

EE3900 Assignment-1

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Download all python codes from

<https://github.com/vrahul02/EE3900/tree/main/Assignment-1/Codes>

and latex-tikz codes from

<https://github.com/vrahul02/EE3900/tree/main/Assignment-1/Assignment-1.tex>

doing row operations. In this problem,

$$\mathbf{M} = \begin{pmatrix} 3 & 3 \\ 5 & 5 \end{pmatrix} \xrightarrow{R_1 \rightarrow R_1 - \frac{3R_2}{5}} \begin{pmatrix} 0 & 0 \\ 5 & 5 \end{pmatrix} \quad (0.0.7)$$

$$\Rightarrow \text{rank}(\mathbf{M}) = 1 \quad (0.0.8)$$

as the number of nonzero rows is 1.

Thus the points A, B, C are collinear and forms a line.

PROBLEM VECTORS Q.2.28

Verify if $A = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $B = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$, $C = \begin{pmatrix} 8 \\ 6 \end{pmatrix}$ are points on a line.

SOLUTION

The direction vectors of AB and BC are

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 3 \\ 3 \end{pmatrix} \quad (0.0.1)$$

$$\mathbf{C} - \mathbf{B} = \begin{pmatrix} 2 \\ 2 \end{pmatrix} \quad (0.0.2)$$

If **A**, **B**, **C** form a line, then, AB and BC should have the same direction vector. Hence, there exists a k such that

$$\mathbf{B} - \mathbf{A} = k \times (\mathbf{C} - \mathbf{B}) \quad (0.0.3)$$

$$\begin{pmatrix} 3 \\ 3 \end{pmatrix} = k \times \begin{pmatrix} 2 \\ 2 \end{pmatrix} \quad (0.0.4)$$

$$\Rightarrow k = \frac{2}{3} \quad (0.0.5)$$

Thus the points A, B, C are collinear and forms a line.

An alternative method is to create the matrix

$$\mathbf{M} = (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T \quad (0.0.6)$$

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

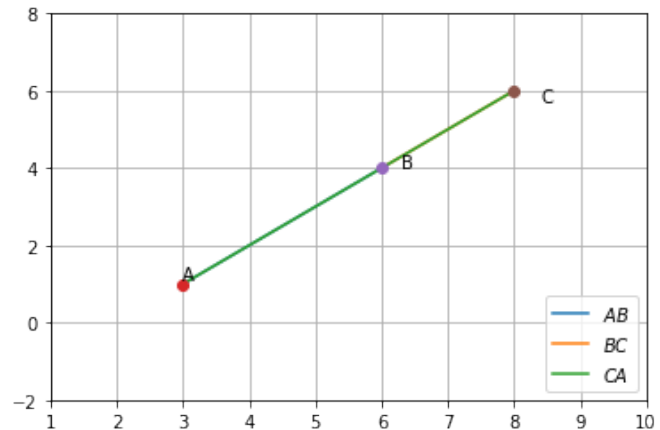


Fig. 0: Plot of vectors