

# 1.5.15

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**Question** The midpoint of the line segment joining  $A(2a, 4)$  and  $B(-2, 3b)$  is  $(1, 2a+1)$ . Find the values of  $a$  and  $b$ .

**Solution:**

Let us solve the given equation theoretically and then verify the solution computationally. From the given data,

$$\mathbf{A} = \begin{pmatrix} 2a \\ 4 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -2 \\ 3b \end{pmatrix} \quad (1)$$

Let the midpoint of points  $A$  and  $B$  be  $C$ . where,

$$\mathbf{C} = \begin{pmatrix} 1 \\ 2a+1 \end{pmatrix} \quad (2)$$

We know that the midpoint formula for the points  $A$  and  $B$  is

$$\mathbf{C} = \frac{\mathbf{A} + \mathbf{B}}{2} \quad (3)$$

Now we can find the values of  $a$  and  $b$  by using the midpoint formula(Eq.3):

$$\mathbf{C} = \frac{\begin{pmatrix} 2a \\ 4 \end{pmatrix} + \begin{pmatrix} -2 \\ 3b \end{pmatrix}}{2} \quad (4)$$

$$\begin{pmatrix} 1 \\ 2a+1 \end{pmatrix} = \frac{\begin{pmatrix} 2a \\ 4 \end{pmatrix} + \begin{pmatrix} -2 \\ 3b \end{pmatrix}}{2} \quad (5)$$

$$\begin{pmatrix} 1 \\ 2a+1 \end{pmatrix} = \frac{\begin{pmatrix} 2a-2 \\ 4+3b \end{pmatrix}}{2} \quad (6)$$

$$\begin{pmatrix} 1 \\ 2a+1 \end{pmatrix} = \begin{pmatrix} a-1 \\ 2+\frac{3b}{2} \end{pmatrix} \quad (7)$$

As the two vector matrices are equal, their corresponding elements are also equal. By equating the corresponding elements, we get:

$$1 = a - 1 \text{ and } 2a + 1 = 2 + \frac{3b}{2} \quad (8)$$

By solving the above equation we get

$$a = 2 \text{ and } b = \frac{4a-2}{3} \quad (9)$$

As the value of  $a=2$ , we get:

$$b = \frac{4(2) - 2}{3} \quad (10)$$

$$b = \frac{8 - 2}{3} \quad (11)$$

$$b = \frac{6}{3} \quad (12)$$

$$b = 2 \quad (13)$$

So the final answer is

$$a = 2 \text{ and } b = 2 \quad (14)$$

From the figure it is clearly verified that the theoretical solution matches with the computational solution.

