# 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

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

Normal vector form of 3x - 5y =7 is

$$\begin{pmatrix} -3 \\ 5 \end{pmatrix} \cdot \left[ \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} \right] = 0, \text{ with } \begin{pmatrix} -3 \\ 5 \end{pmatrix} \text{ as}$$

normal vector.

Normal vector form of 4x+ay+9=0 is

$$\begin{pmatrix} 4 \\ a \end{pmatrix} \cdot \left[ \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} \frac{-9}{4} \\ 0 \end{pmatrix} \right], \text{ with } \begin{pmatrix} 4 \\ a \end{pmatrix} \text{ as normal}$$

vector.

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

-12 + 5a = 0

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