

1. What is the value of the determinant

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+xyz & 1 \\ 1 & 1 & 1+xyz \end{vmatrix} ?$$

- (a) $1+x+y+z$ (b) $2xyz$
(c) $x^2y^2z^2$ (d) $2x^2y^2z^2$

2. If $\begin{vmatrix} x & y & 0 \\ 0 & x & y \\ y & 0 & x \end{vmatrix} = 0$, then which one of the following is correct?

- (a) $\frac{x}{y}$ is one of the cube roots of unity
(b) x is one of the cube roots of unity
(c) y is one of the cube roots of unity
(d) $\frac{x}{y}$ is one of the cube roots of -1

3. Consider the set A of all matrices of order 3×3 with entries 0 or 1 only. Let B be the subset of A consisting of all matrices whose determinant is 1. Let C be the subset of A consisting of all matrices whose determinant is -1 . Then which one of the following is correct?

- (a) C is empty
(b) B has as many elements as C
(c) $A = B \cup C$
(d) B has thrice as many elements as C

4. If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$, then what is A^3 equal to?

- (a) $\begin{bmatrix} \cos 3\theta & \sin 3\theta \\ -\sin 3\theta & \cos 3\theta \end{bmatrix}$ (b) $\begin{bmatrix} \cos^3 \theta & \sin^3 \theta \\ -\sin^3 \theta & \cos^3 \theta \end{bmatrix}$
(c) $\begin{bmatrix} \cos 3\theta & -\sin 3\theta \\ \sin 3\theta & \cos 3\theta \end{bmatrix}$ (d) $\begin{bmatrix} \cos^3 \theta & -\sin^3 \theta \\ \sin^3 \theta & \cos^3 \theta \end{bmatrix}$

5. What is the order of

$$(x \ y \ z) \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} ?$$

- (a) 3×1 (b) 1×1
(c) 1×3 (d) 3×3

6. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then the value of A^4 is

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

7. The matrix A has x rows and $x + 5$ columns. The matrix B has y rows and $11 - y$ columns. Both AB and BA exist. What are the values of x and y respectively?

- (a) 8 and 3 (b) 3 and 4
(c) 3 and 8 (d) 8 and 8

8. If A is a square matrix, then the value of $\text{adj } A^T - (\text{adj } A)^T$ is equal to

- (a) A
(b) $2|A|I$, where I is the identity matrix
(c) null matrix whose order is same as that of A
(d) unit matrix whose order is same as that of A

9. The value of the determinant $\begin{vmatrix} \cos^2 \frac{\theta}{2} & \sin^2 \frac{\theta}{2} \\ \sin^2 \frac{\theta}{2} & \cos^2 \frac{\theta}{2} \end{vmatrix}$ for all values

- of θ , is
(a) 1 (b) $\cos \theta$
(c) $\sin \theta$ (d) $\cos 2\theta$

10. If a, b, c are non-zero real numbers, then the inverse of the

matrix $A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ is equal to

- (a) $\begin{bmatrix} a^{-1} & 0 & 0 \\ 0 & b^{-1} & 0 \\ 0 & 0 & c^{-1} \end{bmatrix}$ (b) $\frac{1}{abc} \begin{bmatrix} a^{-1} & 0 & 0 \\ 0 & b^{-1} & 0 \\ 0 & 0 & c^{-1} \end{bmatrix}$
(c) $\frac{1}{abc} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (d) $\frac{1}{abc} \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$

11. The system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = k^2$ has no solution if k equals

- (a) 0 (b) 1
(c) -1 (d) -2

12. The value of the determinant $\begin{vmatrix} 1-\alpha & \alpha-\alpha^2 & \alpha^2 \\ 1-\beta & \beta-\beta^2 & \beta^2 \\ 1-\gamma & \gamma-\gamma^2 & \gamma^2 \end{vmatrix}$ is equal to

- (a) $(\alpha-\beta)(\beta-\gamma)(\alpha-\gamma)$
(b) $(\alpha-\beta)(\beta-\gamma)(\gamma-\alpha)$
(c) $(\alpha-\beta)(\beta-\gamma)(\gamma-\alpha)(\alpha+\beta+\gamma)$
(d) 0

