5.2.66

EE25BTECH11064 - Yojit Manral

Question:
Solve the system of equations and hence find the value of m which satisfies

$$2x + 3y = 11 \tag{1}$$
$$2x + 4y = -24 \tag{2}$$
$$y = mx + 3 \tag{3}$$

Solution:
→ We have

$$\mathbf{n_1}^T\mathbf{x} = c_1 \qquad \mathbf{n_2}^T\mathbf{x} = c_2$$

$$\mathbf{n_1} = \begin{pmatrix}2\\3\end{pmatrix} \qquad c_1 = 11 \tag{4}$$
$$\mathbf{n_2} = \begin{pmatrix}2\\4\end{pmatrix} \qquad c_2 = -24 \tag{5}$$

→ To solve the given system of equations

$$\begin{pmatrix}\mathbf{n_1}^T\\\mathbf{n_2}^T\end{pmatrix}\mathbf{x} = \begin{pmatrix}c_1\\c_2\end{pmatrix} \implies \begin{pmatrix}2&3\\2&4\end{pmatrix}\mathbf{x} = \begin{pmatrix}11\\-24\end{pmatrix} \tag{6}$$

→ Using augmented matrix

$$\left(\begin{array}{cc|c}2&3&11\\2&4&-24\end{array}\right) \xrightarrow[R_1 \leftrightarrow R_1 - 3R_2]{R_2 \leftrightarrow R_2 - R_1} \left(\begin{array}{cc|c}2&0&116\\0&1&-35\end{array}\right) \xrightarrow{R_1 \leftrightarrow (1/2)R_1} \left(\begin{array}{cc|c}1&0&58\\0&1&-35\end{array}\right) \tag{7}$$

$$\implies \begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}58\\-35\end{pmatrix} \implies x = 58 \text{ and } y = -35 \tag{8}$$

→ From (3)

$$m = \frac{y-3}{x} = -\frac{19}{29} \tag{9}$$

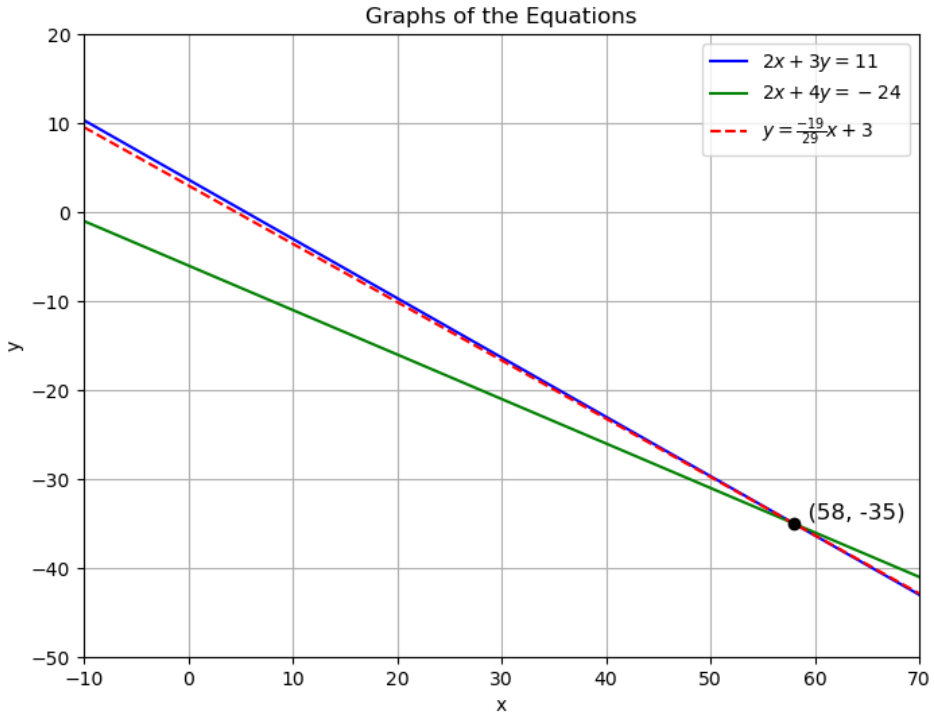

Fig. 0: Plot of the Equations