

Assignment 1

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Download all python codes from

<https://github.com/sachinombdubey/Matrix-theory/codes>

and latex-tikz codes from

<https://github.com/sachinombdubey/Matrix-theory>

1 QUESTION No. 42

Find the coordinates of the foot of the perpendicular from the point $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$ to the line

$$(3 \quad -4)\mathbf{x} = 16. \quad (1.0.1)$$

2 EXPLANATION

The slope of the given line $(3 \quad -4)\mathbf{x}=16$ is $\frac{3}{4}$
(By comparing with $y=mx+c$)

The product of slopes of two perpendicular lines is -1. Hence, the slope of the perpendicular drawn from $(-1,3)$ is $\frac{-4}{3}$

Now, using the equation $m = \frac{y - y_1}{x - x_1}$

$$x_1 = -1, y_1 = 3, m = \frac{-4}{3}$$

\therefore The equation of perpendicular line drawn from $(-1,3)$ is

$$(4 \quad 3)\mathbf{x} = 5$$

The above line equations can be expressed as the matrix equation

$$\begin{bmatrix} 3 & -4 \\ 4 & 3 \end{bmatrix} \mathbf{x} = \begin{bmatrix} 16 \\ 5 \end{bmatrix}$$

The augmented matrix for the above equation is row reduced as follows

$$\begin{bmatrix} 3 & -4 & 16 \\ 4 & 3 & 5 \end{bmatrix}$$

$$\xleftrightarrow{R_1 \leftarrow R_1/3}$$

$$\begin{bmatrix} 1 & -4/3 & 16/3 \\ 4 & 3 & 5 \end{bmatrix}$$

$$\xleftrightarrow{R_2 \leftarrow R_2 - 4R_1}$$

$$\begin{bmatrix} 1 & -4/3 & 16/3 \\ 4 & 25/3 & -49/3 \end{bmatrix}$$

$$\xleftrightarrow{R_2 \leftarrow R_2 \times 3/25}$$

$$\begin{bmatrix} 1 & -4/3 & 16/3 \\ 0 & 1 & -49/25 \end{bmatrix}$$

$$\xleftrightarrow{R_1 \leftarrow R_1 + 4/3 \times R_2}$$

$$\begin{bmatrix} 1 & 0 & 68/25 \\ 0 & 1 & -49/25 \end{bmatrix}$$

Thus, The foot of the perpendicular is at point $(68/25, -49/25)$ i.e. $(2.72, -1.96)$