Assignment 1

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Download all python codes

https://github.com/Vallidevibolla/704−Valli−Devi−assignment/blob/main/Collinear.py

and latex-tikz codes from

https://github.com/Vallidevibolla/704−Valli−Devi−assignment/blob/main/latex

1 Question 14

Find the value of k, if the points $\mathbf{A} = \begin{pmatrix} k \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$are collinear

2 Solution

Given:- Given:- $\mathbf{A} = \begin{pmatrix} k \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$
Given that the points are collinear, so we create a matrix

$$\mathbf{M} = \begin{pmatrix} \mathbf{A} - \mathbf{B} & \mathbf{B} - \mathbf{C} \end{pmatrix}^\top \tag{2.0.1}$$

where $rank(\mathbf{M}) = 1$.We have the matrix $\mathbf{M}$ as,

$$\mathbf{M} = \begin{pmatrix} k - 6 & 3 - (-2) \\ 6 - (-3) & -2 - 4 \end{pmatrix} \tag{2.0.2}$$

$$\implies \mathbf{M} = \begin{pmatrix} k - 6 & 5 \\ 9 & -6 \end{pmatrix} \tag{2.0.3}$$

Now we row reduce the matrix $\mathbf{M}$,

$$\begin{pmatrix} k - 6 & 5 \\ 9 & -6 \end{pmatrix} \xleftrightarrow{R_1 \leftrightarrow R_2} \begin{pmatrix} 9 & -6 \\ k - 6 & 5 \end{pmatrix} \tag{2.0.4}$$

$$\leftrightarrow \begin{pmatrix} 9 & -6 \\ 0 & 9 \times 5 - (-6 \times (k - 6)) \end{pmatrix} \tag{2.0.5}$$

$$\leftrightarrow \begin{pmatrix} 9 & -6 \\ 0 & 9 + 6k \end{pmatrix} \tag{2.0.6}$$

$$\xleftrightarrow{R_2 \rightarrow \frac{R_2}{6}} \begin{pmatrix} 9 & -6 \\ 0 & \frac{3}{2} + k \end{pmatrix} \tag{2.0.7}$$

$$\xleftrightarrow{R_1 \rightarrow \frac{R_1}{3}} \begin{pmatrix} 1 & \frac{-2}{3} \\ 0 & \frac{3}{2} + k \end{pmatrix} \tag{2.0.8}$$

Since $rank(\mathbf{M}) = 1$,we have

$$\frac{3}{2} + k = 0 \tag{2.0.9}$$

$$\implies k = \frac{-3}{2} \tag{2.0.10}$$

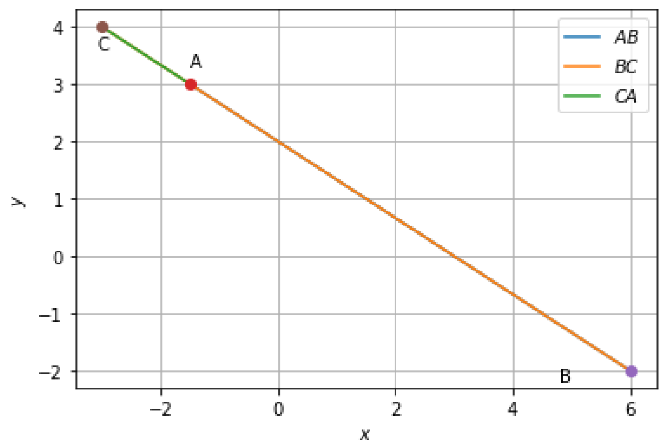

Fig. 2.1: Graphical solution

$\therefore$ The figure verifies that the points are indeed collinear for $k = \frac{-3}{2}$