

1.4.24

EE25BTECH11008 - Anirudh M Abhilash

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Question

If $P(9a - 2, -b)$ divides the line segment joining $A(3a + 1, -3)$ and $B(8a, 5)$ in the ratio $3 : 1$, find the values of a and b .

Solution

If $P(9a - 2, -b)$ divides the line segment joining $A(3a + 1, -3)$ and $B(8a, 5)$ in the ratio $3 : 1$, find the values of a and b .

By the section formula (internal division), the coordinates of the point P are given by

$$P = \frac{m \begin{pmatrix} x_2 \\ y_2 \end{pmatrix} + n \begin{pmatrix} x_1 \\ y_1 \end{pmatrix}}{m + n},$$

where P divides AB in the ratio $m : n$.

Here, $A = \begin{pmatrix} 3a + 1 \\ -3 \end{pmatrix}$, $B = \begin{pmatrix} 8a \\ 5 \end{pmatrix}$, and $m : n = 3 : 1$.

$$P = \frac{3 \binom{8a}{5} + 1 \binom{3a+1}{-3}}{3+1} \quad (1)$$

$$= \frac{\binom{24a}{15} + \binom{3a+1}{-3}}{4} \quad (2)$$

$$= \frac{\binom{27a+1}{12}}{4} \quad (3)$$

$$= \binom{\frac{27a+1}{4}}{3}. \quad (4)$$

But $P = \binom{9a-2}{-b}$. Hence equating coordinates:

$$9a - 2 = \frac{27a+1}{4}, \quad (5)$$

$$-b = 3. \quad (6)$$

From (1),

$$4(9a - 2) = 27a + 1 \quad (7)$$

$$36a - 8 = 27a + 1 \quad (8)$$

$$9a = 9 \quad (9)$$

$$a = 1. \quad (10)$$

From (2),

$$-b = 3 \quad (11)$$

$$b = -3 \quad (12)$$

$$\boxed{a = 1, \quad b = -3}$$

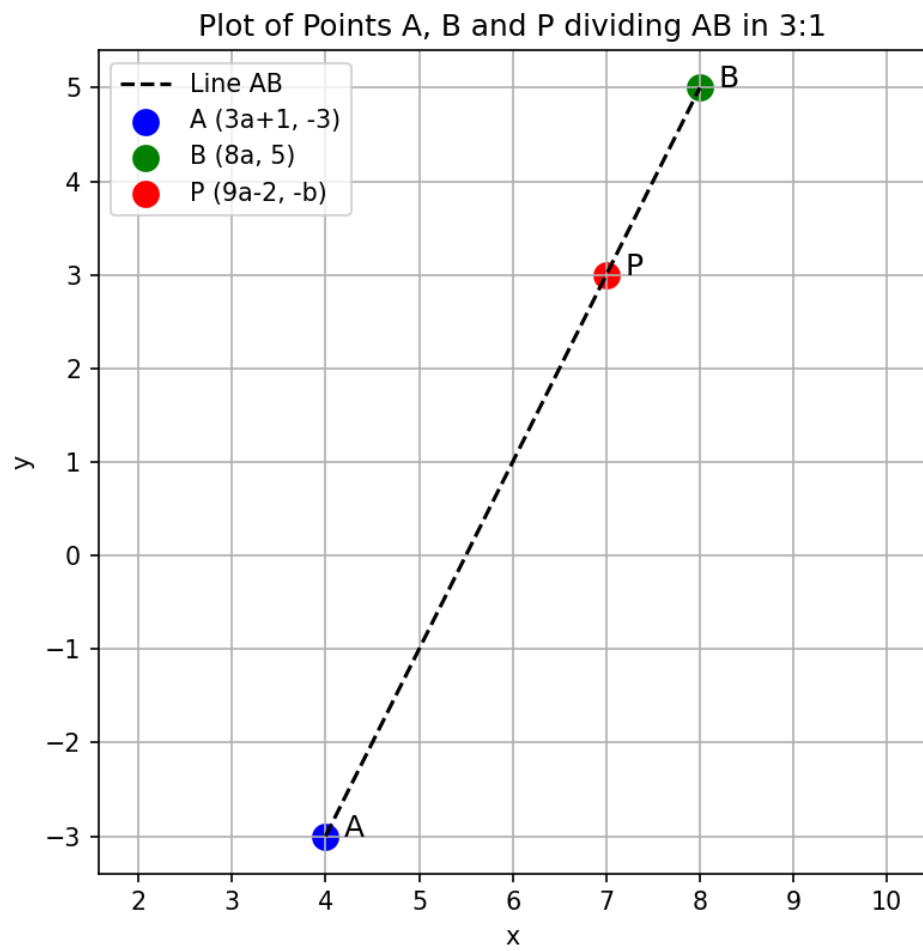


Figure 1: Plot