Shiksha Classes Bhandara

Mathematics **Topic : Matrices and Determinants** **MM 100**

Q.1 The trace $T_r(A)$ of a 3 × 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 of the following statements cannot 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) $T_r(A^2) = T_r(A)^2$

Q.2 Let A be an invertible matrix, which of the following is not true –
(A) $(A')^{-1} = (A^{-1})'$ (B) $A^{-1} = |A|^{-1}$
(C) $(A^2)^{-1} = (A^{-1})^2$ (D) None of these

Q.3 If 1 is a cube root of unity, find the value of
$$\begin{vmatrix} 1 & \omega & \omega^2 & \omega^3 \\ \omega & \omega^2 & \omega^3 & 1 \\ \omega^2 & \omega^3 & 1 & \omega \\ \omega^3 & 1 & \omega & \omega^2 \end{vmatrix}$$
(A) $\pm i\sqrt{3}$. (B) $\pm\ i\,3\sqrt{2}$
(C) 2i (D) None of these

Q.4 If A and B are non singular Matrices of same order then Adj. (AB) is
(A) Adj. (A) (Adj. B) (B) (Adj. B) (Adj. A)
(C) Adj. A + Adj. B (D) none of these

Q.5 If a is real and $\sqrt{2}ax + \sin By + \cos Bz = 0$, $x + \cos By + \sin Bz = 0$, $-x + \sin By - \cos Bz = 0$, then the set of all values of a for which the system of linear equations has a non-trivial solution, is –
(A) [1, 2] (B) [–1, 1]
(C) [1, ∞] (D) $[2^{-1/2}, 2^{1/2}]$

Q.6 A and B are two given matrices such that the order of A is 3×4 , if A′ B and BA′ are both defined then
(A) order of B′ is 3 × 4 (B) order of B′A is 4 × 4
(C) order of B′A is 3 × 3 (D) B′A is undefined

Q.7 If A is a non-singular matrix satisfying AB – BA = A, then which one of the following holds true –
(A) det. B = 0 (B) B = 0
(C) det. A = 1 (D) det. (B + I) = det. (B – I)

Q.8 If $A_1, A_3, \ldots\ A_{2n-1}$ are n skew symmetric matrices of same order then $B = \sum_{r=1}^{n}(2r-1)(A_{2r-1})^{2r-1}$ will be
(A) symmetric
(B) skew symmetric
(C) neither symmetric nor skew symmetric
(D) data is adequate

Q.9 If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ is equal to –
(A) 0 (B) $A^2 + B^2$
(C) $A^2 + 2AB + B^2$ (D) A + B

Q.10 If x, y, z are unequal and $\begin{vmatrix} x^3 & (x+a)^3 & (x-a)^3 \\ y^3 & (y-a)^3 & (y-a)^3 \\ z^3 & (z+a)^3 & (z-a)^3 \end{vmatrix} = 0$, the the value of $a^2(x + y + z)$
(A) xyz (B) 3xyz
(C) xyz/2 (D) 2xyz

Q.11 There are two numbers x making the value of the determinant $\begin{vmatrix} 1 & -2 & 5 \\ 2 & x & -1 \\ 0 & 4 & 2x \end{vmatrix}$ equal to 86. The sum of these two numbers, is
(A) – 4 (B) 5
(C) – 3 (D) 9

Q.12 If f (x) satisfies the equation
$$\begin{vmatrix} f(x-3) & f(x+4) & f\left((x+1)(x-2)-(x-1)^2\right) \\ 5 & 4 & -5 \\ 5 & 6 & 15 \end{vmatrix} = 0$$
for all real x, then-
(A) f (x) is not periodic
(B) f (x) is periodic and is of period 1
(C) f (x) is periodic and is of period 7
(D) f (x) is an odd function

Q.13 If a_0, a_1, a_2, a_3, a_4 are in A.P. with the common difference d, the value of $\begin{vmatrix} a_1a_2 & a_1 & a_0 \\ a_2a_3 & a_2 & a_1 \\ a_3a_4 & a_3 & a_2 \end{vmatrix}$ is
(A) $2d^4$ (B) $2d^3$
(C) $2d^2$ (D) 2d

