

# 1.6.12

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## Question:

Point  $(-4, 2)$  lies on the line segment joining the points  $\mathbf{A}(-4, 6)$  and  $\mathbf{B}(-4, -6)$ .

## Solution:

Here  $\mathbf{A} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$ ,  $\mathbf{B} = \begin{pmatrix} -4 \\ -6 \end{pmatrix}$ , and  $\mathbf{C}$  be  $\mathbf{C} = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$

point	Coordinates
<b>A</b>	$(-4, 6)$
<b>B</b>	$(-4, -6)$
<b>C</b>	$(-4, 2)$

TABLE 0: variables used

Points  $\mathbf{A}, \mathbf{B}, \mathbf{C}$  are defined to be collinear if

$$\text{rank}(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A}) = 1 \quad (0.1)$$

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 0 \\ -12 \end{pmatrix} \quad (0.2)$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 0 \\ -4 \end{pmatrix} \quad (0.3)$$

From equations 0.1 and using 0.2 and 0.3, the collinearity matrix can be expressed as

$$\begin{pmatrix} 0 & 0 \\ -12 & -4 \end{pmatrix} \quad (0.4)$$

which is a rank 1 matrix. To find the ratio which  $\mathbf{C}$  divides  $\mathbf{A}, \mathbf{B}$ . Using section formula,

$$\begin{pmatrix} -4 \\ 2 \end{pmatrix} = \frac{\begin{pmatrix} -4 \\ 6 \end{pmatrix} + k \begin{pmatrix} -4 \\ -6 \end{pmatrix}}{1 + k} \quad (0.5)$$

$$\Rightarrow 2k \begin{pmatrix} 0 \\ 4 \end{pmatrix} = 2 \begin{pmatrix} 0 \\ 4 \end{pmatrix} \quad (0.6)$$

$$\text{or, } k = \frac{1}{2}. \quad (0.7)$$

Since the ratio is positive and the 3 points are collinear we can conclude that point  $\mathbf{C}$  lies on the line segment joining  $\mathbf{A}, \mathbf{B}$

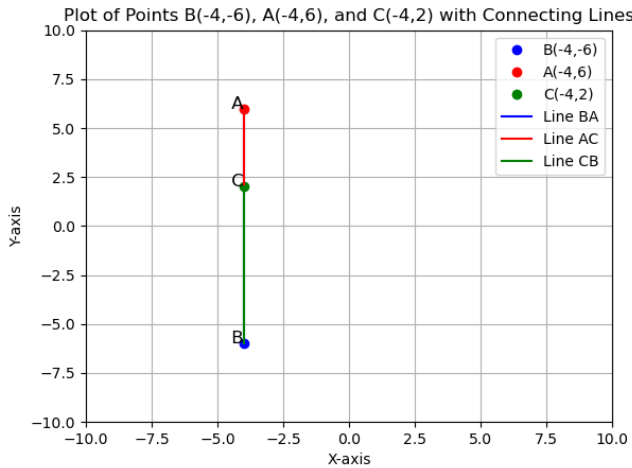


Fig. 0.1: Line connecting  $ABC$