

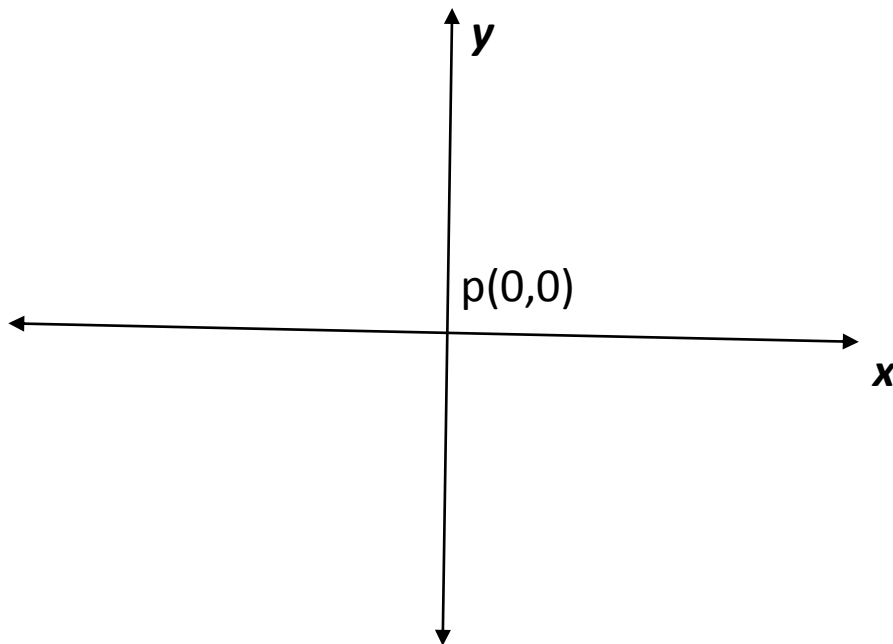
Analytic Geometry

Lecture(1)

Fundamental Concepts:-

1) The Cartesian Coordinate System:-

The coordinate of point (x,y) is the x -coordinate of point p and y is y -coordinate of point p



2) The distance between two points:-

Let two points $p_1(x_1, y_1)$ and $p_2(x_2, y_2)$ the distance between p_1 and p_2 is

$$\overline{p_1 p_2} = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

If $x_1 = x_2 \Rightarrow \overline{p_1 p_2} = |y_2 - y_1|$

If $y_1 = y_2 \Rightarrow \overline{p_1 p_2} = |x_2 - x_1|$

Example

Find the distance between the following points

1) $p_1(1, -3)p_2(5, 5)$

Solution

$$\begin{aligned}\overline{p_1p_2} &= \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2} \\ \overline{p_1p_2} &= \sqrt{(5 - -3)^2 + (5 - 1)^2} = \sqrt{8^2 + 4^2} \\ &= \sqrt{64 + 16} = \sqrt{80}\end{aligned}$$

2) $p_1(-6, 0)p_2(-2, 3)$

Solution

$$\begin{aligned}\overline{p_1p_2} &= \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2} \\ \overline{p_1p_2} &= \sqrt{(3 - 0)^2 + (-2 - -6)^2} = \sqrt{3^2 + 4^2} \\ &= \sqrt{9 + 16} = \sqrt{25} = 5\end{aligned}$$

3) $p_1(-2, 4)p_2(3, 4)$

Solution

$$\begin{aligned}y_1 &= y_2 \Rightarrow \overline{p_1p_2} = |x_2 - x_1| \\ &= |3 - -2| = |5| = 5\end{aligned}$$

4) $p_1(-2, 5)p_2(2, 7)$

Solution

$$\overline{p_1 p_2} = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

$$\overline{p_1 p_2} = \sqrt{()^2 + ()^2} = \sqrt{ }$$

5) $p_1(5, -1)p_2(5, -4)$

Solution

$$\Rightarrow \overline{p_1 p_2} = | - |$$

$$= | | = | | =$$

3) The midpoint between two points:-

If P_m is a midpoint of $p_1(x_1, y_1)$ and $p_2(x_2, y_2)$ then the coordinate of P_m is

$$P_m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Example(2)

Find the midpoint of the following points

1) $p_1(5, 1)p_2(-3, 3)$

solution

$$P_m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$P_m = \left(\frac{5 + -3}{2}, \frac{1 + 3}{2} \right) = \left(\frac{2}{2}, \frac{4}{2} \right) = (1, 2)$$

2) $p_1(-4, 0)p_2(-1, 6)$

solution

$$P_m = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$P_m = \left(\frac{-4 + -1}{2}, \frac{0 + 6}{2} \right) = \left(\frac{-5}{2}, \frac{6}{2} \right)$$

$$= \left(\frac{-5}{2}, 3 \right)$$

3) $p_1(0, -7)p_2(-8, 1)$

Solution

4) $p_1(-2, 5)p_2(2, 7)$

Solution