1. If the matrix $\begin{bmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{bmatrix}$ is orthogonal, then -

(a) $\alpha = \pm\frac{1}{\sqrt{2}}$ (b) $\beta = \pm\frac{1}{\sqrt{6}}$

(c) $\gamma = \pm\frac{1}{\sqrt{3}}$ (d) all of these

2. If matrix A = $\begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ where a, b, c are real positive numbers, abc = 1 and $A^T A = 1$, then the value of $a^3 + b^3 + c^3$ is -

(a) 3 (b) 2 (c) 4 (d) 1

3. For $k = \frac{1}{\sqrt{50}}$, the value of a, b, c such that PP′ = I, where

$P = \begin{bmatrix} 2/3 & 3k & a \\ -1/3 & -4k & b \\ 2/3 & -5k & c \end{bmatrix}$ is-

(a) $\pm\frac{16}{5\sqrt{2}}, \pm\frac{13}{5\sqrt{2}}, \mp\frac{1}{3\sqrt{2}}$ (b) $\mp\frac{1}{3\sqrt{2}}, \pm\frac{13}{5\sqrt{2}}, \pm\frac{16}{5\sqrt{2}}$

(c) $\pm\frac{13}{5\sqrt{2}}, \pm\frac{16}{5\sqrt{2}}, \mp\frac{1}{3\sqrt{2}}$ (d) None of these

4. If A is non-singular matrix of order 3 × 3, then adj (adj A) is equal to -

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

5. If the matrices A, B, (A + B) are non-singular, then $[A (A + B)^{-1} B]^{-1}$, is equal to -

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

6. If B is a non-singular matrix and A is a square matrix, then det (B^{-1} AB) is equal to -

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

7. If the matrix A = $\begin{bmatrix} y+a & b & c \\ a & y+b & c \\ a & b & y+c \end{bmatrix}$ has rank 3, then -

(a) y≠ (a + b + c) (b) y ≠ 1

(c) y = 0 (d) y ≠ - (a + b + c) and y ≠ 0

8. If $A^k = 0$, for some value of k, $(I - A)^p = I + A + A^2 + \ldots A^{k-1}$, thus p is (A is nilpotent with index k).

(a) -1 (b) -2 (c) -3 (d) None of these

9. The value(s) of m does the system of equations 3x + my = m and 2x - 5y = 20 has a solution satisfying the conditions x > 0, y > 0

(a) M∈ (0, ∞) (b) $M \in \left(-\infty, -\frac{15}{2}\right) \cup (30, \infty)$

(c) $M \in \left(-\frac{15}{2}, \infty\right)$ (d) None of these

10. If A = $\begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ and X is a matrix such that A = BX, then X equals-

(a) $\frac{1}{2}\begin{bmatrix} -2 & 4 \\ 3 & 5 \end{bmatrix}$ (b) $\frac{1}{2}\begin{bmatrix} 2 & 4 \\ 3 & -5 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & 4 \\ 3 & -5 \end{bmatrix}$ (d) None

11. $\begin{bmatrix} 1 & -\tan\theta/2 \\ \tan\theta/2 & 1 \end{bmatrix}\begin{bmatrix} 1 & \tan\theta/2 \\ -\tan\theta/2 & 1 \end{bmatrix}^{-1}$ is equal to-

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

(c) $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ (d) None of these

12. 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) ½ (c) 1/3 (d) None of these

13. Let A = $\begin{bmatrix} \cos^2\theta & \sin\theta\cos\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and

B = $\begin{bmatrix} \cos^2\phi & \sin\phi\cos\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$ then AB = 0, if-

(a) θ = nϕ, n = 0, 1, 2, …….

(b) θ + ϕ = nπ n = 0, 1, 2, ……

(c) $\theta = \phi + (2n+1)\frac{\pi}{2}$, n = 0, 1, 2, ……

(d) $\theta = \phi + n\frac{\pi}{2}$, n = 0, 1, 2, …..

