

# 1.7.9

AI25BTECH11023 - Pratik R

**Question:**

If the points  $\mathbf{A} = (k + 1, 2k)$ ,  $\mathbf{B} = (3k, 2k + 3)$ , and  $\mathbf{C} = (5k - 1, 5k)$  are collinear, then find the value of  $k$ .

**Solution:**

Given that

$$\mathbf{A} = \begin{pmatrix} k + 1 \\ 2k \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 3k \\ 2k + 3 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 5k - 1 \\ 5k \end{pmatrix}.$$

$\mathbf{A}$ ,  $\mathbf{B}$  and  $\mathbf{C}$  are collinear therefore

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

$$(\mathbf{B} - \mathbf{A}) = \begin{pmatrix} 2k - 1 \\ 3 \end{pmatrix} \quad (0.2)$$

$$(\mathbf{C} - \mathbf{A}) = \begin{pmatrix} 4k - 2 \\ 3k \end{pmatrix} \quad (0.3)$$

$$(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T = \begin{pmatrix} 2k - 1 & 3 \\ 4k - 2 & 3k \end{pmatrix} \quad (0.4)$$

$R_2 \rightarrow R_2 - (R_1 \times 2) :$

$$= \begin{pmatrix} 2k - 1 & 3 \\ 0 & 3k - 6 \end{pmatrix} \quad (0.5)$$

For rank = 1,

$$3k - 6 = 0 \implies k = 2 \quad (0.6)$$

Hence , the value of  $k$  is 2.

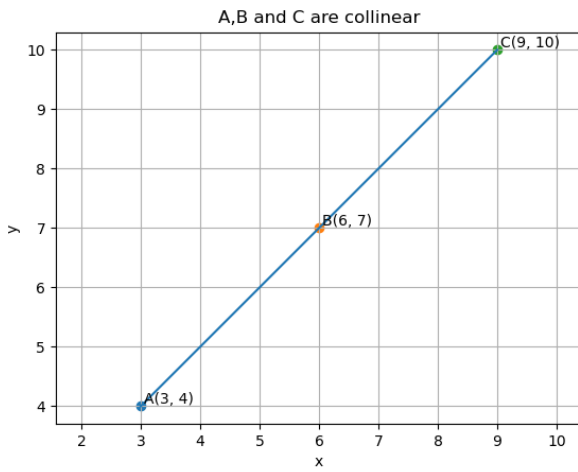


Fig. 0.1