

# MIND MAP : LEARNING MADE SIMPLE CHAPTER - 12

The coordinates of the centroid of the triangle, whose vertices are  $(x_1, y_1, z_1)$ ,  $(x_2, y_2, z_2)$  and  $(x_3, y_3, z_3)$  are  $\left( \frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3} \right)$

**Eg:** The centroid of a triangle ABC is at the point (1, 1, 1). If the coordinates of A and B are (3, -5, 7) and (-1, 7, -6), respectively, find the coordinates of the point C.

**Sol:** Let the coordinates of C be  $(x, y, z)$  and the coordinates of the centroid G be (1, 1, 1). Then  $\frac{x+3-1}{3} = 1$ , i.e.,  $x=1$ ;

$$\frac{y-5+7}{3} = 1, \text{ i.e., } y=1;$$

$$\frac{z+7-6}{3} = 1, \text{ i.e., } z=2. \text{ So, } C(x, y, z) = (1, 1, 2)$$

The coordinates of the midpoint of the line segment joining two points

$P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  are  $\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$ .

**Eg:** Find the midpoint of the line joining two points  $P(1, -3, 4)$  and  $Q(-4, 1, 2)$ .

**Sol:** Coordinates of the midpoint of the line joining the points P & Q are

$$\left( \frac{1-4}{2}, \frac{-3+1}{2}, \frac{4+2}{2} \right) \text{ i.e. } \left( \frac{-3}{2}, -1, 3 \right)$$

## Introduction to Three Dimensional Geometry

Section Formula

Coordinates of the Centroid of a Triangle

Coordinates of a Midpoint

Introduction

Distance between Two Points

The coordinates of the point R which divides the line segment joining two points  $P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  internally and externally in the ratio  $m : n$  are given by

$$\left( \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}, \frac{mz_2 + nz_1}{m+n} \right) \text{ \& } \left( \frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}, \frac{mz_2 - nz_1}{m-n} \right)$$

respectively.

**Eg:** Find the coordinates of the point which divides the line segment joining the points (1, -2, 3) and (3, 4, -5) in the ratio 2:3 internally.

**Sol:** Let  $P(x, y, z)$  be the point which divides line segment joining A (1, -2, 3) and B (3, 4, -5) internally in the ratio 2:3. Therefore,

$$x = \frac{2(3) + 3(1)}{2+3} = \frac{9}{5}, \quad y = \frac{2(4) + 3(-2)}{2+3} = \frac{2}{5}, \quad z = \frac{2(-5) + 3(3)}{2+3} = \frac{-1}{5}$$

Thus, the required point is  $\left( \frac{9}{5}, \frac{2}{5}, \frac{-1}{5} \right)$ .

- In three dimensions, the coordinate axes of a rectangular cartesian coordinate system are three mutually perpendicular lines. The axes are called x, y and z axes.
- The three planes determined by the pair of axes are the coordinate planes, called xy, yz and zx-planes.
- The three coordinate planes divide the space into eight parts known as octants.
- The coordinates of a point P in 3D Geometry is always written in the form of triplet like (x,y,z). Here, x, y and z are the distances from yz, zx and yx planes, respectively.

**Eg:**

- Any point on x-axis is : (x, 0, 0)
- Any point on y-axis is : (0, y, 0)
- Any point on z-axis is : (0, 0, z)

Distance between two points  $P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  is given by

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

**Eg:** Find the distance between the points  $P(1, -3, 4)$  and  $Q(-4, 1, 2)$ .

**Sol:** The distance PQ between the points P & Q is given by

$$PQ = \sqrt{(-4-1)^2 + (1+3)^2 + (2-4)^2} \\ = \sqrt{25+16+4} = \sqrt{45} = 3\sqrt{5} \text{ units}$$

