

5.2.68

AI25BTECH11001 - ABHISEK MOHAPATRA

Question: Solve $2x + 3y = 11$ and $2x + 4y = -24$ and hence find the value of m for which $y = mx + 3$.

Solution: Given:

$$2x + 3y = 11 \quad (1)$$

,

$$2x + 4y = -24 \quad (2)$$

And,

$$y = mx + 3 \quad (3)$$

So,

$$\begin{pmatrix} 2 & 3 \\ 2 & 4 \\ m & -1 \end{pmatrix} \mathbf{X} = \begin{pmatrix} 11 \\ -24 \\ -3 \end{pmatrix} \quad (4)$$

Augumented Matrix:

$$\left(\begin{array}{cc|c} 2 & 3 & 11 \\ 2 & 4 & -24 \\ m & -1 & -3 \end{array} \right) \quad (5)$$

$$\xrightarrow{R_2 \rightarrow R_2 - R_1} \left(\begin{array}{cc|c} 2 & 3 & 11 \\ 0 & 1 & -35 \\ m & -1 & -3 \end{array} \right) \quad (6)$$

$$\xrightarrow{R_3 \rightarrow R_3 - \frac{m}{2} R_1} \left(\begin{array}{cc|c} 2 & 3 & 11 \\ 0 & 1 & -35 \\ 0 & -1 - \frac{3m}{2} & -3 - \frac{11m}{2} \end{array} \right) \quad (7)$$

$$\xrightarrow{R_3 \rightarrow R_3 + (1 + \frac{3m}{2}) R_2} \left(\begin{array}{cc|c} 2 & 3 & 11 \\ 0 & 1 & -35 \\ 0 & 0 & -38 - \frac{116m}{2} \end{array} \right) \quad (8)$$

for solution to exist, the rank must be 2.

$$-38 - \frac{116}{2}m = 0 \Rightarrow 58m = -38 \Rightarrow m = -\frac{19}{29} \quad (9)$$

So, $m = -\frac{19}{29}$.

Graph:

