5.2.35

EE25BTECH11032 - Kartik Lahoti

Question:

Solve the following system of linear equations.

$$3x + 4y = 10$$

$$2x - 2y = 2$$

Solution:
The equation of line L_1 is,

$$\begin{pmatrix} 3 & 4 \end{pmatrix} \mathbf{x} = 10 \tag{1}$$

The equation of line L_2 is,

$$\begin{pmatrix} 2 & -2 \end{pmatrix} \mathbf{x} = 2 \tag{2}$$

On putting the equations in a matrix, we will get

$$\implies \begin{pmatrix} 3 & 4 \\ 2 & -2 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 10 \\ 2 \end{pmatrix} \tag{3}$$

So the augmented matrix is,

$$\left(\begin{array}{cc|c} 3 & 4 & 10 \\ 2 & -2 & 2 \end{array}\right) \tag{4}$$

$$\left(\begin{array}{cc|c} 3 & 4 & 10 \\ 2 & -2 & 2 \end{array}\right) \xleftrightarrow{R_2 \to R_2 - \frac{2}{3}R_1} \left(\begin{array}{cc|c} 3 & 4 & 10 \\ 0 & \frac{-14}{3} & \frac{-14}{3} \end{array}\right) \tag{5}$$

$$\left(\begin{array}{cc|c} 3 & 4 & 10 \\ 0 & \frac{-14}{3} & \frac{-14}{3} \end{array}\right) \xleftrightarrow{R_2 \to \frac{-3}{14}R_2} \left(\begin{array}{cc|c} 3 & 4 & 10 \\ 0 & 1 & 1 \end{array}\right) \tag{6}$$

$$\left(\begin{array}{cc|c} 3 & 4 & 10 \\ 0 & 1 & 1 \end{array}\right) \xleftrightarrow{R_1 \to R_1 - 4R_2} \left(\begin{array}{cc|c} 3 & 0 & 6 \\ 0 & 1 & 1 \end{array}\right) \tag{7}$$

$$\left(\begin{array}{cc|c} 3 & 0 & 6 \\ 0 & 1 & 1 \end{array}\right) \xleftrightarrow{R_1 \to \frac{1}{3}R_1} \left(\begin{array}{cc|c} 1 & 0 & 2 \\ 0 & 1 & 1 \end{array}\right) \tag{8}$$

$$\implies \mathbf{x} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} \tag{9}$$

Therefore the two lines will intersect at $\begin{pmatrix}2\\1\end{pmatrix}$.