CUET (UG) – MATHEMATICS

Chapter Test - Unit IV: Calculus - Vectors and Three-Dimensional Geometry

General Instructions

1. Total Questions: **20**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Each question carries **5 marks**.
5. For each correct answer: **+5 marks**.
6. For each incorrect answer: **-1 mark**.
7. No negative marking for unanswered questions.
8. Use of calculator or electronic devices is strictly prohibited.
9. Choose the most appropriate answer from the given options.

1. If the angle between vectors $\vec{a}$ and $\vec{b}$ is $\pi/6$, then the angle between $2\vec{a}$ and $-3\vec{b}$ is:
   (A) $\pi/6$
   (B) $5\pi/6$
   (C) $-\pi/6$
   (D) $\pi/3$

2. The value of $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{i} \times \hat{k}) + \hat{k} \cdot (\hat{i} \times \hat{j})$ is:
   (A) 0
   (B) -1
   (C) 1
   (D) 3

3. The shortest distance between the z-axis and the line $x + y + 2z - 3 = 0 = 2x + 3y + 4z - 4$ is:
   (A) 1
   (B) 2
   (C) 3
   (D) 4

4. If a vector $\vec{r}$ makes angles 60° and 45° with the x and y axes respectively, then the angle it makes with the z-axis is:
   (A) 30°
   (B) 45°
   (C) 60°
   (D) 90°

5. The area of a triangle with vertices $(1, 1, 2)$, $(2, 3, 5)$ and $(1, 5, 5)$ is:
   (A) $\sqrt{61}/2$
   (B) $\sqrt{61}$
   (C) $\sqrt{59}/2$
   (D) $\sqrt{59}$

6. The vector $\vec{b} = 3\hat{i} + 4\hat{k}$ is projected on the y-axis. The magnitude of this projection is:
   (A) 3
   (B) 4
   (C) 5
   (D) 0

7. If $\vec{a} \cdot \vec{b} = -|\vec{a}||\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is:
   (A) 0°
   (B) 45°
   (C) 90°
   (D) 180°

8. The distance of the point (a, b, c) from the xy-plane is:
   (A) $|a|$
   (B) $|b|$
   (C) $|c|$
   (D) $\sqrt{a^2 + b^2}$

9. The direction ratios of the line joining $(2, 3, 5)$ and $(-1, 3, 2)$ are:
   (A) $(1, 6, 7)$
   (B) $(-3, 0, -3)$
   (C) $(3, 0, 3)$
   (D) Both (B) and (C)

10. The equation of the line passing through $(1, 2, 3)$ and parallel to the line $\frac{x-4}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$ is:
    (A) $\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z-3}{8}$
    (B) $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z-8}{3}$
    (C) $\frac{x-1}{-4} = \frac{y-2}{1} = \frac{z-3}{10}$
    (D) $\frac{x-1}{4} = \frac{y-2}{-1} = \frac{z-3}{-10}$

11. If $|\vec{a}| = 10, |\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = 12$, then $|\vec{a} \times \vec{b}|$ is:
    (A) 10
    (B) 16
    (C) 14
    (D) 20

12. The value of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are perpendicular is:
    (A) 70/11
    (B) 10/7
    (C) 7/10
    (D) 11/70

13. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ is:
    (A) 3/2
    (B) $-3/2$
    (C) 0
    (D) 3

14. The angle between the line $\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(3\hat{i} - \hat{j} + 2\hat{k})$ and the x-axis is:
    (A) $\cos^{-1}(3/\sqrt{14})$
    (B) $\cos^{-1}(1/\sqrt{14})$
    (C) $\cos^{-1}(2/\sqrt{14})$
    (D) $\pi/2$

15. The unit vector perpendicular to both $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is:
    (A) $\hat{i} - \hat{j} + \hat{k}$
    (B) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$
    (C) $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$
    (D) $\hat{i} + \hat{j} - \hat{k}$