13. The adjoint of the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 0 \\ 0 & 3 & 1 \end{bmatrix}$ is

- (a) $\begin{bmatrix} -1 & 6 & 2 \\ -2 & 1 & -4 \\ 6 & 3 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 6 & -2 \\ -2 & 1 & 4 \\ 6 & -3 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} 6 & 1 & 2 \\ 4 & -1 & 2 \\ 6 & 3 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} -6 & 2 & 1 \\ 4 & -2 & 1 \\ 3 & 1 & -6 \end{bmatrix}$

14. If $A = \begin{pmatrix} -2 & 2 \\ 2 & -2 \end{pmatrix}$, then which one of the following is correct?

- (a) $A^2 = -2A$
(c) $A^2 = -3A$

- (b) $A^2 = -4A$
(d) $A^2 = 4A$

15. If $p + q + r = a + b + c = 0$, then the determinant $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}$

equals

- (a) 0
(c) $pa + qb + rc$
- (b) 1
(d) $pa + qb + rc + a + b + c$

16. What is the inverse of the matrix

$$A = \begin{pmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix} ?$$

- (a) $\begin{pmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{pmatrix}$

- (c) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{pmatrix}$ (d) $\begin{pmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$

17. If A is a 2×3 matrix and AB is a 2×5 matrix, then B must be a [2018-1]

- (a) 3×5 matrix (b) 5×3 matrix
(c) 3×2 matrix (d) 5×2 matrix

18. If $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $A^2 - kA - I_2 = O$, where I_2 is the 2×2

identity matrix, then what is the value of k ?

- (a) 4 (b) -4
(c) 8 (d) -8

19. A square matrix A is called orthogonal if

- (a) $A = A^2$ (b) $A' = A^{-1}$
(c) $A = A^{-1}$ (d) $A = A'$

Where A' is the transpose of A .

20. For a square matrix A , which of the following properties hold?

- $(A^{-1})^{-1} = A$
- $\det(A^{-1}) = \frac{1}{\det A}$
- $(\lambda A)^{-1} = \lambda A^{-1}$ where λ is a scalar

Select the correct answer using the code given below:

- (a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

21. Which one of the following factors does the expansions of

the determinant $\begin{vmatrix} x & y & 3 \\ x^2 & 5y^3 & 9 \\ x^3 & 10y^3 & 27 \end{vmatrix}$ contain?

- (a) $x - 3$ (b) $x - y$
(c) $Y - 3$ (d) $x - 3y$

22. What is the adjoint of the matrix

$$\begin{pmatrix} \cos(-\theta) & -\sin(-\theta) \\ -\sin(-\theta) & \cos(-\theta) \end{pmatrix} ?$$

- (a) $\begin{pmatrix} \cos \theta - \sin \theta \\ -\sin \theta \cos \theta \end{pmatrix}$ (b) $\begin{pmatrix} \cos \theta \sin \theta \\ \sin \theta \cos \theta \end{pmatrix}$

- (c) $\begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$ (d) $\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$

23. If A and B are two invertible square matrices of same order, then what is $(AB)^{-1}$ equal to?

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

24. If $a + b + c = 0$, then one of the solution of

$$\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0 \text{ is}$$

- (a) $x = a$

(b) $x = \sqrt{\frac{3(a^2 + b^2 + c^2)}{2}}$

(c) $x = \sqrt{\frac{2(a^2 + b^2 + c^2)}{3}}$

- (d) $x = 0$

25. What should be the value of x so that the matrix $\begin{pmatrix} 2 & 4 \\ -8 & x \end{pmatrix}$ does not have an inverse?

- (a) 16 (b) -16
(c) 8 (d) -8

26. The system of equation

$$2x + y - 3z = 5$$

$$3x - 2y + 2z = 5 \text{ and}$$

$$5x - 3y - z = 16$$

- (a) is inconsistent
(b) is consistent, with a unique solution
(c) is consistent, with infinitely many solutions
(d) has its solution lying along x -axis in three - dimensional space

27. If u, v and w (all positive) are the $p^{\text{th}}, q^{\text{th}}$ and r^{th} terms of a GP, the determinant of the matrix

$$\begin{vmatrix} \ln u & p \\ \ln v & q \\ \ln w & r \end{vmatrix} \text{ is}$$

- (a) 0
(b) 1
(c) $(p - q)(q - r)(r - p)$
(d) $\ln u \times \ln v \times \ln w$

28. Consider the following in respect of matrices A, B and C of same order:

- $(A + B + C)' = A' + B' + C'$
- $(AB)' = A'B'$
- $(ABC)' = C'B'A'$

Where A' is the transpose of the matrix A . Which of the above are correct?

