

5.2.51

EE25BTECH11049 - Sai Krishna Bakki

Question:

Solve the following system of linear equations.

$$5x + 2y = 4$$

$$7x + 3y = 5$$

Solution:

The equation of line L_1 is,

$$(5 \ 2)\mathbf{x} = 4 \quad (1)$$

The equation of line L_2 is,

$$(7 \ 3)\mathbf{x} = 5 \quad (2)$$

On putting the equations in a matrix, we will get

$$\Rightarrow \begin{pmatrix} 5 & 2 \\ 7 & 3 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 4 \\ 5 \end{pmatrix} \quad (3)$$

So the augmented matrix is,

$$\left(\begin{array}{cc|c} 5 & 2 & 4 \\ 7 & 3 & 5 \end{array} \right) \quad (4)$$

$$\left(\begin{array}{cc|c} 5 & 2 & 4 \\ 7 & 3 & 5 \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 - \frac{7}{5}R_1} \left(\begin{array}{cc|c} 5 & 2 & 4 \\ 0 & \frac{1}{5} & \frac{-3}{5} \end{array} \right) \quad (5)$$

$$\left(\begin{array}{cc|c} 5 & 2 & 4 \\ 0 & \frac{1}{5} & \frac{-3}{5} \end{array} \right) \xrightarrow{R_2 \rightarrow 5R_2} \left(\begin{array}{cc|c} 5 & 2 & 4 \\ 0 & 1 & -3 \end{array} \right) \quad (6)$$

$$\left(\begin{array}{cc|c} 5 & 2 & 4 \\ 0 & 1 & -3 \end{array} \right) \xrightarrow{R_1 \rightarrow R_1 - 2R_2} \left(\begin{array}{cc|c} 5 & 0 & 10 \\ 0 & 1 & -3 \end{array} \right) \quad (7)$$

$$\left(\begin{array}{cc|c} 5 & 0 & 10 \\ 0 & 1 & -3 \end{array} \right) \xrightarrow{R_1 \rightarrow \frac{1}{5}R_1} \left(\begin{array}{cc|c} 1 & 0 & 2 \\ 0 & 1 & -3 \end{array} \right) \quad (8)$$

$$\Rightarrow \mathbf{x} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} \quad (9)$$

Therefore the two lines will intersect at $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

