1.9.30

EE25BTECH11042 - Nipun Dasari

Question:The mid-point of segment AB is the point $P(0,4)$. If the coordinates of B are $(-2,3)$ then the coordinates of A are _____.

Solution:

Given Information

The midpoint of segment AB is $P(0,4)$.

The coordinates of point B are $(-2,3)$.

We need to find the coordinates of point A using a specific matrix method based on the section formula.

Matrix Setup

First, write the coordinates of the points as column matrices:

$$P = \begin{pmatrix} 0 \\ 4 \end{pmatrix},$$

$$B = \begin{pmatrix} -2 \\ 3 \end{pmatrix},$$

$$A = \begin{pmatrix} x \\ y \end{pmatrix}$$

The Formula

Since P is the midpoint, it is known that A divides BP in the ratio -2:1 internally or in other words 2:1 externally. Here k = -2, Thus by section formula:

$$A = \frac{kP + B}{1 + k}$$

Substituting k = -2 we get

$$A = 2P - B$$

Calculation

Substitute the matrices:

$$A = 2\begin{pmatrix} 0 \\ 4 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

Scalar multiplication:

$$A = \begin{pmatrix} 0 \\ 8 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

Matrix subtraction:

$$A = \begin{pmatrix} 0-(-2) \\ 8-3 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

Conclusion

The coordinates of point A are $(2, 5)$.

Quick check: midpoint of $A(2, 5)$ and $B(-2, 3)$ is

$$\left(\frac{2+(-2)}{2}, \frac{5+3}{2} \right) = (0, 4) = P$$

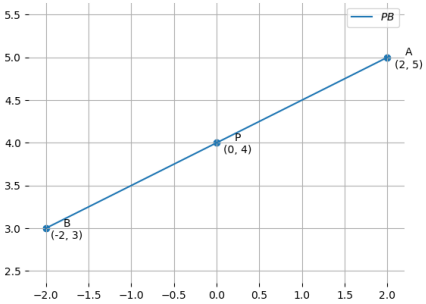

Fig. 0.1: GRAPH PLOT USING PYTHON ONLY

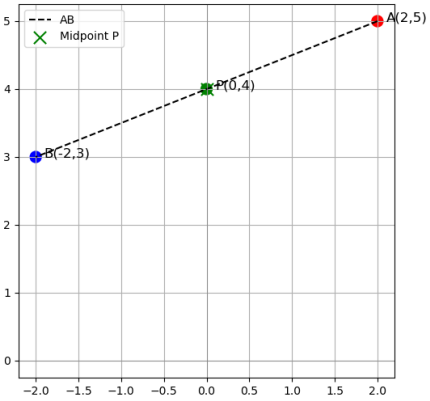

Fig. 0.2: GRAPH PLOT USING SHARED OUTPUT FROM C