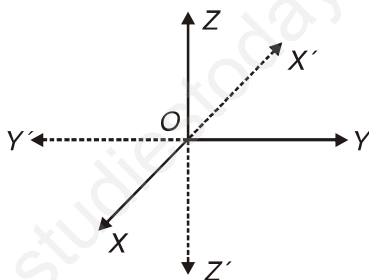**CHAPTER - 12**

INTRODUCTION TO THREE DIMENSIONAL COORDINATE GEOMETRY

● Three mutually perpendicular lines in space define three mutually perpendicular planes, called Coordinate planes, which in turn divide the space into eight parts known as octants and the lines are known as Coordinate axes.

Coordinate axes :   XOX', YOY', ZOZ'

Coordinate planes :   XOY, YOZ, ZOX or

                                  XY, YX, ZX planes

Octants :   OXYZ, OX'YZ, OXY'Z, OXYZ'

                             OX' Y'Z, OXY'Z', OX'YZ', OX'Y'Z'

● Coordinates of a point P are the perpendicular distances of P from three coordinate planes YZ, ZX and XY respectively.

● The distance between the point $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$ is given by

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

● Let $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ be two points in space and let R be a point on line segment PQ such that it divides PQ in the ratio $m_1 : m_2$

    (i)   internally, then the coordinates of R are

$$\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}, \frac{m_1z_2 + m_2z_1}{m_1 + m_2}\right)$$

(ii)   externally, then coordinates of R are

$$\left(\frac{m_1x_2 - m_2x_1}{m_1 - m_2}, \frac{m_1y_2 - m_2y_1}{m_1 - m_2}, \frac{m_1z_2 - m_2z_1}{m_1 - m_2}\right)$$

● Coordinates of centroid of a triangle whose vertices are (x_1, y_1, z_1), (x_2, y_2, z_2) and (x_3, y_3, z_3) are

$$\left(\frac{x_1 + y_1 + z_1}{3}, \frac{x_2 + y_2 + z_2}{3}, \frac{x_3 + y_3 + z_3}{3}\right)$$

VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

1. Find image of $(-2, 3, 5)$ in YZ plane.

2. Name the octant in which $(-5, 4, -3)$ lies.

3. Find the distance of the point $P(4, -3, 5)$ from XY plane.

4. Find the distance of point $P(3, -2, 1)$ from z–axis.

5. Write coordinates of foot of perpendicular from $(3, 7, 9)$ on x axis.

6. Find the distance between points $(2, 3, 4)$ and $(-1, 3, -2)$.

SHORT ANSWER TYPE QUESTIONS (4 MARKS)

7. Show that points $(4, -3, -1)$, $(5, -7, 6)$ and $(3, 1, -8)$ are collinear.

8. Find the point on y–axis which is equidistant from the point $(3, 1, 2)$ and $(5, 5, 2)$.

9. Find the coordinates of a point equidistant from four points $(0,0,0)$, $(2,0,0)$, $(0,3,0)$ and $(0,0,8)$, if it exists.

10. The centroid of $\triangle ABC$ is at $(1,1,1)$. If coordinates of A and B are $(3,-5,7)$ and $(-1, 7, -6)$ respectively, find coordinates of point C.

11. If the extremities (end points) of a diagonal of a square are (1,–2,3) and (2,–3,5) then find the length of the side of square.

12. Determine the point in XY plane which is equidistant from the points A (1, –1, 0) B(2, 1, 2) and C(3, 2, –1).

13. If the points A(1, 0, –6), B(–5, 9, 6) and C(–3, p, q) are collinear, find the value of p and q.

14. Show that the points A(3,3,3), B(0,6,3), C(1,7,7) and D(4,4,7) are the vertices of a square.

15. The coordinates of mid point of sides of Δ ABC are (–2, 3, 5), (4, –1, 7) and (6, 5, 3). Find the coordinates of vertices of ΔABC.

16. Find the coordinates of the point P which is five-sixth of the way from A(2, 3, –4) to B(8, –3, 2).

ANSWERS

1. (2,3,5)

2. OX' YZ'

3. 5 units

4. $\sqrt{13}$ units

5. (3,0,0)

6. $\sqrt{45}$ units

8. (0, 5, 0)

9. $\left(1, \dfrac{3}{2}, 4\right)$

10. (1,1,2)

11. $\sqrt{3}$ units

12. $\left(\dfrac{3}{2}, 1, 0\right)$

13. p = 6, q = 2

15. $\begin{bmatrix}(0, 9, 1), \\ (-4, -3, 9), \\ (12, 1, 5)\end{bmatrix}$

16. (7,–2,1)