14. Let A be the set of all 3 × 3 symmetric matrix all of whose entries are either 0 or 1 five of these entries are 1 and four of them are zero. Find the number of matrix in A are-

(a) 3 (b) 6 (c) 9 (d) 12

15. If A and B are square matrices such that AB = B and BA = A, then $A^2 + B^2$ is equal to-

(a) 2AB (b) A+ B (c) AB (d) 2BA

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16. Let P be a non-singular matrix $1 + P + P^2 + ... + P^n = O$ (O denotes the null matrix), then P^{-1} is-
(a) P^n (b) $-P^n$
(c) $-(1 + P + P^2 + ...+ P^n)$ (d) None of these

17. Let a matrix $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$, $Q = PAP^T$ where P^T is transpose of matrix P. then $P^T Q^{2005} P$ is-
(a) $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$
(b) $\frac{1}{4}\begin{bmatrix} 1+2005\sqrt{3} & 6015 \\ 2005 & 1-2005\sqrt{3} \end{bmatrix}$
(c) $\frac{1}{4}\begin{bmatrix} 1+2005\sqrt{3} & 2005 \\ 2005 & 1-2005\sqrt{3} \end{bmatrix}$
(d) $\begin{bmatrix} 2005 & 2005 \\ 0 & 1 \end{bmatrix}$

18. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$, $n \in N$, then A^{4n} equals -
(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$ (c) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

19. If $X = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then X^n, for $n \in N$, is equal to -
(a) $2^{n-1} X$ (b) n^2X (c) nX (d) $2^{n+1} X$

20. For the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}$, which is correct -
(a) $A^3 + 3A^2 - I = 0$ (b) $A^3 - 3A^2 - I = 0$
(c) $A^3 + 2A^2 - I = 0$ (d) $A^3 - A^2 + I = 0$

21. If A and B are square Matrices of order 3 such that $|A| = -1$, $|B| = 3$ then $|3AB|$ = ---------
(a) -9 (b) -81 (c) -27 (d) 81

22. If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, then $(A - 2I)(A - 3I) =$
(a) A (b) I (c) 0 (d) 5I

23. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is square root of I_2, then α, β and γ will satisfy the relation-
(a) $1 + \alpha^2 + \beta\gamma = 0$ (b) $1 - \alpha^2 + \beta\gamma = 0$
(c) $1 + \alpha^2 - \beta\gamma = 0$ (d) $\alpha^2 + \beta\gamma = 1$

24. The multiplicative inverse of $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is
(a) $\begin{bmatrix} -\cos\theta & -\sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$ (b) $\begin{bmatrix} \cos\theta & \sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$
(c) $\begin{bmatrix} -\cos\theta & \sin\theta \\ -\sin\theta & -\cos\theta \end{bmatrix}$ (d) None

25. 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 values of a & c are
(a) -1, 1 (b) 1, 2 (c) 1, -1 (d) None

26. If $A = \begin{bmatrix} i & -i \\ -i & i \end{bmatrix}$, $B = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$, then A^8 equals
(a) 4B (b) 128B (c) -128B (d) - 64B

27. If $A(\theta) = \begin{bmatrix} 1 & \tan\theta \\ -\tan\theta & 1 \end{bmatrix}$ and AB = I, then $(\sec^2\theta)$ B is equal to-
(a) $A(\theta)$ (b) $A(-\theta)$ (c) $A(\theta/2)$ (d) $A(-\theta/2)$

28. Which of the following is always correct
(a) B' A B is symmetric if A is symmetric
(b) B' A B is symmetric if A is skew Symmetric
(c) B' A B is skew symmetric if A is symmetric
(d) None of these

29. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ such that $A^2 = B$ then α is :
(a) 1 (b) -1 (c) 4 (d) None of these

30. If $A^2 = 8A + kI$ where $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ then k is :
(a) 7 (b) -7 (c) 1 (d) -1

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