V11M

Virudhunagar District

Common Second Mid Term Test - 2024

Standard 11

MATHEMATICS

Time: 1.30 Hrs. Marks: 50

Part - I

Choose the correct answer: **10×1=10**

1) The value of the determinant of $A = \begin{bmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{bmatrix}$ is

a) $-2abc$ b) abc c) 0 d) $a^2+b^2+c^2$

2) If the points $(x, -2)$, $(5, 2)$, $(8, 8)$ are collinear, then x is equal to

a) -3 b) $1/3$ c) 1 d) 3

3) What must be the matrix X, if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?

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

4) If $\begin{vmatrix} x+1 & x & x+2 \\ 0 & x+2 & x+3 \\ 0 & 0 & x+3 \end{vmatrix} = 0$, then the value of x is

a) $x = 1, 2, 3$ b) $x = -1, 2, -3$ c) $x = -1, -2, -3$ d) $x = 1, -2, -3$

5) A vector makes equal angle with the positive direction of the coordinate axes. Then each angle is equal to

a) $\cos^{-1}\left(\frac{1}{3}\right)$ b) $\cos^{-1}\left(\frac{2}{3}\right)$ c) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ d) $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$

6) 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

a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$

7) 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 $\vec{a}.(\vec{b} \times \vec{c}) = 70$, then x is equal to

a) 5 b) 7 c) 26 d) 10

8) Sum of the squares of the direction cosines is

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

9) The value of $\lim_{x \to 2^-} \lfloor x \rfloor$ is

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

10) The value of $\lim_{x \to 3} \frac{x^2 - 6x + 5}{x^3 - 8x + 7}$ is

a) $\frac{2}{5}$ b) $\frac{-2}{5}$ c) $\frac{5}{2}$ d) $\frac{-5}{2}$

Part - II

Answer ANY FOUR questions: **4×2=8**

11) Simplify: $\sec\theta \begin{bmatrix} \sec\theta & \tan\theta \\ \tan\theta & \sec\theta \end{bmatrix} - \tan\theta \begin{bmatrix} \tan\theta & \sec\theta \\ \sec\theta & \tan\theta \end{bmatrix}$

12) If $A = \begin{bmatrix} 7 & 3 \\ -2 & \alpha \end{bmatrix}$ is a singular matrix, then find the value of α.

13) Find the direction cosines and direction ratios of the vector $3\hat{i} - 4\hat{j} + 8\hat{k}$.

14) If $\vec{a}$ and $\vec{b}$ are any two vectors, then prove that $|\vec{a} \times \vec{b}|^2 + (\vec{a} . \vec{b})^2 = |\vec{a}|^2 |\vec{b}|^2$.

15) Evaluate: $\lim_{x \to 2} \frac{x^4 - 16}{x - 2}$

16) Evaluate: $\lim_{x \to \infty} \frac{x^3 + 2x + 3}{5x^2 + 1}$

Part - III

Answer ANY FOUR questions: **4×3=12**

17) If $A = \begin{bmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{bmatrix}$, compute A^2.

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

19) Show that the vectors $2\hat{i} - \hat{j} + \hat{k}$, $3\hat{i} - 4\hat{j} - 4\hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ form a right angled triangle.

20) Find the sine angle between the vectors $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = 4\hat{i} - 2\hat{j} + 2\hat{k}$.

21) Test the existence of the limit, $\lim_{x \to 1} \frac{4|x-1| + x - 1}{|x-1|}$, $x \neq 1$

22) Evaluate: $\lim_{t \to 0} \frac{\sqrt{t^2 + 9} - 3}{t^2}$

Part - IV

Answer ANY FOUR questions: **4×5=20**

23) Using factor theorem, prove that $\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = (x-1)^2 (x+9)$.

24) Prove that $\begin{vmatrix} a^2 & bc & ac + c^2 \\ a^2 + ab & b^2 & ac \\ ab & b^2 + bc & c^2 \end{vmatrix} = 4a^2b^2c^2$.

25) Prove that, the vectors $5\hat{i} + 6\hat{j} + 7\hat{k}$, $7\hat{i} - 8\hat{j} + 9\hat{k}$, $3\hat{i} + 20\hat{j} + 5\hat{k}$ are coplanar.

26) If $|\vec{a}| = 5$, $|\vec{b}| = 6$, $|\vec{c}| = 7$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then find the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$.

27) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and $A^3 - 6A^2 + 7A + KI = 0$, then find the value of K.

28) Suppose that the diameter of an animal's pupils is given by $f(x) = \frac{160x^{-0.4} + 90}{4x^{-0.4} + 15}$, where x is the intensity of light and f(x) is in mm. Find the diameter of the pupils with (a) minimum light (b) maximum light.
