

55. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then

- (a) $\alpha = 2ab, \beta = a^2 + b^2$ (b) $\alpha = a^2 + b^2, \beta = ab$
(c) $\alpha = a^2 + b^2, \beta = 2ab$ (d) $\alpha = a^2 + b^2, \beta = a^2 - b^2$

56. If A is a non-singular matrix of order 3×3 , then $\text{adj}(\text{adj}A)$ is equal to

- (a) $|A|A$ (b) $|A|^2A$
(c) $|A|^{-1}A$ (d) none of these



57. If A and B are two square matrices such that $AB = A$ and $BA = B$ then
 (a) A, B are idempotent (b) only A is idempotent
 (c) only B is idempotent (d) none of these

58. The matrices

$$P = \begin{bmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_3 & v_3 & w_3 \end{bmatrix} \text{ and } Q = \frac{1}{9} \begin{bmatrix} 2 & 2 & 1 \\ 12 & -5 & m \\ -8 & 1 & 5 \end{bmatrix}$$

are such that $PQ = I$ (an identity matrix). Solving the equations

$$\begin{bmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_3 & v_3 & w_3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 5 \end{bmatrix} \text{ the value of } y \text{ comes out to be } -3. \text{ Then the value of } m \text{ is equal to}$$

- (a) 27 (b) 7
 (c) -27 (d) -7
59. If A is a square matrix such that $A^2 = A$ and $(I + A)^n = I + \lambda A$, then $\lambda = ?$
 (a) $(2n - 1)$ (b) $2^n - 1$
 (c) $2n + 1$ (d) none of these
60. If A is skew-symmetric, then A^n for $n \in N$ is
 (a) symmetric (b) skew-symmetric
 (c) diagonal (d) none of these
61. If ω is the cube root of unity, then
 $\begin{bmatrix} \omega & \omega^2 \\ 1 & \omega \\ \omega^2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 \\ \omega \\ \omega^2 \end{bmatrix}$ equals
 (a) $\begin{bmatrix} \omega - \omega^2 \\ \omega - \omega^2 \\ \omega - 2\omega^2 \end{bmatrix}$ (b) $\begin{bmatrix} 1 \\ \omega \\ \omega^2 \end{bmatrix}$
 (c) $(\omega - \omega^2) \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ (d) none of these
62. Consider the system of equations in x, y, z as $x \sin 3\theta - y + z = 0$, $x \cos 2\theta + 4y + 3z = 0$ and $2x + 7y + 7z = 0$. If this system has a non-trivial solution, then for any integer n , the values of θ are given by
 (a) $\left[n + \frac{(-1)^n}{3} \right] \pi$ (b) $\left[n + \frac{(-1)^n}{4} \right] \pi$
 (c) $\left[n + \frac{(-1)^n}{6} \right] \pi$ (d) $\frac{n\pi}{2}$
63. If a matrix A is symmetric as well as skew-symmetric, then
 (a) A is a diagonal matrix (b) A is a null matrix
 (c) A is a unit matrix (d) A is a triangular matrix



64. If $A = \begin{bmatrix} 3 & 4 \\ 4 & 4 \end{bmatrix}$, and $B = \begin{bmatrix} -2 & -2 \\ 0 & -2 \end{bmatrix}$, then $(A + B)^{-1}$ is
 (a) is a skew-symmetric matrix (b) $A^{-1} + B^{-1}$
 (c) does not exist (d) none of these
65. Let p be an odd prime number and T_p be the following set of matrices

$$T_p = \left\{ A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} : a, b, c \in \{0, 1, 2, \dots, p-1\} \right\}$$

The number of A in T_p such that the trace of A is not divisible by p but $\det(A)$ is divisible by p is

- (a) $(p-1)(p^2 - p + 1)$ (b) $p^3 - (p-1)^2$
 (c) $(p-1)^2$ (d) $(p-1)(p^2 - 2)$

ANSWER KEY

1. (a)	2. (b)	3. (c)	4. (a)	5. (a)	6. (d)	7. (d)	8. (c)	9. (d)	10. (b)
11. (c)	12. (a)	13. (d)	14. (d)	15. (b)	16. (c)	17. (d)	18. (a)	19. (c)	20. (b)
21. (a)	22. (d)	23. (a)	24. (a)	25. (b)	26. (c)	27. (a)	28. (a)	29. (a)	30. (b)
31. (a)	32. (a)	33. (d)	34. (a)	35. (a)	36. (b)	37. (a)	38. (b)	39. (d)	40. (a)
41. (a)	42. (b)	43. (c)	44. (a)	45. (a)	46. (a)	47. (c)	48. (a)	49. (c)	50. (c)
51. (d)	52. (b)	53. (a)	54. (a)	55. (c)	56. (a)	57. (a)	58. (d)	59. (b)	60. (d)
61. (d)	62. (c)	63. (b)	64. (d)	65. (c)					



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