CBSE NCERT Based Chapter wise Questions (2025-2026)

Class-XII

Subject: MATHEMATICS

Chapter Name : Three Dimentional Geometry (Chap : 11)

Total : 12 Marks (expected) [MCQ(1)-2 Mark, VSA-(2)-2 Marks, SA-(1)-3 Marks, LA(1)-5 Marks]

Level - 1 & 2 (Higher Order)

Section - A

MCQ Type :

1. The angle between the two diagonals of a cube is

Ⓐ $\frac{\pi}{6}$ Ⓑ $\frac{\pi}{4}$ Ⓒ $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ Ⓓ $\cos^{-1}\left(\frac{1}{3}\right)$

(Hints : DCS, DRS)

2. If P(x,y,z) is a point in the space at a distance r from the origin 0, then the direction cosines of the line OP are

Ⓐ $\frac{r}{x}, \frac{r}{y}, \frac{r}{z}$ Ⓑ rx, ry, rz Ⓒ $\frac{x}{y}, \frac{y}{r}, \frac{z}{r}$ Ⓓ None of these

(Hints : DCS)

3. If a line passing through the point with position vector $\vec{\alpha}$ and parallel to vector $\vec{\beta}$, then the vector equation of the line is –

Ⓐ $\vec{r} = \vec{\alpha} + \vec{\beta}$ Ⓑ $\vec{r} = \vec{\alpha} - t\vec{\beta}$ Ⓒ $\vec{r} = \vec{\alpha} + t\vec{\beta}$ Ⓓ None of these

(Hints : Equation of line)

4. The direction ratios of the line $3x - 2 = 2y + 1 = 2z - 4$ are proportional to

Ⓐ $\frac{1}{3}, -\frac{1}{2}, \frac{1}{2}$ Ⓑ $-\frac{1}{3}, \frac{1}{2}, \frac{1}{2}$ Ⓒ $\frac{1}{3}, \frac{1}{2}, \frac{1}{2}$ Ⓓ $\frac{1}{3}, \frac{1}{2}, -\frac{1}{2}$

(Hints : DRS)

5. The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{-2} = \frac{y-2}{-4} = \frac{3-z}{6}$ are

Ⓐ coincident Ⓑ skew Ⓒ intersecting Ⓓ parallel

(Hints : DRS)

6. A line passing through a point having position vector $\vec{a}$ and perpendicular to the lines $\vec{r} = \vec{a}_1 + \lambda_1\vec{b}_1$ and $\vec{r} = \vec{a}_2 + \lambda_1\vec{b}_2$ is

Ⓐ $\vec{r} = \vec{a} + t(\vec{b}_1 \times \vec{b}_2)$ Ⓑ $\vec{r} = \vec{a} + t.(\vec{b}_1.\vec{b}_2)$ Ⓒ $\vec{r}.\vec{a} = t.(\vec{b}_1.\vec{b}_2)$ Ⓓ $\vec{r} - \vec{a} = (\vec{b}_1 \times \vec{b}_2)$

(Hints : DCS, DRS)

7. If $\vec{r} = (3\hat{i} + \hat{j} - 4\hat{k}) + t(\hat{i} + \hat{j} + \hat{k})$ and $\vec{r} = (5\hat{i} - \hat{j}) + t'(3\hat{i} + 2\hat{j} + 4\hat{k})$ then $\cos\theta = ?$

Ⓐ $\sqrt{\frac{27}{29}}$ Ⓑ $\frac{10}{26}$ Ⓒ $\frac{9}{\sqrt{29}}$ Ⓓ $\frac{10}{\sqrt{26}}$

(Hints : Angle formula)

Section - B

Very Short Answer (VSA) :

1. Can the numbers –1, 1, 0 be the direction cosines of a straight line ? can the above numbers be the direction ratios of a straight line ?

(Hints : DRS, DCS)

2. The direction angle of a straight line are 120°, 45°, 30°. Is the statement true ? Give reason for your answer.

(Hints : DCS)

3. The coordinates of the projection of the point P(2, –3, 5) on Y axis is (0, –β, 0). Find the value of β.

(Hints : cos α, cos β, cos γ)

4. Write the cartesian and vector equation of z axis .

(Hints : Equation of line)

5. Write the coordinate axis to which the line.

   $\frac{x-5}{2}=\frac{y+6}{0}=\frac{z-3}{2}$ is perpendicular

(Hints : Angle between the lines)

6. Find the angle between the lines whose direction ratios are given by 3, 4, 5 and 1, 1, –2 .

(Hints : Angle between the lines)

7. Find the equation of a line passing through he point (1, 2, 3) and parallel to the line $\frac{x-1}{2}=\frac{7-y}{3}=-z$

(Hints : Equation of line)

Section - C

Short Answer Question (SA) :

1. Find the acute angle between the two straight lines whose direction cosines are given by

   $l + m + n = 0,\ l^2 + m^2 - n^2 = 0$

(Hints : DCS)

2. Let $\vec{P}=2\hat{i}+\hat{j}-2\hat{k}$ and $\vec{Q}=4\hat{i}-3\hat{j}$. Find the acute angle between $\vec{P}$ and $\vec{Q}$.

(Hints : Angle between two vectors)

3. Prove that the acute angle between two diagonals of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$

(Hints : Angle between the lines)

4. A straight line L makes angles α, β, γ and δ with the four diagonals of a cube, prove that,

   $\sin^2\alpha+\sin^2\beta+\sin^2\gamma+\sin^2\delta=\frac{8}{3}$

(Hints : DCS)

5. Find the direction ratios of a straight line which makes equal angles with the coordinate axes. How many such straight line are there ?

