

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 an angle θ with the line $(-m \ 1)x = c$

2 SOLUTION

Given, Equation of the line,

$$L_1 = \mathbf{n}_1^T \mathbf{x} = c \quad (2.0.1)$$

$$\mathbf{n}_1 = \begin{pmatrix} -m \\ 1 \end{pmatrix} \quad (2.0.2)$$

Line 'L' makes angle θ with L_1

We get the normal vector \mathbf{n} of L when we multiply the rotation matrix with normal vector of L_1

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

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

Equation of a line is,

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

Since L passes through the origin,

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (2.0.6)$$

Equation of the line is,

$$\mathbf{n}^T \mathbf{x} = 0 \quad (2.0.7)$$

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

To plot the line,

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

ie,

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

$$\mathbf{n} = \begin{pmatrix} -1 \\ -1 \end{pmatrix} \quad (2.0.10)$$

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

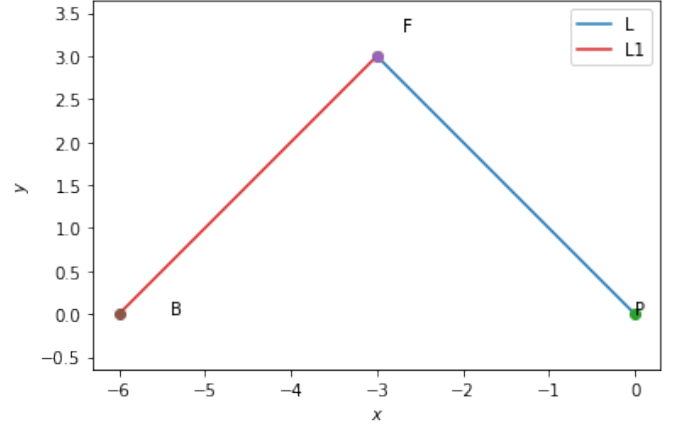


Fig. 0: The Constructed triangle