Matrix-Lines

SHREYAS CHANDUPUTTA

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Symbol	Value	Description
P	$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$	given point
Q	$\begin{pmatrix} 2 \\ 3 \end{pmatrix}$	given point
R	$\begin{pmatrix} \frac{2+n}{1+n} \\ \frac{3}{1+n} \end{pmatrix}$	intersecting point

Table 1: Parameters

1 Problem Statement

A line perpendicular to the line segement joining the points (1,0)and(2,3)divides it in the ratio 1:n . find the equation of the line? .

2 Construction

Figure 1: Equation of the Straight Line

3 Solution

Given that resultant will divide the equation of line in the ratio 1:n and the line is perpendicular to line segment joining the points (1,0)and(2,3))

Let $\mathbf{P} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$

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

We know if 2 points of the linesegment is given then,

Direction vector of line joining two points **P Q** is M=Q-P

$$\mathbf{M} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{1}$$

$$\mathbf{M} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \tag{2}$$

We know, that position or directional vector of points P and Q line segement used as the normal vector

The general equation of the required perpendicular line is $\mathbf{M}^\top\mathbf{X} = c$.

The perpendicular line cutting a line segment P and Q in ratio 1:n is passes through the point R.

$$\mathbf{R} = \frac{Q + nP}{1 + n} \tag{3}$$

Equation of line passing through $\mathbf{R}$ is

$$\mathbf{M}^\top(X - R) = 0 \tag{4}$$

$$\mathbf{M}^\top\mathbf{X} - \mathbf{M}^\top\mathbf{R} = 0 \tag{5}$$

From eq3, eq5 and eq2 we can find the required Perpenducular line equation.

$$\begin{pmatrix} 1 \\ 3 \end{pmatrix}^\top \mathbf{X} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}^\top \begin{pmatrix} \frac{2+n}{1+n} \\ \frac{3}{1+n} \end{pmatrix} \tag{6}$$

Therefore, equation of the line is :

nx+1x+3y+3ny = n+11

4 Software

Download the following code using,

and execute the code by using command

Python3 Assignment4.py

5 Conclusion

We found the equation of a line perpendicular to the line segment joining the points (1,0)and(2,3) divides it in the ratio 1:n .