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SECOND MID TERM TEST - 2024

11 - STD

MATHEMATICS

Time : 1.30 Hrs

2 4 5 1 A 2 1

Marks : 45

I Answer all the questions. 10 X 1 = 10

1. If $A=\begin{bmatrix}\lambda & 1\\ -1 & -\lambda\end{bmatrix}$ then for what value of λ, $A^2 = 0$?
   1) 0 2) ±1 3) −1 4) 1
2. If $\Delta=\begin{vmatrix}a & b & c\\ x & y & z\\ p & q & r\end{vmatrix}$ then $\begin{vmatrix}ka & kb & kc\\ kx & ky & kz\\ kp & kq & kr\end{vmatrix}$ is 1) Δ 2) KΔ 3) 3KΔ 4) $K^3\Delta$
3. Let A and B be two symmetric, matrices of small order. Then which one of the following statement is not true? 1) A + B is a symmetric matrix 2) AB is a symmetric matrix 3) $AB = (BA)^T$ 4) $A^TB = AB^T$
4. The value of $\theta \in \left(0, \frac{\pi}{2}\right)$ for which the vectors $\vec{a}=(\sin\theta)\hat{i} + (\cos\theta)\hat{j}$ and $\vec{b}=\hat{i}-\sqrt{3}\hat{j}+2\hat{k}$ are perpendicular, is equal to 1) $\frac{\pi}{3}$ 2) $\frac{\pi}{6}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$
5. If $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=2\hat{i}+x\hat{j}+\hat{k}, \vec{c}=\hat{i}-\hat{j}+4\hat{k}$ and $\vec{a}.(\vec{b} X \vec{c})$ then x is equal to
   1) 5 2) 7 3) 26 4) 10
6. If A is a square matrix, then which of the following is not symmetric?
   1) $A + A^T$ 2) AA^T 3) A^TA 4) $A-A^T$
7. If the points (x, −2), (5, 2), (8,8) ar collinear, then x is equal to
   1) -3 2) 3) 1 4) 3
8. If $\lambda\hat{i} + 2\lambda\hat{j} + 2\lambda\hat{k}$ is a unit vector, then the value of λ is
   1) $\frac{1}{3}$ 2) $\frac{1}{4}$ 3) $\frac{1}{9}$ 4) $\frac{1}{2}$
9. If $A=\begin{bmatrix}6 & 3\\ 2 & a\end{bmatrix}$ is a singular matrix, then the value of a.
   1) 6 2) 3 3) 1 4) 2
10. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}|=4, |\vec{b}|=3$ and $\vec{a}.\vec{b}=6$, find the angle between $\vec{a}$ and $\vec{b}$ 1) π 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{3}$

II Answer any 3 questions. Q. no. 15 is compulsory. 3 X 2 = 6

11. Determine 3B +4 C − D if B, C and D are given by

$$B=\begin{bmatrix}2 & 3 & 0\\ 1 & -1 & 5\end{bmatrix}, C=\begin{bmatrix}-1 & -2 & 3\\ -1 & 0 & 2\end{bmatrix} D=\begin{bmatrix}0 & 4 & -1\\ 5 & 6 & -5\end{bmatrix}$$

12. If $\overline{PO}+\overline{OQ}=\overline{QO}+\overline{OR}$ Prove that the points P, Q, R are collinear.

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13. Compute |A| using sarrus rule if $A=\begin{bmatrix}3 & 4 & 1\\ 0 & -1 & 2\\ 5 & -2 & 6\end{bmatrix}$

14. Find the value λ for which the vectors $\vec{a}$ and $\vec{b}$ are perpendicular, where $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+3\hat{k}$.

15. If (k, 2), (2, 4) and (3, 2) are vertices of the triangle of area 4 square units then determine the value of k.

III Answer any 3 questions. Q. No. 20 is compulsory. 3 X 3= 9

16. Find the area of the parallelogram whose adjacent sides are $\vec{a}=3\hat{i}+\hat{j}+4\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$.

17. If two rows (columns) of a matrix are identical, then prove that, its determinant is zero.

18. Prove that $\begin{vmatrix}1 & a & a^2-bc\\ 1 & b & b^2-ca\\ 1 & c & c^2-ab\end{vmatrix}=0$

19. Verify that |AB| = |A| |B| if $A=\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$ and $B=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$.

20. For any vector $\vec{a}$ Prove that $|\vec{a}\times\hat{i}|^2+|\vec{a}\times\hat{j}|^2+|\vec{a}\times\hat{k}|^2=2|\vec{a}|^2$.

IV Answer all the questions. 4 X 5 = 20

21. a) Express the matrix $A=\begin{bmatrix}1 & 3 & 5\\ -6 & 8 & 3\\ -4 & 6 & 5\end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix. ***(OR)*** b) Prove that the medians of a triangle are concurrent.

22. a) If ABCD is a quadrilateral and E and F are the midpoints of AC and BD respectively, then prove that $\overline{AB}+\overline{AD}+\overline{CB}+\overline{CD}=4\overline{EF}$. ***(OR)***

b) Prove that $\begin{vmatrix}1+a & 1 & 1\\ 1 & 1+b & 1\\ 1 & 1 & 1+c\end{vmatrix}=abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$.

23. a) Show that $\begin{vmatrix}b+c & a-c & a-b\\ b-c & c+a & b-a\\ c-b & c-a & a+b\end{vmatrix}=8abc$ ***(OR)***

b) Show that the points whose position vectors $4\hat{i}+5\hat{j}+\hat{k}$, $-\hat{j}-\hat{k}$, $3\hat{i}+9\hat{j}+4\hat{k}$ and $-4\hat{i}+4\hat{j}+4\hat{k}$ are coplanar.

24. a) Prove that $\begin{vmatrix}1 & x & x\\ x & 1 & x\\ x & x & 1\end{vmatrix}^2=\begin{vmatrix}1-2x^2 & -x^2 & -x^2\\ -x^2 & -1 & x^2-2x\\ -x^2 & x^2-2x & -1\end{vmatrix}$. ***(OR)***

b) Find the unit vectors perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$.

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