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.tex

1 Question No. 2.110

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

2 Solution

Given, Equation of the line,

$$L_1 = \mathbf{n_1^T} \mathbf{x} = c \tag{2.0.1}$$

$$\mathbf{n_1} = \begin{pmatrix} -m \\ 1 \end{pmatrix} \tag{2.0.2}$$

Line 'L' makes angle θ with L_1

We get the normal vector ,n of L when we multiply the rotation matrix with normal vector of L_1

$$\mathbf{n} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} -m \\ 1 \end{pmatrix}$$
 (2.0.3)

$$\mathbf{n} = \begin{pmatrix} -m\cos\theta - \sin\theta \\ -m\sin\theta + \cos\theta \end{pmatrix}$$
 (2.0.4)

Equation of a line is,

$$\mathbf{n}^{\mathbf{T}}(\mathbf{x} - \mathbf{A}) = 0 \tag{2.0.5}$$

Since L passes through the origin,

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{2.0.6}$$

Equation of the line is,

$$\mathbf{n}^{\mathbf{T}}\mathbf{x} = 0 \tag{2.0.7}$$

$$(-\sin\theta - m\cos\theta \cos\theta - m\sin\theta)\mathbf{x} = 0 \quad (2.0.8)$$

To plot the line,

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

ie,

$$\mathbf{n} = \begin{pmatrix} -\sin \pi/2 - \cos \pi/2 \\ \cos \pi/2 - \sin \pi/2 \end{pmatrix} \tag{2.0.9}$$

$$\mathbf{n} = \begin{pmatrix} -1 \\ -1 \end{pmatrix} \tag{2.0.10}$$

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

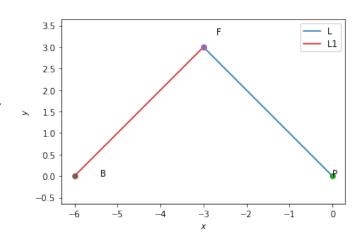


Fig. 0: The Constructed triangle