- (a) 1 and 2 only (b) 2 and 3 only
 (c) 1 and 3 only (d) 1, 2 and 3

29. Let matrix B be the adjoint of a square matrix A, ℓ be the identity matrix of same order as A. If $k (\neq 0)$ is the determinant of the matrix A, then what is AB equal to?

- (a) ℓ (b) $k \ell$
 (c) $k^2 \ell$ (d) $(1/k)\ell$

30. What is the determinant of the matrix $\begin{pmatrix} x & y & y+z \\ z & z & z+x \\ y & z & x+y \end{pmatrix}$?

- (a) $(x-y)(y-z)(z-x)$ (b) $(x-z)(z-x)$
 (c) $(y-z)(z-x)$ (d) $(z-x)^2(x+y+z)$

31. If A, B and C are the angles of a triangle and

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 + \sin A & 1 + \sin B & 1 + \sin C \\ \sin A + \sin^2 A & \sin B + \sin^2 B & \sin C + \sin^2 C \end{vmatrix} = 0,$$

then which one of the following is correct?

- (a) The triangle ABC is isosceles
 (b) The triangle ABC is equilateral
 (c) The triangle ABC is scalene
 (d) No conclusion can be drawn with regard to the nature of the triangle

32. Consider the following in respect of matrices A and B of same order:

1. $A^2 - B^2 = (A+B)(A-B)$
2. $(A-I)(I+A) = 0 \Leftrightarrow A^2 = I$

Where I is the identity matrix and O is the null matrix.

Which of the above is/are correct?

- (a) 1 only (b) 2 only
 (c) Both 1 and 2 (d) Neither 1 nor 2

33. What is the area of the triangle with vertices /

$$\left(x_1, \frac{1}{x_1}\right), \left(x_2, \frac{1}{x_2}\right), \left(x_3, \frac{1}{x_3}\right) ?$$

- (a) $(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)$
 (b) 0

(c) $\left| \frac{(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)}{x_1 x_2 x_3} \right|$

(d) $\left| \frac{(x_1 - x_2)(x_2 - x_3)(x_3 - x_1)}{2x_1 x_2 x_3} \right|$

34. If $B = \begin{pmatrix} 3 & 2 & 0 \\ 2 & 4 & 0 \\ 1 & 1 & 0 \end{pmatrix}$, then what is adjoint of B equal to ?

(a) $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ -2 & -1 & 8 \end{pmatrix}$

(b) $\begin{pmatrix} 0 & 0 & -2 \\ 0 & 0 & -1 \\ 0 & 0 & 8 \end{pmatrix}$

(c) $\begin{pmatrix} 0 & 0 & 2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$

(d) It does not exist

35. If $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, then the matrix A is/an

- (a) Singular matrix (b) Involutory matrix
 (c) Nilpotent matrix (d) Idempotent matrix

36. If A is an identity matrix of order 3, then its inverse (A^{-1})

- (a) is equal to null matrix (b) is equal to A
 (c) is equal to 3A (d) does not exist

37. A is a square matrix of order 3 such that its determinant is 4. What is the determinant of its transpose?

- (a) 64 (b) 36
 (c) 32 (d) 4

38. If A is a square matrix of order $n > 1$, then which one of the following is correct ?

- (a) $\det(-A) = \det A$ (b) $\det(-A) = (-1)^n \det A$
 (c) $\det(-A) = -\det A$ (d) $\det(-A) = n \det A$

DIRECTION (Qs. 39 - 40) : Consider the following for the next 02 (two) items :

Let A and B be (3×3) matrices with $\det A = 4$ and $\det B = 3$.

