Assignment-1

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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

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

2) The equation of a line is given by

$$\mathbf{n}^\top \mathbf{x} = c$$

where $\mathbf{n}$ is the normal vector of the line.

Vector form of 3x - 5y =7 is

$$\begin{pmatrix} 3 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 7 \qquad (0.0.1)$$

with $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ as normal vector.

Vector form of 4x+ay+9=0 is

$$\begin{pmatrix} 4 & a \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = -9 \qquad (0.0.2)$$

with $\begin{pmatrix} 4 \\ a \end{pmatrix}$ as normal vector.

By result in 1,

$$\begin{pmatrix} 3 \\ -5 \end{pmatrix} \begin{pmatrix} 4 \\ a \end{pmatrix} = 0 \qquad (0.0.3)$$

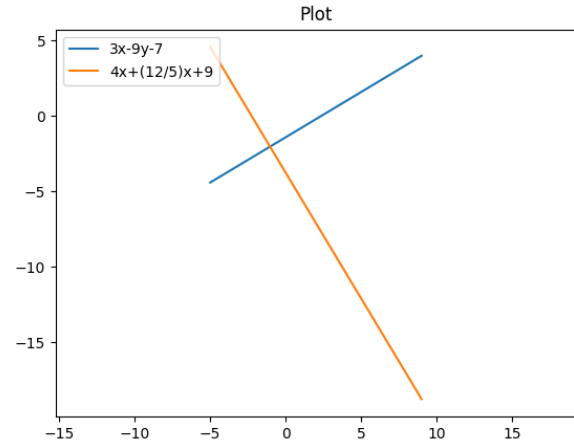$$12 - 5a = 0 \qquad (0.0.4)$$

$$So \ a = \frac{12}{5} \qquad (0.0.5)$$

PLOT

Fig. 0. Plot of two lines with a = $\frac{12}{5}$