

Assignment 2

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Download all python codes from

https://github.com/kavyakamal66/IITH-INTERNSHIP/blob/main/Assignment_2/code_2.py

and latex-tikz codes from

https://github.com/kavyakamal66/IITH-INTERNSHIP/blob/main/Assignment_2/latex_2.py

1 QUESTION No. 2.110

Find the equation of the line passing through the origin and making angle θ with the line $(-m \ 1)x = c$

2 SOLUTION

Given, Equation of the line,

$$L_1 = (-m \ 1)x = c \quad (2.0.1)$$

Line 'L' makes angle θ with L_1

Direction vector of L_1 is $\begin{pmatrix} 1 \\ m \end{pmatrix}$

We get the direction vector of L when we multiply the rotation matrix with direction matrix of L_1

$$\begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} 1 \\ m \end{pmatrix} = \begin{pmatrix} \cos \theta - m \sin \theta \\ \sin \theta + m \cos \theta \end{pmatrix} \quad (2.0.2)$$

When Multiplied the direction vector with norm matrix we get the normal vector, n of L

$$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} \cos \theta - m \sin \theta \\ \sin \theta + m \cos \theta \end{pmatrix} = \begin{pmatrix} -\sin \theta - m \cos \theta \\ \cos \theta - m \sin \theta \end{pmatrix} \quad (2.0.3)$$

Equation of a line is,

$$n^T(x - A) = 0 \quad (2.0.4)$$

Since L passes through the origin, $A = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$

ie, Equation of the line is,

$$n^T x = 0 \quad (2.0.5)$$

$$(-\sin \theta - m \cos \theta \ \cos \theta - m \sin \theta)x = 0 \quad (2.0.6)$$

To plot the line,

Assuming $m = 1$, $c = 6$ and $\theta = \pi/2$

ie,

$$n^T = (-\sin \pi/2 - \cos \pi/2 \ \cos \pi/2 - \sin \pi/2) \quad (2.0.7)$$

$$n^T = (-1 \ -1) \quad (2.0.8)$$

Therefore, Equation of the line is $(-1 \ -1)x = 0$

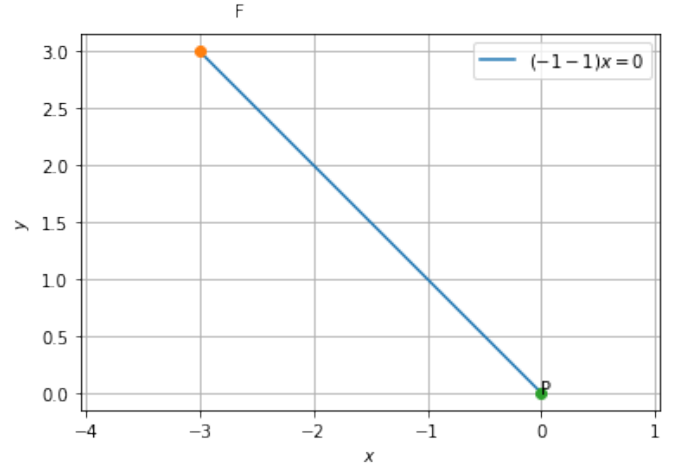


Fig. 0: The Constructed triangle