(Hints : DRS)

6. A straight line in the zx plane makes an angle of $\frac{\pi}{3}$ with the z–axis ; find the direction cosines of the line.

(Hints : DCS)

7. If α, β, γ are the direction angles of a straight line, then prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$.

(Hints : $l^2 + m^2 + n^2 = 1$)

8. Let L_1, m_1, n_1 and l_2, m_2, n_2 be the direction ratios of two given straight lines. Find the direction ratios of a straight line which is perpendicular to both the given straight lines.

(Hints : DCS)

9. Show that the line joining the points P and Q with position vectors $\vec{p} = p_1\hat{i} + p_2\hat{j} + p_3\hat{k}$ and $\vec{q} = q_1\hat{i} + q_2\hat{j} + q_3\hat{k}$ passes through the origin if $\vec{p} \cdot \vec{q} = |\vec{p}||\vec{q}|$

(Hints : Equation of line)

10. Find the points on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point P(1, 3, 3) .

(Hints : take general point on the line)

11. Show that the points whose position vectors are $4\hat{i} + 5\hat{k}$, $\hat{i} + \hat{j} + 3\hat{k}$ and $-5\hat{i} + 3\hat{j} - \hat{k}$ and a are collinear.

(Hints : Straight line)

12. The equation of a line is given by x = by + c, z = ay + d, write it in symmetric form and vector form.

(Hints : Lines in different form)

13. The line $\frac{x-2}{3} = \frac{y+1}{2} = \frac{z-1}{-1}$ intersects the curve $xy = c^2$, z = 0. Then the value of c^2 is _____ .

(Hints : take general point on the line)

14. Find S.D between the lines : $\frac{x-1}{1} = \frac{y-1}{1} = \frac{z-1}{1}$ & $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{1}$

(Hints : formula of S.D)

Section - D

Long Answer Question (LA) :

1. Find the distance between the lines :

   $\vec{r} = (\hat{i} + 2\hat{j} - 4\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\vec{r} = (3\hat{i} + 3\hat{j} - 5\hat{k}) + \mu(2\hat{i} + 3\hat{j} + 6\hat{k})$

(Hints : SD formula)

2. Prove that the lines l_1 and l_2 are not intersecting lines.

   where $l_1 : \frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$, $l_2 : \frac{x}{2} = \frac{y-5}{3} = \frac{z+1}{4}$

(Hints : SD $\neq$ 0)

3. The base of a triangle is 5 units long and has equation $\frac{x+2}{2} = \frac{y-1}{1} = \frac{z}{4}$. Find the area of the triangle if its remaining vertex is at (1, –1, 2) .

(Hints : Calculate foot of the perpendicular of (1, –1, 2))

4. Show that the lines $\vec{r} = (\hat{i} + \hat{j} + \hat{k}) + t(\hat{i} - \hat{j} + \hat{k})$ are $\vec{r} = (3\hat{i} - \hat{k}) + s(4\hat{j} - 16\hat{k})$ intersect and find the position vector of their point of intersection.

(Hints : Compaining $i, j, \hat{k}$ components from both sides)

5. Prove that the straight lines whose direction cosines are given by the equations.

   al + bm + cn = 0 and fmn + gnl + hlm = 0 are at right angles if

   $\frac{f}{a} + \frac{g}{b} + \frac{h}{c} = 0$

(Hints : DCS, DRS)

6. Prove that the straight lines whose direction cosines are given by the equations.

   al + bm + cn = 0 and fmn + gnl + hlm = 0 are parallel if

   $a^2f^2 + b^2h^2 + c^2h^2 - 2(abfg + gcgh + cahf) = 0$

(Hints : DCS, DRS)

7. A straight line makes angles α β γ and δ with the four diagonals of a cube, prove that

$\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$

(Hints : DCS, DRS)

ANSWER

Section - A

1. Ⓓ
2. Ⓒ
3. Ⓒ
4. Ⓒ
5. Ⓓ
6. Ⓐ
7. Ⓐ

Section - B

1. No, Yes
2. No
3. 3
4. $\frac{x-x_1}{o} = \frac{y-y_1}{o} = \frac{z-z_1}{c}, c \neq 0$
$r = \alpha + t(c\hat{k}), c \neq 0$
5. Y axis
6. $\cos^{-1}\left(\frac{-\sqrt{3}}{10}\right)$
7. $\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z-3}{-1}$

Section - C

1. $\frac{\pi}{3}$
2. $\theta = \cos^{-1}\left(\frac{14}{15}\right)$
5. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$, Two,
6. $\left(\frac{\sqrt{3}}{2}, 0, \frac{1}{2}\right)$
8. $m_1n_2 - m_2n_1$, $n_1l_2 - n_2l_1$, $l_1m_2 - l_2m_1$
10. (4, 3, 7) (–2, –1, 3)
12. $\frac{x-c}{b} = \frac{y-o}{1} = \frac{z-d}{a}$
$\vec{r} = \left(c\hat{i} + d\hat{k}\right) + t\left(b\hat{i} + \tilde{j} + a\hat{k}\right)$
13. $C^2 = 5$
14. $SD = \sqrt{2}$

Section - D

1. $\frac{\sqrt{293}}{7}$
2. S.D $\neq 0$
3. $\sqrt{\frac{1775}{28}}$
4. $(3\hat{i} - \hat{j} + 3\hat{k})$