39. What is $\det(2AB)$ equal to ?

- (a) 96 (b) 72 (c) 48 (d) 36

40. What is $\det(3AB^{-1})$ equal to ?

- (a) 12 (b) 18 (c) 36 (d) 48

41. The cofactor of the element 4 in the determinant

$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 5 & 8 & 9 \end{vmatrix}$$
 is

- (a) 2 (b) 4
 (c) 6 (d) -6

42. If A is a square matrix of order 3 with $|A| \neq 0$, then which one of the following is correct ?

- (a) $|adj A| = |A|$ (b) $|adj A| = |A|^2$
 (c) $|adj A| = |A|^3$ (d) $|adj A|^2 = |A|$

43. If $A = \begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}, B = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}, C = \begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}$

where $i = \sqrt{-1}$, then which one of the following is correct?

- (a) $AB = -C$
 (b) $AB = C$
 (c) $A^2 = B^2 = C^2 = I$, where I is the identity matrix
 (d) $BA \neq C$

44. If $2A = \begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix}$, then what is A^{-1} equal to ?

DAY - 4

MATRICES & DETERMINANTS

(a) $\begin{pmatrix} 2 & -1 \\ -3 & 2 \end{pmatrix}$ (b) $\frac{1}{2}\begin{pmatrix} 2 & -1 \\ -3 & 2 \end{pmatrix}$

(c) $\frac{1}{4}\begin{pmatrix} 2 & -1 \\ -3 & 2 \end{pmatrix}$ (d) None of these

45. If $\begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix} \times \begin{pmatrix} 5 & -2 \\ -3 & 1 \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ 17 & \lambda \end{pmatrix}$, then what is λ equal to?

- (a) 7 (b) -7
(c) 9 (d) -9

46. What is the value of the determinant

$$\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix} ?$$

- (a) 0 (b) abc
(c) $ab + bc + ca$ (d) $abc(a+b+c)$

47. Consider the following statements in respect of the matrix

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

1. The matrix A is skew-symmetric.
2. The matrix A is symmetric.
3. The matrix A is invertible.

Which of the above statements is/are correct ?

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

48. Consider two matrices $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & -4 \\ 2 & 1 & -4 \end{bmatrix}$.

Which one of the following is correct ?

- (a) B is the right inverse of A
(b) B is the left inverse of A
(c) B is the both sided inverse of A
(d) None of the above

49. One of the roots of

$$\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = 0$$
 is :

- (a) abc (b) $a+b+c$
(c) $-(a+b+c)$ (d) $-abc$

50. If A is any matrix, then the product AA is defined only when A is a matrix of order $m \times n$ where :

- (a) $m > n$ (b) $m < n$
(c) $m = n$ (d) $m \leq n$

51. The determinant of an odd order skew symmetric matrix is always :

- (a) Zero (b) One
(c) Negative (d) Depends on the matrix

52. If any two adjacent rows or columns of a determinant are interchanged in position, the value of the determinant :

- (a) Becomes zero (b) Remains the same
(c) Changes its sign (d) Is doubled

53. If $a \neq b \neq c$ are all positive, then the value of the determinant

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$
 is

- (a) non-negative (b) non-positive
(c) negative (d) positive

54. Let A and B be two matrices such that $AB = A$ and $BA = B$. Which of the following statements are correct ?

1. $A^2 = A$
2. $B^2 = B$
3. $(AB)^2 = AB$

Select the correct answer using the code given below :

- (a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

55. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, where $i = \sqrt{-1}$, then what is x

equal to ?

- (a) 3 (b) 2
(c) 1 (d) 0

Day - 4 Answer Key									
1	2	3	4	5	6	7	8	9	10
C	D	B	A	B	A	C	C	B	A
11	12	13	14	15	16	17	18	19	20
D	B	B	B	A	A	A	A	B	A
21	22	23	24	25	26	27	28	29	30
A	A	A	D	B	B	A	C	B	D
31	32	33	34	35	36	37	38	39	40
A	B	D	A	B	B	B	D	A	C
41	42	43	44	45	46	47	48	49	50
C	B	A	D	B	A	A	B	C	C
51	52	53	54	55					
A	C	C	D	D					