Assignment 1

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PROBLEM

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

SOLUTION

Let, A = $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, B = $\begin{pmatrix} -2 \\ -2 \end{pmatrix}$ and C = $\begin{pmatrix} 8 \\ 2 \end{pmatrix}$

Now,

$$B - A = \begin{pmatrix} -2 - 3 \\ -2 - 0 \end{pmatrix} = \begin{pmatrix} -5 \\ -2 \end{pmatrix} \qquad (0.0.1)$$
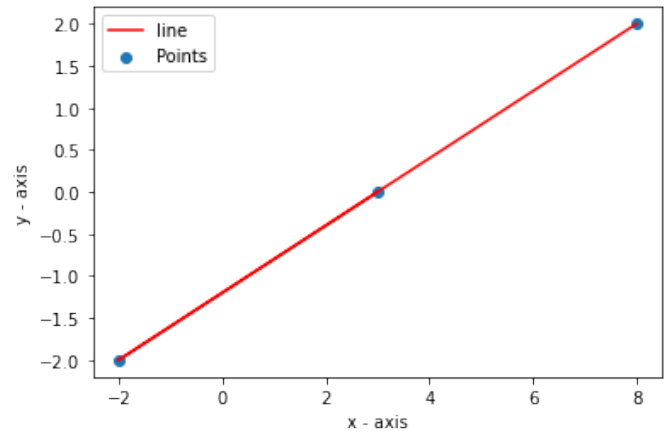
$$C - A = \begin{pmatrix} 8 - 3 \\ 2 - 0 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix} \qquad (0.0.2)$$

Forming the matrix M,

$$M = \begin{pmatrix} B - A & C - A \end{pmatrix}^{\top} \qquad (0.0.3)$$

$$= \begin{pmatrix} -5 & 5 \\ -2 & 2 \end{pmatrix}^{\top} \qquad (0.0.4)$$

$$= \begin{pmatrix} -5 & -2 \\ 5 & 2 \end{pmatrix} \qquad (0.0.5)$$

Using matrix transformation,

$$M = \begin{pmatrix} -5 & -2 \\ 5 & 2 \end{pmatrix} \xleftrightarrow{R_1 \to -R_1} \begin{pmatrix} 5 & 2 \\ 5 & 2 \end{pmatrix} \qquad (0.0.6)$$

$$\xleftrightarrow{R_2 \to R_2 - R_1} \begin{pmatrix} 5 & 2 \\ 0 & 0 \end{pmatrix} \qquad (0.0.7)$$

$$\qquad (0.0.8)$$

$$\implies rank(M) = 1$$

Thus, the points are **collinear**.