5.2.18

EE25BTECH11015 - Bhoomika V

Question :-
Solve the following system of linear equation.
$8x + 5y = 9$
$3x + 2y = 4$

Solution:
We are solving the system:

$$8x + 5y = 9, \quad 3x + 2y = 4$$

Coefficient matrix and vector

$$A = \begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}, \quad b = \begin{bmatrix} 9 \\ 4 \end{bmatrix}$$

Performing row operations (RREF)

$R_1 \to \frac{R_1}{8}$

$$\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix} \xrightarrow{R_1 \to R_1/8} \begin{bmatrix} 1 & 5/8 \\ 3 & 2 \end{bmatrix}, \quad b = \begin{bmatrix} 9 \\ 4 \end{bmatrix} \xrightarrow{R_1 \to R_1/8} \begin{bmatrix} 9/8 \\ 4 \end{bmatrix}$$

Eliminate first column in R_2: $R_2 \to R_2 - 3R_1$

$$\begin{bmatrix} 1 & 5/8 \\ 3 & 2 \end{bmatrix} \xrightarrow{R_2 \to R_2 - 3R_1} \begin{bmatrix} 1 & 5/8 \\ 0 & 1/8 \end{bmatrix}, \quad b = \begin{bmatrix} 9/8 \\ 4 \end{bmatrix} \xrightarrow{R_2 \to R_2 - 3R_1} \begin{bmatrix} 9/8 \\ 5/8 \end{bmatrix}$$

$R_2 \to 8R_2$

$$\begin{bmatrix} 1 & 5/8 \\ 0 & 1/8 \end{bmatrix} \xrightarrow{R_2 \to 8R_2} \begin{bmatrix} 1 & 5/8 \\ 0 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} 9/8 \\ 5/8 \end{bmatrix} \xrightarrow{R_2 \to 8R_2} \begin{bmatrix} 9/8 \\ 5 \end{bmatrix}$$

Eliminate second column in R_1: $R_1 \to R_1 - (5/8)R_2$

$$\begin{bmatrix} 1 & 5/8 \\ 0 & 1 \end{bmatrix} \xrightarrow{R_1 \to R_1 - (5/8)R_2} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} 9/8 \\ 5 \end{bmatrix} \xrightarrow{R_1 \to R_1 - (5/8)R_2} \begin{bmatrix} -1 \\ 5 \end{bmatrix}$$

Answer

$$x = -1, \quad y = 5$$

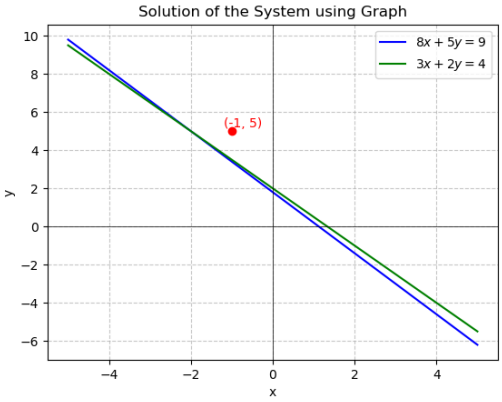
Solution of the System using Graph
8x + 5y = 9
3x + 2y = 4
(-1, 5)
y
x
10
8
6
4
2
0
−2
−4
−6
−4
−2
0
2
4

Fig. 0.1