The $x$-coordinate, $y$-coordinate, and $z$-coordinate of point $(-3, -1, 6)$ are negative, negative, and positive respectively. Therefore, this point lies in octant $\text{III}$. 

The $x$-coordinate, $y$-coordinate, and $z$-coordinate of point $(2, -4, -7)$ are positive, negative, and negative respectively. Therefore, this point lies in octant $\text{VIII}$.

Q4:

Fill in the blanks:

Answer:

(i) The $x$-axis and $y$-axis taken together determine a plane known as the **XY-plane**.

(ii) The coordinates of points in the $XY$-plane are of the form $(x, y, 0)$.

(iii) Coordinate planes divide the space into **eight** octants.

Exercise 12.2 : Solutions of Questions on Page Number : 273

Q1:

Find the distance between the following pairs of points:

(i) $(2, 3, 5)$ and $(4, 3, 1)$

(ii) $(-3, 7, 2)$ and $(2, 4, -1)$

(iii) $(-1, 3, -4)$ and $(1, -3, 4)$

(iv) $(2, -1, 3)$ and $(-2, 1, 3)$

Answer:

The distance between points $P(x_1, y_1, z_1)$ and $P(x_2, y_2, z_2)$ is given by

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

(i) Distance between points $(2, 3, 5)$ and $(4, 3, 1)$

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

$$= \sqrt{2^2 + 0^2 + (-4)^2}$$

$$= \sqrt{4 + 16}$$

$$= \sqrt{20}$$

$$= 2\sqrt{5}$$

(ii) Distance between points $(\alpha, 3, 2)$ and $(2, 4, \alpha + 1)$
Using section formula, show that the points A (2, -3, 4), B (1, 2, 1) and $C\left(0, \frac{1}{3}, 2\right)$ are collinear.

Answer:

The given points are A (2, -3, 4), B (1, 2, 1), and $C\left(0, \frac{1}{3}, 2\right)$.

Let P be a point that divides AB in the ratio $k:1$.

Hence, by section formula, the coordinates of P are given by

$$\left(\frac{k(-1) + 2}{k + 1}, \frac{k(2) - 3}{k + 1}, \frac{k(1) + 4}{k + 1}\right)$$

Now, we find the value of $k$ at which point P coincides with point C.

$$\frac{-k + 2}{k + 1} = 0$$

By taking $k = 2$, we obtain $k = 2$.

For $k = 2$, the coordinates of point P are $\left(0, \frac{1}{3}, 2\right)$.

i.e., $C\left(0, \frac{1}{3}, 2\right)$ is a point that divides AB externally in the ratio 2:1 and is the same as point P.

Hence, points A, B, and C are collinear.

Q5:

Find the coordinates of the points which trisect the line segment joining the points P (4, 2, -6) and Q (10, -16, 6).

Answer:

Let A and B be the points that trisect the line segment joining points P (4, 2, -6) and Q (10, -16, 6).

Point A divides PQ in the ratio 1:2. Therefore, by section formula, the coordinates of point A are given by

$$\left(\frac{1(10) + 2(4)}{1 + 2}, \frac{1(-16) + 2(2)}{1 + 2}, \frac{1(6) + 2(-6)}{1 + 2}\right) = (6, -4, -2)$$

Point B divides PQ in the ratio 2:1. Therefore, by section formula, the coordinates of point B are given by