4.2.28

EE25BTECH11025 - Ganachari Vishwambhar

Question:

Solve the system of linear equations:

$$5x - 8y = -1 \tag{1}$$

$$3x - \frac{24}{5}y = \frac{-3}{5} \tag{2}$$

Solution:

Given:

$$\begin{pmatrix} 5 & -8 \end{pmatrix}\mathbf{x} = -1; \begin{pmatrix} 3 & \left(\frac{-24}{5}\right) \end{pmatrix}\mathbf{x} = \frac{-3}{5} \tag{3}$$

$$A = \begin{pmatrix} 5 & -8 \\ 3 & \left(\frac{-24}{5}\right) \end{pmatrix}; \mathbf{x} = \begin{pmatrix} x \\ y \end{pmatrix}; \mathbf{b} = \begin{pmatrix} -1 \\ \left(\frac{-3}{5}\right) \end{pmatrix} \tag{4}$$

$$A\mathbf{x} = \mathbf{b} \tag{5}$$

Let:

Rank of coefficient matrix = r

Rank of Augmented matrix = r_a

Order of coefficient matrix = n

Augmented Matrix:

$$\begin{pmatrix} 5 & -8 & \bigg| & -1 \\ 3 & \left(\frac{-24}{5}\right) & \bigg| & \left(\frac{-3}{5}\right) \end{pmatrix} \tag{6}$$

$$R_2 \rightarrow R_2 - \frac{3}{5}R_1 \tag{7}$$

$$\begin{pmatrix} 5 & -8 & \bigg| & -1 \\ 0 & 0 & \bigg| & 0 \end{pmatrix} \tag{8}$$

$$r = 1; r_a = 1; n = 2 \tag{9}$$

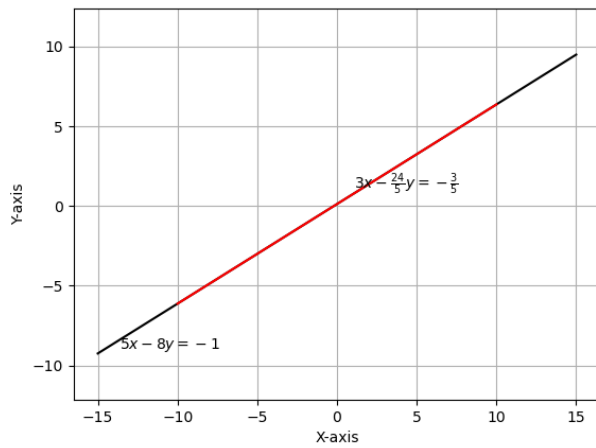$$\because r = r_a < n \tag{10}$$

Infinite solutions exist for the given system of linear equations.

Fig. 1: Plot of the given system of lines