# 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 $\theta$ with the the line $\begin{pmatrix}-m & 1\end{pmatrix} x = c$

## 2 Solution

Given, Equation of the line,

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

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

Line 'L' makes angle $\theta$ with $L_1$

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

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

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

Equation of a line is,

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

Since L passes through the origin,

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

Equation of the line is,

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

$$\begin{pmatrix} -\sin\theta - m\cos\theta & \cos\theta - m\sin\theta \end{pmatrix}\mathbf{x} = 0 \tag{2.0.8}$$

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 $\begin{pmatrix}-1 & -1\end{pmatrix} x = 0$

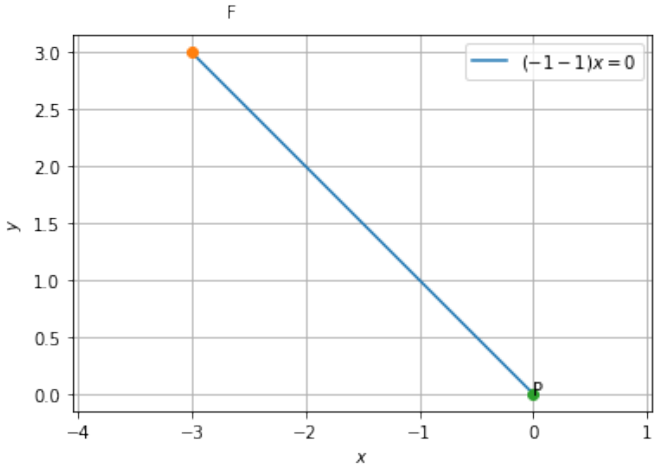


Fig. 0: The Constructed triangle