

4.10.2

EE25BTECH11004 - Aditya Appana

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Question

The distance of the point of intersection of the lines $2x - 3y + 5 = 0$ and $3x + 4y = 0$ from the line $5x - 2y = 0$ is _____.

Solution

We need to find the point of intersection of the lines $2x - 3y + 5 = 0$ and $3x + 4y = 0$, which we can do by forming the augmented matrix.

$$\begin{pmatrix} 2 & -3 & -5 \\ 3 & 4 & 0 \end{pmatrix} \quad (1)$$

Using row transformations:

$$\begin{pmatrix} 2 & -3 & 5 \\ 3 & 4 & 0 \end{pmatrix} \xrightarrow{R_2 \rightarrow R_2 - \frac{3}{2}R_1} \begin{pmatrix} 2 & -3 & 5 \\ 0 & \frac{17}{2} & \frac{-15}{2} \end{pmatrix} \quad (2)$$

Solving, we get the point of intersection as

$$\begin{pmatrix} \frac{-20}{17} \\ \frac{17}{15} \end{pmatrix} \quad (3)$$

To find the distance of this point from the line $5x - 2y = 0$, we use the formula:

$$\left| \frac{\mathbf{n}^T \mathbf{x} - c}{\|\mathbf{n}\|} \right| = d \quad (4)$$

$$\left| \frac{\begin{pmatrix} 5 \\ -2 \end{pmatrix}^T \begin{pmatrix} -\frac{20}{17} \\ \frac{15}{17} \end{pmatrix}}{\sqrt{5^2 + 2^2}} \right| = \left| \frac{-130}{17\sqrt{29}} \right| = \frac{130}{17\sqrt{29}} = d \quad (5)$$

The distance of the point of intersection of the lines $2x - 3y + 5 = 0$ and $3x + 4y = 0$ from the line $5x - 2y = 0$ is $\frac{130}{17\sqrt{29}}$.

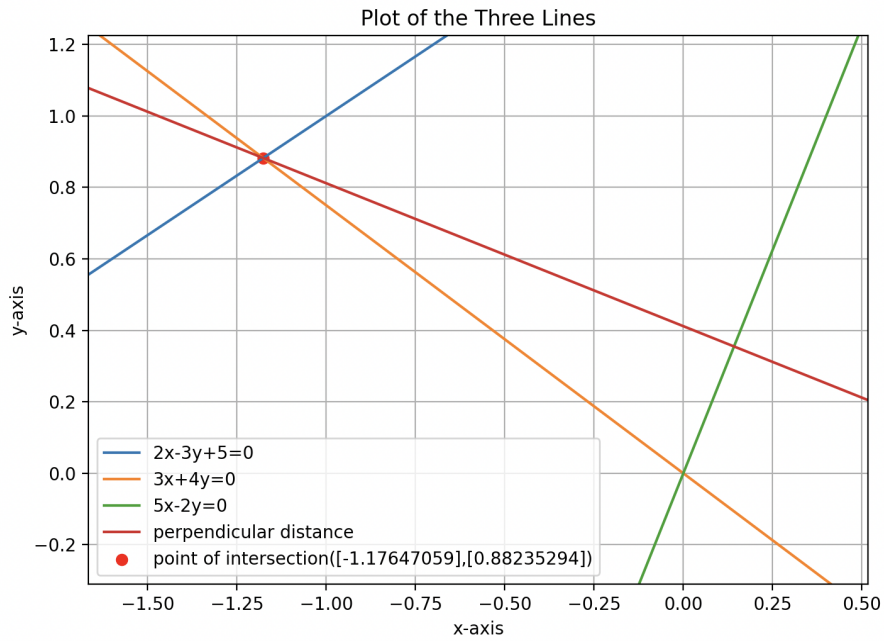


Figure 1: Plot