Assignment 1: Matrix Theory

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Assignment1

Abstract—This assignment solves a problem to find the slope of a line.

Download all python codes from

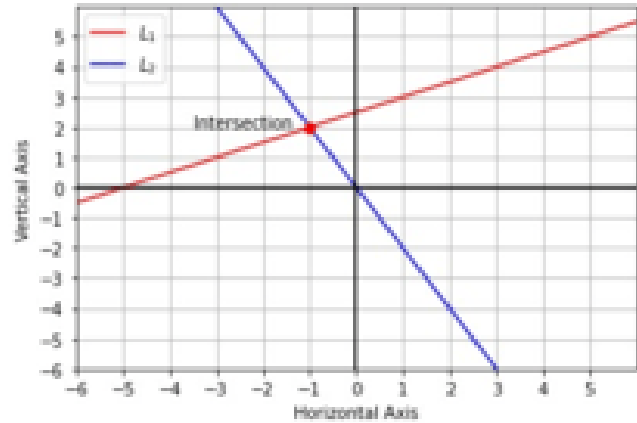https://github.com/Alok0895/Assignment1/blob/
master/Assignment1.py

and latex-tikz codes from

https://github.com/Alok0895/Assignment1/blob/
master/Assignment1.tex

Fig. 0: Perpendicular Lines crossing

1 PROBLEM

The perpendicular from the origin to the line

$$\begin{pmatrix} -m & 1 \end{pmatrix} \mathbf{x} = c$$

meets it at the point $\mathbf{P} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ .find the value of m and c .

2 SOLUTION

The line

$$\begin{pmatrix} -m & 1 \end{pmatrix} \mathbf{x} = c \qquad (2.0.1)$$

meets it at the point $\mathbf{P} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ Since,

$$\mathbf{P} - \mathbf{0} = \mathbf{P} \qquad (2.0.2)$$

is the normal vector, where $\mathbf{0}$ is the origin, then

$$\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix} \qquad (2.0.3)$$

is the direction vector, Hence

$$\mathbf{m}^T \mathbf{P} = 0 \qquad (2.0.4)$$

$$\implies \begin{pmatrix} 1 & m \end{pmatrix} \begin{pmatrix} -1 \\ 2 \end{pmatrix} = 0$$

$$\implies (-1 + 2m) = 0$$

$$\implies m = \frac{1}{2} \qquad (2.0.5)$$

now, the line

$$\begin{pmatrix} -m & 1 \end{pmatrix} \mathbf{x} = c$$

meets it at the point $\mathbf{P} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and using the value of m from 2.0.5 we get,

$$\begin{pmatrix} \frac{-1}{2} & 1 \end{pmatrix} \mathbf{P} = c$$

$$\implies \begin{pmatrix} \frac{-1}{2} & 1 \end{pmatrix} \begin{pmatrix} -1 \\ 2 \end{pmatrix} = c$$

$$\implies c = \frac{5}{2}$$

Hence, the value of m and c are obtained as

$$m = \frac{1}{2}, \ c = \frac{5}{2}$$

respectively.