Assignment 1

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Download all python codes from

and latex-tikz codes from

1 PROBLEM

(Vector 2.7) Determine if the points

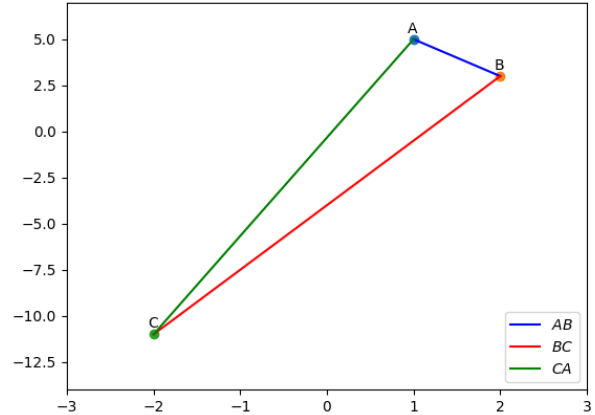$$\begin{pmatrix}1\\5\end{pmatrix}, \begin{pmatrix}2\\3\end{pmatrix}, \begin{pmatrix}-2\\-11\end{pmatrix} \qquad (1.0.1)$$

are collinear

Fig. 0: Plot of the points

2 SOLUTION

Let

$$\mathbf{A} = \begin{pmatrix}1\\5\end{pmatrix}, \qquad (2.0.1)$$

$$\mathbf{B} = \begin{pmatrix}2\\3\end{pmatrix}, \qquad (2.0.2)$$

$$\mathbf{C} = \begin{pmatrix}-2\\-11\end{pmatrix} \qquad (2.0.3)$$

Lets define a matrix $\mathbf{M}$

$$\mathbf{M} = \begin{pmatrix}\mathbf{B} - \mathbf{A} & \mathbf{C} - \mathbf{A}\end{pmatrix}^{T} \qquad (2.0.4)$$

If $rank(\mathbf{M}) = 1$, the points are collinear. The rank of a matrix is the number of nonzero rows left after doing row operations. In this problem,

$$\mathbf{M} = \begin{pmatrix}1 & -2\\-3 & -16\end{pmatrix} \xleftrightarrow{R_2 \leftarrow 5R_2 - R_1} \begin{pmatrix}1 & -2\\-16 & -78\end{pmatrix} \qquad (2.0.5)$$

$$\implies rank(\mathbf{M}) = 2 \qquad (2.0.6)$$

Therefore, the points are not collinear