## 1

## Assignment 1

## Chirag Mehta - AI20BTECH11006

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

$$\begin{pmatrix} 1 \\ 5 \end{pmatrix}, \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \begin{pmatrix} -2 \\ -11 \end{pmatrix} \tag{1.0.1}$$

are collinear

2 SOLUTION

Let

$$\mathbf{A} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}, \tag{2.0.1}$$

$$\mathbf{B} = \begin{pmatrix} 2\\3 \end{pmatrix},\tag{2.0.2}$$

$$\mathbf{C} = \begin{pmatrix} -2\\ -11 \end{pmatrix} \tag{2.0.3}$$

Lets define a matrix M as

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

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,

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

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

Therefore, the points are not collinear

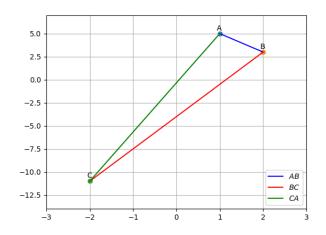


Fig. 0: Plot of the points