Matrix-Lines

Kukunuri Sampath Govardhan

CONTENTS

***Abstract*—This document shows how to find equation of a line passing trough a point (2,2) and cutting off intercepts on the axes whose sum is 9 using python.**

I. PROBLEM STATEMENT

Find equation of a line passing trough a point (2,2) and cutting off intercepts on the axes whose sum is 9.

II. CONSTRUCTION

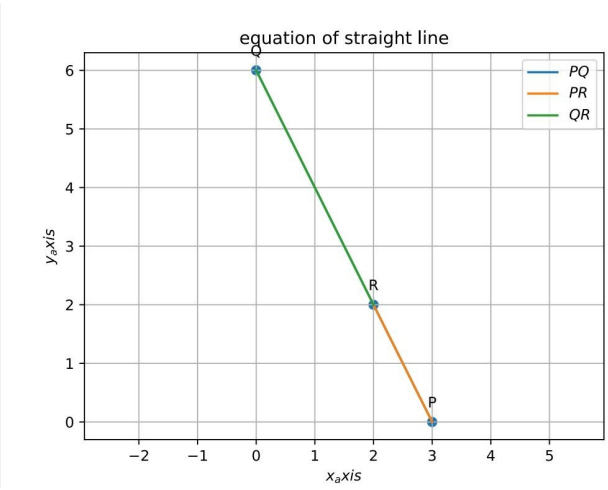

Fig. 1. Equation of the Straight Line

Symbol	Value	Description
P	$\begin{pmatrix} a \\ 0 \end{pmatrix}$	Point on X-axis
Q	$\begin{pmatrix} 0 \\ b \end{pmatrix}$	Point on Y-axis
R	$\begin{pmatrix} 2 \\ 2 \end{pmatrix}$	Given Point
a + b	9	Given Condition

TABLE I
PARAMETERS

III. SOLUTION

Given that resultant line passes through point(2,2) and intercepts on axes whose sum is 9 (let x intercept is a and y intercept is b therefore, a + b = 9)

so, b = 9 - a

Let P=$\begin{pmatrix} a \\ 0 \end{pmatrix}$, Q=$\begin{pmatrix} 0 \\ 9-a \end{pmatrix}$, R=$\begin{pmatrix} 2 \\ 2 \end{pmatrix}$

Equation of line is $n^T\mathbf{X} = \mathbf{c}$.

Now we have 3 points which lies on same line so,
The Equation of line through P is

$$n^T \begin{pmatrix} a \\ 0 \end{pmatrix} = c \tag{1}$$

Equation of line passing through Q is

$$n^T \begin{pmatrix} 0 \\ 9-a \end{pmatrix} = c \tag{2}$$

Now eq1 + eq2,

$$n^T \begin{pmatrix} a \\ 9-a \end{pmatrix} = 2c \tag{3}$$

Equation of line passing through R is

$$n^T \begin{pmatrix} 2 \\ 2 \end{pmatrix} = c \tag{4}$$

From eq3 and eq4 we can find normal vector n,

$$n^T \begin{pmatrix} a & 9-a \\ 2 & 2 \end{pmatrix} = c. \begin{pmatrix} 2 \\ 1 \end{pmatrix} \tag{5}$$

Therefore,

$$n^T = \begin{pmatrix} a & 9-a \\ 2 & 2 \end{pmatrix}^{-1} . \begin{pmatrix} 2 \\ 1 \end{pmatrix} .c \tag{6}$$

$$n^T = \begin{pmatrix} 3a-9 \\ -2 \end{pmatrix} . \frac{c}{4a-18} \tag{7}$$

Now eq4 can be expressed as,

$$\begin{pmatrix} 3a-9 \\ -2 \end{pmatrix} . \begin{pmatrix} 2 \\ 2 \end{pmatrix} . \frac{c}{4a-18} = c \tag{8}$$

Thus, we get **a = 2, thus b = 9-a = 7**

by substuting a in eq6, finally

$$n^T = \begin{pmatrix} 0.3 \\ 0.2 \end{pmatrix} .c \tag{9}$$

The Resultant Equation of line is n^T**X = c**

$$\begin{pmatrix} 0.3 \\ 0.2 \end{pmatrix} .X.c = c \tag{10}$$

i.e,

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} .X = 10 \tag{11}$$

Therefore equation of the line is,

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} .X = 10 \tag{12}$$

3x + 2y = 10

IV. Software

Download the following code using,
and execute the code by using command

Python3 Assignment4.py

svn co https://github.com/mygit-sampath-govardhan/fwc-iith-assignments/blob/5b65abbf8e5e3c803b1bff8cf4a95092e100de75/Assignment-4(Matrices-line)/codes/Assignment4.py

V. Conclusion

We found the equation of a line passing trough a point (2,2) and cutting off intercepts on the axes whose sum is 9.