Q.14 If $\Delta = \begin{vmatrix} \cos\frac{\theta}{2} & 1 & 1 \\ 1 & \cos\frac{\theta}{2} & -\cos\frac{\theta}{2} \\ -\cos\frac{\theta}{2} & 1 & -1 \end{vmatrix}$ lies in the interval
(A) [2, 4] (B) [0, 4]
(C) [1, 3] (D) [–2, 2]

Q.15 A solution of the set of equations
$x+y + z = xy + yz + zx = 0$, $x^3 + y^3 + z^3 = -3$ is-
(A) $1, \omega, \omega^2$ (B) $1, \omega, -\omega^2$
(C) $1, -\omega, \omega^2$ (D) $-1, -\omega, -\omega^2$
($\omega \neq 1$ being a cube root of unity)

Q.16 The set of equations 2x + y + 3z = 1, x – 2y + 2z = – 1, 4x + 7y + 5z = 5 has
(A) a unique solution
(B) no solution
(C) a finite number of solutions
(D) an infinite number of solutions

Q.17 If A, B are two square matrices such that AB = A and BA = B, then
(A) Only B is idempotent (B) A, B are idempotent
(C) Only A is idempotent (D) None of these

Q.18 The matrix $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$ is –
(A) symmetric (B) unique
(C) orthogonal (D) scalar

Q.19 Matrix M_r is defined as $M_r = \begin{bmatrix} r & r-1 \\ r-1 & r \end{bmatrix}$, $r \in N$.
Then det (M_1) + det. (M_2) + ... + det. (M_{2009}) = ?
(A) 2009 (B) $(2009)^2$
(C) $(2009)^3$ (D) None of these

Q.20 The set of equations : $\lambda x - y + (\cos\theta) z = 0; 3x + y + 2z = 0; (\cos\theta) x + y + 2z = 0$; $0 \le \theta < 2\pi$, has non-trivial solution(s)
(A) for no value of λ and θ
(B) for all values of λ and θ
(C) for all values of λ and only two values of θ
(D) for only one value of λ and all values of θ

For Q.21-Q.25 :
The answer to each question is a NUMERICAL VALUE.

Q.21 If $x \ne 2, y \ne 2, z \ne 2$ and $\begin{vmatrix} 2 & y & z \\ x & 2 & z \\ x & y & 2 \end{vmatrix} = 0$, then the value of $\frac{2}{2-x} + \frac{2}{2-y} + \frac{2}{2-z} =$

Q.22 In the determinant $\Delta = \begin{vmatrix} 4 & -5 & -1 \\ 2 & 3 & -8 \\ 6 & -3 & 4 \end{vmatrix}$, the sum of the minors of elements of third row is –

Q.23 If α, β, γ are the roots of $x^3 - x^2 - 8 = 0$, find the value of
$$\begin{vmatrix} \gamma+\alpha & \alpha+\beta & \beta+\gamma \\ \alpha(\beta+\gamma) & \beta(\gamma+\alpha) & \gamma(\alpha+\beta) \\ \alpha^2+1 & \beta^2+1 & \gamma^2+1 \end{vmatrix}$$

Q.24 If $\begin{vmatrix} 2a+b+c & a+2b+c & a+b+2c \\ a+2b+c & a+b+2c & 2a+b+c \\ a+b+2c & 2a+b+c & a+2b+c \end{vmatrix} = \lambda \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$,
then the value of λ is –

Q.25 If $\begin{vmatrix} x^n & x^{n+2} & x^{n+4} \\ y^n & y^{n+2} & y^{n+4} \\ z^n & z^{n+2} & z^{n+4} \end{vmatrix}$
$= \left(\frac{1}{y^2} - \frac{1}{x^2}\right)\left(\frac{1}{z^2} - \frac{1}{y^2}\right)\left(\frac{1}{x^2} - \frac{1}{z^2}\right)$, then n is equal to (–X). Find the value of X.


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