16. If a line makes an angle of $\pi/4$ with the x-axis and $\pi/4$ with the y-axis, then the angle it makes with the z-axis is:
    (A) $\pi/2$
    (B) $\pi/4$
    (C) $\pi/3$
    (D) $\pi/6$

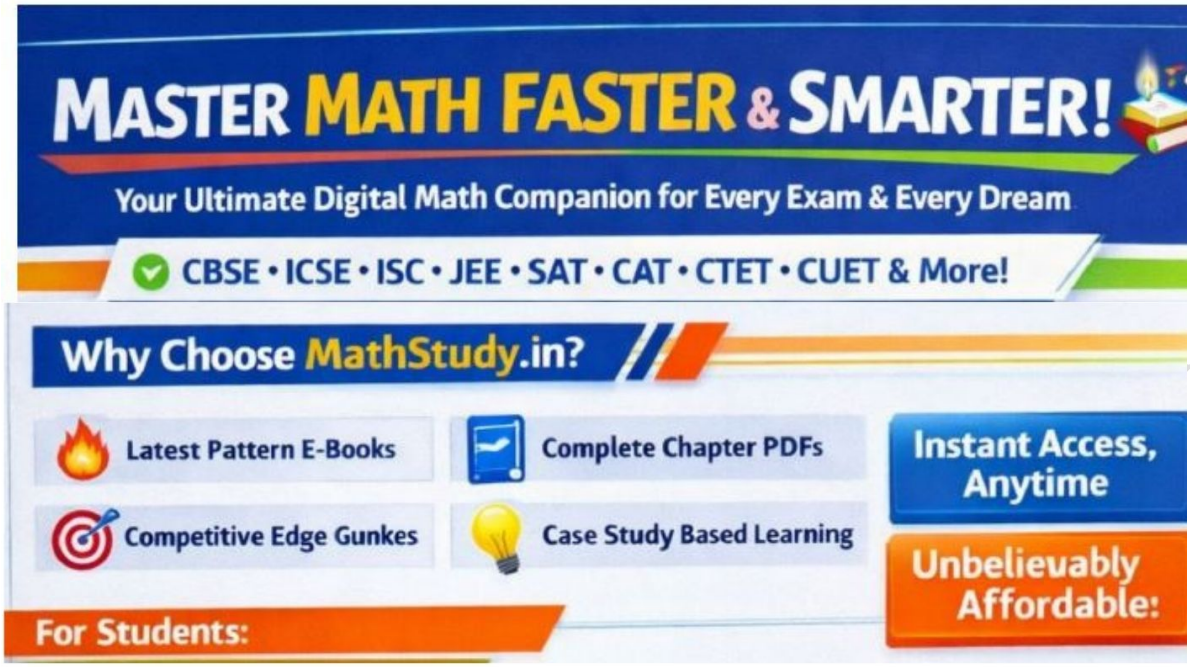
17. The position vector of the midpoint of the line segment joining $P(2, 3, 4)$ and $Q(4, 1, -2)$ is:
    (A) $3\hat{i} + 2\hat{j} + \hat{k}$
    (B) $6\hat{i} + 4\hat{j} + 2\hat{k}$
    (C) $2\hat{i} + \hat{j} + 3\hat{k}$
    (D) $\hat{i} + \hat{j} + \hat{k}$

18. The distance between the points $(2, -3, 1)$ and $(1, -1, 3)$ is:
    (A) 3

(B) $\sqrt{5}$
(C) $\sqrt{9}$
(D) Both (A) and (C)

19. If the direction ratios of two lines are $(1, 1, 2)$ and $(\sqrt{3}-1, -\sqrt{3}-1, 4)$, the angle between them is:
(A) $30°$
(B) $45°$
(C) $60°$
(D) $90°$

20. The vector area of a triangle with adjacent sides $\vec{a}$ and $\vec{b}$ is:
(A) $\vec{a} \times \vec{b}$
(B) $\frac{1}{2}(\vec{a} \times \vec{b})$
(C) $\vec{a} \cdot \vec{b}$
(D) $|\vec{a} \times \vec{b}|$



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