

Assignment-1

Chittepu Rutheesh Reddy
cs21btech11014

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If the straight lines $3x - 5y = 7$ and $4x + ay + 9 = 0$ are perpendicular to one another, find the value of a .

Solution

If two lines are perpendicular, then dot product of their normal vectors is 0.

Normal vector form of $3x - 5y = 7$ is $\begin{pmatrix} -3 \\ 5 \end{pmatrix} \cdot \left[\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} \right] = 0$, with $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$ as normal vector.

Normal vector form of $4x + ay + 9 = 0$ is $\begin{pmatrix} 4 \\ a \end{pmatrix} \cdot \left[\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} -9/4 \\ 0 \end{pmatrix} \right]$, with $\begin{pmatrix} 4 \\ a \end{pmatrix}$ as normal vector.

$$\text{As } \begin{pmatrix} -3 \\ 5 \end{pmatrix} \cdot \begin{pmatrix} 4 \\ a \end{pmatrix} = 0$$

$$-12 + a = 0$$

$$\text{So } a = \left(\frac{12}{5}\right)$$

