

# 1.1.5.15

EE24BTECH11045 - N.Tapasvi

Question:

The midpoint of the line segment joining  $\mathbf{A} \begin{pmatrix} 2a \\ 4 \end{pmatrix}$  and  $\mathbf{B} \begin{pmatrix} -2 \\ 3b \end{pmatrix}$  is  $\mathbf{M} \begin{pmatrix} 1 \\ 2a + 1 \end{pmatrix}$ . Find the values of  $a$  and  $b$ . (10,2019)

**Solution:**

Variable	Description
<b>A</b>	$\begin{pmatrix} 2a \\ 4 \end{pmatrix}$
<b>B</b>	$\begin{pmatrix} -2 \\ 3b \end{pmatrix}$
<b>M(Midpoint)</b>	$\begin{pmatrix} 1 \\ 2a + 1 \end{pmatrix}$
<b>a, b</b>	Values to be found

TABLE I: Variables Used

Let M divide AB in the ratio  $k:1$  then,  $M =$

$$\frac{kB + A}{k + 1}$$

As M is the midpoint  $k=1$

Let the midpoint  $\mathbf{M}$  be given by the formula:

$$\mathbf{M} = \frac{\mathbf{A} + \mathbf{B}}{2}$$

Substituting the coordinates of  $\mathbf{A}$  and  $\mathbf{B}$ :

$$\mathbf{M} = \frac{1}{2} \begin{pmatrix} 2a - 2 \\ 4 + 3b \end{pmatrix}$$

Since

$$\mathbf{M} = \begin{pmatrix} 1 \\ 2a + 1 \end{pmatrix}$$

, we equate the corresponding components:

$$\frac{2a - 2}{2} = 1 \quad \text{and} \quad \frac{4 + 3b}{2} = 2a + 1$$

From the first equation:

$$2a - 2 = 2 \Rightarrow 2a = 4 \Rightarrow a = 2$$

Substitute  $a = 2$  into the second equation:

$$\frac{4 + 3b}{2} = 2(2) + 1 = 5 \Rightarrow 4 + 3b = 10 \Rightarrow 3b = 6 \Rightarrow b = 2$$

Thus,

$$a = 2$$

and

$$b = 2$$

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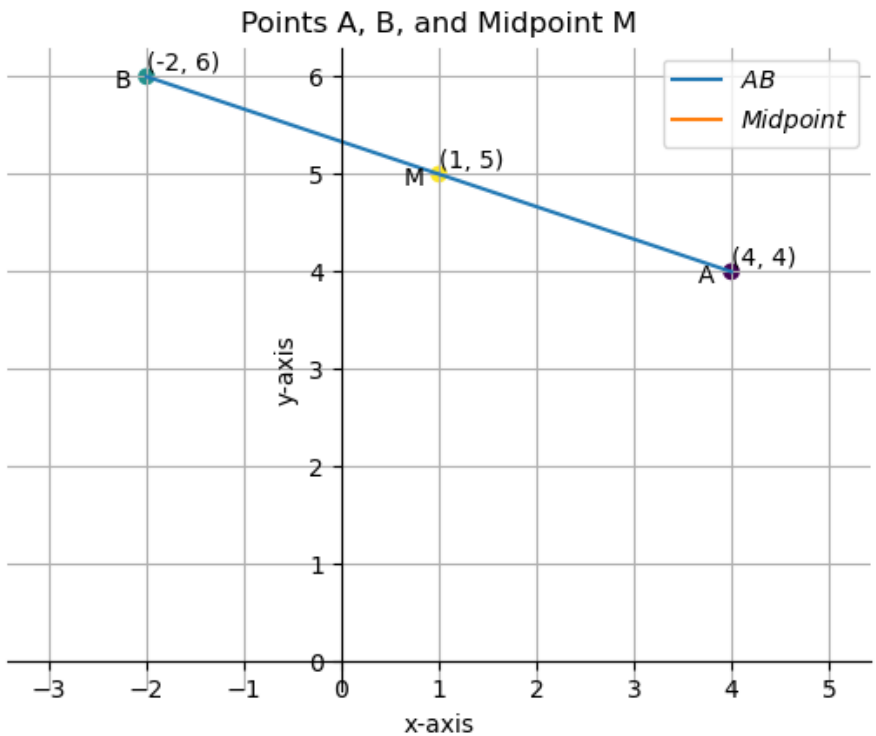


Fig. 1: Plot of the points A,B,M