

Assignment 1

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Download all python codes from

<https://github.com/cmaspi/EE3900/tree/main/Assignment-1/code>

and latex-tikz codes from

<https://github.com/cmaspi/EE3900/blob/main/Assignment-1/assignment-1.tex>

1 PROBLEM

(Vector 2.7) Determine if the points

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

are collinear

2 SOLUTION

Let

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

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

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

Lets define a matrix \mathbf{M} as

$$\mathbf{M} = (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T \quad (2.0.4)$$

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

$$\mathbf{M} = \begin{pmatrix} 1 & -2 \\ -3 & -16 \end{pmatrix} \xrightarrow{R_2 \leftarrow -\frac{R_2}{3} - R_1} \begin{pmatrix} 1 & -2 \\ 0 & \frac{22}{3} \end{pmatrix} \quad (2.0.5)$$

$$\Rightarrow \text{rank}(\mathbf{M}) = 2 \quad (2.0.6)$$

Therefore, the points are not collinear

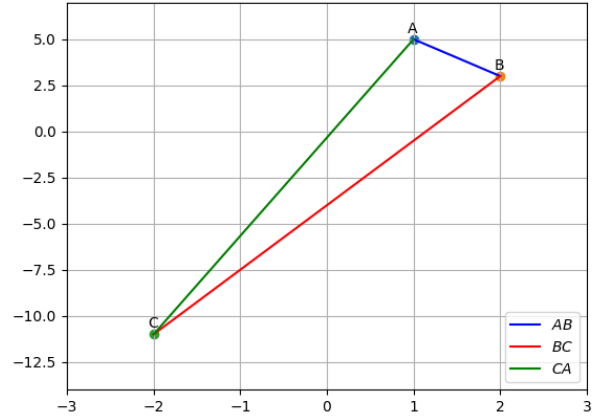


Fig. 0: Plot of the points