भारतीय प्रौद्योगिकी संस्थान हैदराबाद
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Assignment - 12.10.2.11

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1 Problem

Show that the vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear .

2 Solution

given

$$\mathbf{A} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} \tag{1}$$

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \\ -8 \end{pmatrix} \tag{2}$$

$$\begin{pmatrix} \mathbf{A}^\top \\ \mathbf{B}^\top \end{pmatrix} = \begin{pmatrix} 2 & -3 & 4 \\ -4 & 6 & -8 \end{pmatrix} \tag{3}$$

Forming the collinearity matrix (4)

$$\begin{pmatrix} 2 & -3 & 4 \\ -4 & 6 & -8 \end{pmatrix} \xleftrightarrow{\frac{1}{2}R_1 \to R_1} \begin{pmatrix} 1 & -\frac{3}{2} & 2 \\ -4 & 6 & -8 \end{pmatrix} \tag{5}$$

$$\xleftrightarrow{-\frac{1}{4}R_2 \leftarrow R_2} \begin{pmatrix} 1 & -\frac{3}{2} & 2 \\ 1 & \frac{3}{2} & 2 \end{pmatrix} \tag{6}$$

$$\xleftrightarrow{R_2 - 1R_1 \to R_2} \begin{pmatrix} 1 & -\frac{3}{2} & 2 \\ 0 & 0 & 0 \end{pmatrix} \tag{7}$$

There is 1 nonzero in the row echelon form of the matrix,so the rank is 1 . if rank of the matrix is 1 then the vectors are collinear

3 Code Link

https://github.com/sssurajit/fwc/blob/main/vectors/12.10.2.11/codes/vector.py

Execute the code by using the command
python3 vector.py