

My Presentation

Using Beamer

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Question

Find the value of p for which the points

$A = \begin{pmatrix} -5 \\ 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ p \end{pmatrix}$, $C = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$ are collinear

Solution

Given:- $A = \begin{pmatrix} -5 \\ 1 \end{pmatrix}, B = \begin{pmatrix} 1 \\ p \end{pmatrix}, C = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$

Given that the points are collinear, so we create a matrix

$$M = (B - A \quad C - A)^T \quad (1)$$

where $\text{rank}(M) = 1$. We have the matrix M as,

$$M = \begin{pmatrix} 1 + 5 & p - 1 \\ 4 + 5 & -2 - 1 \end{pmatrix} \quad (2)$$

$$M = \begin{pmatrix} 6 & p - 1 \\ 9 & -3 \end{pmatrix} \quad (3)$$

Solution

Now we row reduce the matrix M ,

$$\begin{pmatrix} 6 & p-1 \\ 9 & -3 \end{pmatrix} \quad (4)$$

$$\begin{matrix} R_1 \leftrightarrow R_2 \\ \longleftrightarrow \end{matrix} \begin{pmatrix} 9 & -3 \\ 6 & p-1 \end{pmatrix} \quad (5)$$

$$\begin{matrix} R_1 \rightarrow \frac{R_1}{3} \\ \longleftrightarrow \end{matrix} \begin{pmatrix} 3 & -1 \\ 6 & p-1 \end{pmatrix} \quad (6)$$

$$\begin{matrix} R_2 \rightarrow R_2 - 2R_1 \\ \longleftrightarrow \end{matrix} \begin{pmatrix} 3 & -1 \\ 0 & p+1 \end{pmatrix} \quad (7)$$

$$(8)$$

Solution

$$\begin{matrix} R_1 \rightarrow \frac{R_1}{3} \\ \longleftarrow \longrightarrow \end{matrix} \begin{pmatrix} 1 & \frac{-1}{3} \\ 0 & p+1 \end{pmatrix} \quad (9)$$

Since $\text{rank}(M) = 1$, we have

$$p+1=0 \quad (10)$$

$$\implies p = -1 \quad (11)$$

Figure verifies that the points are indeed collinear for $p = -1$

Graphical solution

