

SECOND MID TERM TEST - 2023

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(Dist)

11- Std

MATHEMATICS

Time : 1.30 Hrs

Marks : 45

I. Choose the correct answer:

10×1=10

1. If A is a square matrix, then which of the following is not symmetric?

- a) $A + A^T$ b) AA^T c) $A^T A$ d) $A - A^T$

2. If $A = \begin{bmatrix} 1 & a \\ 0 & 1 \end{bmatrix}$, then $A^3 =$ a) $\begin{bmatrix} 1 & a^3 \\ 0 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 3a \\ 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 3a \\ 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 0 \\ a^3 & 1 \end{bmatrix}$

3. If $A + I = \begin{bmatrix} 3 & -2 \\ 4 & 1 \end{bmatrix}$, then $(A+I)(A-I)$ is equal to

- a) $\begin{bmatrix} -5 & -4 \\ 2 & -9 \end{bmatrix}$ b) $\begin{bmatrix} -5 & 4 \\ -8 & 9 \end{bmatrix}$ c) $\begin{bmatrix} 5 & 4 \\ 8 & 9 \end{bmatrix}$ d) $\begin{bmatrix} -5 & -4 \\ -8 & -9 \end{bmatrix}$

4. If $\vec{BA} = 3\hat{i} + 2\hat{j} + \hat{k}$ and the position vector of B is $\hat{i} + 3\hat{j} - \hat{k}$ then the position vector A is a) $4\hat{i} + 2\hat{j} + \hat{k}$ b) $4\hat{i} + 5\hat{j}$ c) $4\hat{i}$ d) $-4\hat{i}$

5. If \vec{a} and \vec{b} are two vectors of magnitude 2 and inclined at an angle 60° , then the angle between \vec{a} and $\vec{a} + \vec{b}$ is a) 30° b) 60° c) 45° d) 90°

6. $\vec{a} = 3\hat{i} + 4\hat{j}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, then the value of $|\vec{a} \times \vec{b}| =$ a) $\sqrt{14}$ b) 5 c) 0 d) $\sqrt{26}$

7. If (1,2,4) and (2,3d,-3) are the initial and terminal points of the vector $\hat{i} + 5\hat{j} - 7\hat{k}$, then the value of d is equal to a) $\frac{7}{3}$ b) $-\frac{7}{3}$ c) $-\frac{5}{3}$ d) $\frac{5}{3}$

8. If $\lambda\hat{i} + 2\lambda\hat{j} + 2\lambda\hat{k}$ is a unit vector, then the value of λ is a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{1}{9}$ d) $\frac{1}{2}$

9. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + x\hat{j} + \hat{k}$, $\vec{c} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{a} \cdot (\vec{b} \times \vec{c}) = 70$, then x is equal to a) 5 b) 7 c) 26 d) 10

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

- a) -3 b) $\frac{1}{3}$ c) 1 d) 3

II. Answer 3 questions. Qn.No. 16 is compulsory:

3×2=6

11. For what value of x, the matrix $A = \begin{bmatrix} 0 & 0 & -2 \\ -1 & 0 & x^3 \\ 2 & -3 & 0 \end{bmatrix}$ is skew - symmetric.

12) If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then prove that \vec{a} and \vec{b} are perpendicular.

13) Prove that vector product is not commutative.

14) Find the value of $\begin{vmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{vmatrix}$.

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11 கணிதம் EM Page - 1

15) Evaluate $\begin{vmatrix} 2014 & 2017 & 0 \\ 2020 & 2023 & 1 \\ 2023 & 2026 & 0 \end{vmatrix}$.

III Note: Answer any three questions. Question No. 20 is compulsory.

3×3=9

16) If $\begin{bmatrix} 3 & x & 0 \\ 4 & y^2 & 1 \\ 0 & -1 & z \end{bmatrix}$ is skew - symmetric, find the value of x, y and z.

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

18) Let \vec{a} , \vec{b} , \vec{c} be unit vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ and the angle between \vec{b} and \vec{c} is $\frac{\pi}{3}$. Prove that $\vec{a} = \pm \frac{2}{\sqrt{3}} (\vec{b} \times \vec{c})$.

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

20) For any vector \vec{r} prove that $\vec{r} = (\vec{r} \cdot \hat{i})\hat{i} + (\vec{r} \cdot \hat{j})\hat{j} + (\vec{r} \cdot \hat{k})\hat{k}$.

IV Note: Answer all the questions.

4×5=20

21) a) If a, b, c are all positive, and are p^{th} , q^{th} and r^{th} terms of a G.P, show that

$$\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix} = 0.$$

(OR)

b) Using Factor Theorem prove that $\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = (x-1)^2 (x+9)$.

22) a) If A_i, B_i, C_i are the factors of a_i, b_i, c_i respectively $i = 1$ to 3 in

$$|A| = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \text{ show that } \begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix} = |A|^2. \text{ (OR)}$$

Prove $\begin{vmatrix} 1 & x & x^2 \\ x & 1 & x \\ x & x & 1 \end{vmatrix} = \begin{vmatrix} 1-2x^2 & -x^2 & -x^2 \\ -x^2 & 1 & x^2-2x \\ -x^2 & x^2-2x & 1 \end{vmatrix}$

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23) a) Prove that "The medians of a triangle are concurrent". (OR)

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

24) If ABCD is a quadrilateral and E and F are midpoint of AC and BD respectively then prove that $\vec{AB} + \vec{AD} + \vec{CB} = 4\vec{EF}$. (OR)

b) Show that prove vector $5\hat{i} + 6\hat{j} + 7\hat{k}$, $7\hat{i} - 8\hat{j} + 9\hat{k}$, $3\hat{i} + 20\hat{j} + 5\hat{k}$ are coplanar.

II கணிதம் EM Page - 2