

Assignment 1

Digjoy Nandi - AI20BTECH11007

Download all python codes from

<https://github.com/Digjoy12/Signal-Processing/blob/main/Assignment%201/Code/untitled1.py>

and latex codes from

<https://github.com/Digjoy12/Signal-Processing/blob/main/Assignment%201/main.tex>

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

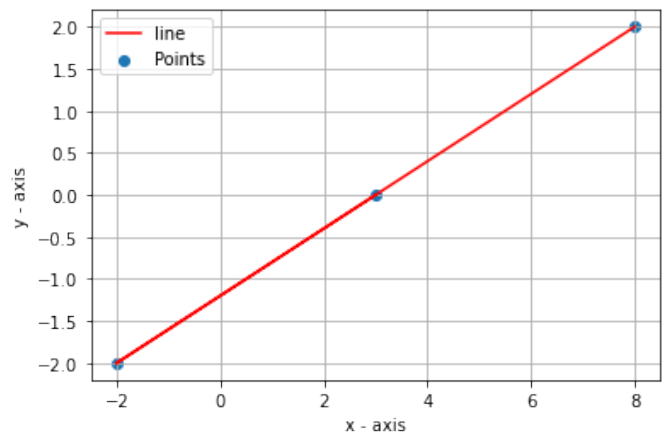


Fig. 0: Plot of the points

PROBLEM

(Vectors - Q2.8) By using the concept of equation of a line, prove that the three points $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, $\begin{pmatrix} -2 \\ -2 \end{pmatrix}$, $\begin{pmatrix} 8 \\ 2 \end{pmatrix}$ are collinear.

SOLUTION

Let,

$$\mathbf{A} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -2 \\ -2 \end{pmatrix} \text{ and } \mathbf{C} = \begin{pmatrix} 8 \\ 2 \end{pmatrix} \quad (0.0.1)$$

Now,

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -2 - 3 \\ -2 - 0 \end{pmatrix} = \begin{pmatrix} -5 \\ -2 \end{pmatrix} \quad (0.0.2)$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 8 - 3 \\ 2 - 0 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \quad (0.0.3)$$

Forming the matrix \mathbf{M} ,

$$\mathbf{M} = (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T \quad (0.0.4)$$

$$= \begin{pmatrix} -5 & 5 \\ -2 & 2 \end{pmatrix}^T \quad (0.0.5)$$

$$= \begin{pmatrix} -5 & -2 \\ 5 & 2 \end{pmatrix} \quad (0.0.6)$$

Using matrix transformation,

$$\mathbf{M} = \begin{pmatrix} -5 & -2 \\ 5 & 2 \end{pmatrix} \xrightarrow{R_1 \rightarrow -R_1} \begin{pmatrix} 5 & 2 \\ 5 & 2 \end{pmatrix} \quad (0.0.7)$$

$$\xrightarrow{R_2 \rightarrow R_2 - R_1} \begin{pmatrix} 5 & 2 \\ 0 & 0 \end{pmatrix} \quad (0.0.8)$$

Thus, the points are **collinear**.