

ASSIGNMENT 3

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Download all python codes from

<https://github.com/Y.Nagarani/ASSIGNMENT2/tree/main/CODES>

and latex-tikz codes from

<https://github.com/Y.Nagarani/ASSIGNMENT2/tree/main>

$$\xleftrightarrow{R_3 \leftarrow R_3 - R_1} \begin{pmatrix} 1 & 2 & 1 \\ 0 & 3 & -2 \\ 0 & 0 & 1 \end{pmatrix} \quad (2.0.6)$$

∴ The above matrix has rank=3. Hence the lines do not intersect. Given lines are not parallel but they lie on parallel planes. such lines are known as skew lines

1 QUESTION No 2.32

Find the shortest distance between lines

$$\mathbf{L}_1 : \mathbf{X} = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} + \lambda_1 \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} \quad (1.0.1)$$

$$\mathbf{L}_2 : \mathbf{X} = \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} + \lambda_2 \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix} \quad (1.0.2)$$

2 SOLUTION

$$\text{Let, } \mathbf{A}_1 = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \mathbf{m}_1 = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} \quad (2.0.1)$$

$$\mathbf{A}_2 = \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}, \mathbf{m}_2 = \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix} \quad (2.0.2)$$

The lines will intersect if

$$\begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} + \lambda_1 \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} + \lambda_2 \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix} \quad (2.0.3)$$

$$\begin{pmatrix} 1 & 2 \\ -1 & 1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} \lambda_1 \\ \lambda_2 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \\ -2 \end{pmatrix} \quad (2.0.4)$$

The augmented matrix for the above equation is row reduced form

$$\begin{pmatrix} 1 & 2 & 1 \\ -1 & 1 & -3 \\ 1 & 2 & 2 \end{pmatrix} \xleftrightarrow{R_2 \leftarrow R_2 + R_1} \begin{pmatrix} 1 & 2 & 1 \\ 0 & 3 & -2 \\ 1 & 2 & 2 \end{pmatrix} \quad (2.0.5)$$

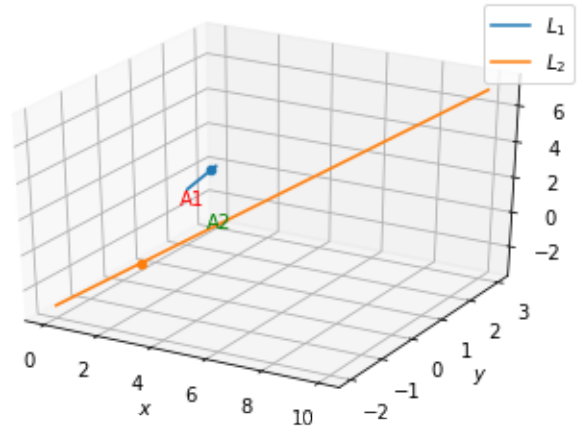


Fig. 0: Skew Lines