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## Minglebox CBSE Prep

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- In three dimensions, the coordinate axes of a rectangular Cartesian coordinate system are three mutually perpendicular lines. The axes are called the 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 three dimensional geometry is always written in the form of triplet like (x, y, z). Here x, y and z are the distances from the YZ, ZX and XY-planes.

(i) Any point on x-axis is of the form (x, 0, 0)

(ii) Any point on y-axis is of the form (0, y, 0)

(iii) Any point on z-axis is of the form (0, 0, z).

- Distance between two points P(x<sub>1</sub>, y<sub>1</sub>, z<sub>1</sub>) and Q (x<sub>2</sub>, y<sub>2</sub>, z<sub>2</sub>) is given by

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

- 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  
$$\left[ \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}, \frac{mz_2 + nz_1}{m+n} \right]$$
 and  $\left[ \frac{mx_2 - nx_1}{m+n}, \frac{my_2 - ny_1}{m+n}, \frac{mz_2 - nz_1}{m+n} \right]$
- The coordinates of the mid-point of the line segment joining two points P  $(x_1, y_1, z_1)$  and Q  $(x_2, y_2, z_2)$  are  
$$\left[ \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right]$$
- 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  
$$\left[ \frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3} \right]$$

## Sample Examples

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

Solution:-

The distance PQ between the points P (1,-3, 4) and Q (- 4, 1, 2) is

$$\begin{aligned}PQ &= \sqrt{(-4-1)^2+(1-(-3))^2+(2-4)^2} \\ &= \sqrt{45} \text{ units}\end{aligned}$$

- Find the equation of the set of the points P such that its distances from the points A (3, 4, -5) and B (-2, 1, 4) are equal.

Solution:-

If P (x, y, z) be any point such that PA = PB

$$\sqrt{(x - 3)^2 + (y - 4)^2 + (z + 5)^2} = \sqrt{(x + 2)^2 + (y - 1)^2 + (z - 4)^2}$$

$$(x - 3)^2 + (y - 4)^2 + (z + 5)^2 = (x + 2)^2 + (y - 1)^2 + (z - 4)^2$$

$$10x + 6y - 18z - 29 = 0$$

- 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.

Solution:-

Let the coordinates of C be (x, y, z) and the coordinates of the centroid G be (1, 1, 1). Then

$$(x+3-1)/3 = 1$$

$$x = 1$$

$$(y-5+7)/3 = 1$$

$$y = 1$$

$$(z+7-6)/3 = 1$$

$$z = 2$$



