

# Assignment-4

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## 1 Problem

0.

If three points (x, -1), (2, 1) and (4, 5) are collinear find the value of x.

$$2x - 2 = 0 \quad (12)$$

$$2x = 2 \quad (13)$$

Dividing with 2 on both sides ,we get

## 2 Solution

The input given

$$x = 1 \quad (14)$$

Hence proved.

$$A = \begin{pmatrix} x \\ -1 \end{pmatrix} \quad (1)$$

$$B = \begin{pmatrix} 2 \\ 1 \end{pmatrix} \quad (2)$$

$$C = \begin{pmatrix} 4 \\ 5 \end{pmatrix} \quad (3)$$

$$D = A - B = \begin{pmatrix} x \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} \quad (4)$$

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

$$E = A - C = \begin{pmatrix} 4 \\ 5 \end{pmatrix} - \begin{pmatrix} x \\ -1 \end{pmatrix} \quad (6)$$

$$= \begin{pmatrix} 4 - x \\ 6 \end{pmatrix} \quad (7)$$

Now the matrix is

$$F = \begin{pmatrix} D \\ E \end{pmatrix} \quad (8)$$

$$= \begin{pmatrix} x - 2 & -2 \\ 4 - x & 6 \end{pmatrix} \quad (9)$$

In the problem they have given that three points lie on a line, that means these three points are collinear.

If points on a line are collinear, rank of matrix is " 1 " then the vectors are linearly dependent.  
For  $2 \times 2$  matrix Rank = 1 means Determinant is 0.

Through pivoting, we obtain

$$= \begin{pmatrix} x - 2 & -2 \\ 4 - x & 6 \end{pmatrix} \quad (10)$$

$$= \begin{pmatrix} x - 2 & -2 \\ 4 - x & 6 \end{pmatrix} \xrightarrow{R1 = 3R1 + R2} \begin{pmatrix} 2x - 2 & 0 \\ 4 - x & 6 \end{pmatrix} \quad (11)$$

if the rank of the matrix is 1 means any one of the row must be zero. So, making the first element in the matrix to

## 3 Construction

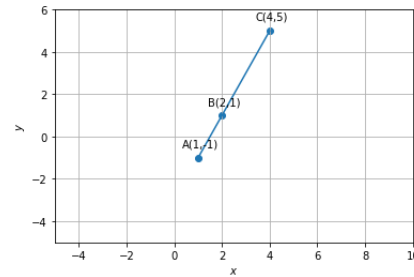


Figure 1:

## 4 Code

\*Verify the above proofs in the following code.

<https://github.com/chandana531/FWC/tree/main/matrix/lin>