Assignment 1

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Download all python codes from

https://github.com/Adarsh1310/EE5609/tree/master/codes

and latex-tikz codes from

https://github.com/Adarsh1310/EE5609

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

$$\begin{pmatrix}3 & -4\end{pmatrix}\mathbf{x} = 16. \tag{1.0.1}$$

2 Explanation

The slope of the given line $\begin{pmatrix}3 & -4\end{pmatrix}\mathbf{x}$=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

$$\begin{pmatrix}4 & 3\end{pmatrix}\mathbf{x} = 5$$

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

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

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

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

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

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

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

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

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

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

Thus, The foot of the perpendicular is at point (68/25 , -49/25)