

# 1.5.16

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**Question:** Find the point  $A$  if  $AB$  is a diameter of the circle with center  $C = (3, -1)$  and point  $B = (2, 6)$ .

**Solution:**

Point	Vector
B	$\begin{pmatrix} 2 \\ 6 \end{pmatrix}$
C	$\begin{pmatrix} 3 \\ -1 \end{pmatrix}$

**Section Formula:**

If a point  $P$  divides the line joining  $A$  and  $B$  internally in the ratio  $m : n$ , then

$$\mathbf{P} = \frac{k\mathbf{B} + \mathbf{A}}{k + 1} = (\mathbf{A} \quad \mathbf{B}) \begin{pmatrix} \frac{1}{k+1} \\ \frac{k}{k+1} \end{pmatrix}. \quad (1)$$

Here,  $C$  is the midpoint of  $AB$ , i.e. ratio  $1 : 1$ .

$$\mathbf{C} = \frac{\mathbf{A} + \mathbf{B}}{2} = (\mathbf{A} \quad \mathbf{B}) \begin{pmatrix} \frac{1}{2} \\ \frac{1}{2} \end{pmatrix}. \quad (2)$$

Express  $\mathbf{A}$  in terms of  $\mathbf{B}$  and  $\mathbf{C}$ :

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

Using matrix notation:

$$\mathbf{A} = 2\mathbf{C} - \mathbf{B} = (\mathbf{B} \quad \mathbf{C}) \begin{pmatrix} -1 \\ 2 \end{pmatrix}. \quad (4)$$

**Substitute values:**

Given:

$$\mathbf{B} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}, \quad \mathbf{C} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

we have,

$$\mathbf{A} = 2 \begin{pmatrix} 3 \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} 4 \\ -8 \end{pmatrix}. \quad (5)$$

$$\mathbf{A} = \begin{pmatrix} 4 \\ -8 \end{pmatrix}$$

(6)

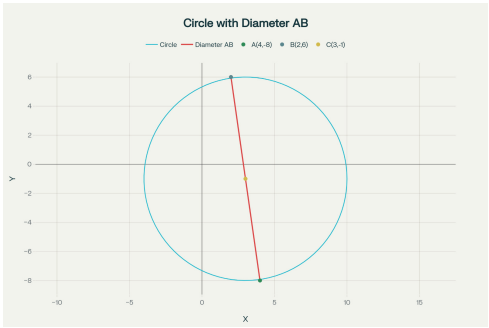


Fig. 0