

Matrix-Lines

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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

3 Solution

1 Problem Statement

To find angle QPR of the triangle PQR which is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates $(3, 4)$ and $(-4, 3)$ respectively.

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 $\mathbf{n}^T \mathbf{X} = c$.

2 Construction

We know if 2 points of the line segment is given then,

Figure 1: triangle inscribed in Circle and its angle QPR

Direction vector of line joining two points \mathbf{P} and \mathbf{Q} is $\mathbf{M} = \mathbf{Q} - \mathbf{P}$

4 Software

$$\mathbf{M} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (1)$$

$$\mathbf{M} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \quad (2)$$

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

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

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

$$\mathbf{R} = \frac{Q + nP}{1 + n} \quad (3)$$

Equation of line passing through \mathbf{R} is

$$\mathbf{M}^T (\mathbf{X} - \mathbf{R}) = 0 \quad (4)$$

$$\mathbf{M}^T \mathbf{X} - \mathbf{M}^T \mathbf{R} = 0 \quad (5)$$

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

$$\begin{pmatrix} 1 \\ 3 \end{pmatrix}^T \mathbf{X} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}^T \begin{pmatrix} \frac{2+n}{1+n} \\ \frac{3}{1+n} \end{pmatrix} \quad (6)$$

Therefore, equation of the line is :

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

Download the following code using,

```
svn co https://github.com/
mygit-sampath-govardhan/fwc-iith-assignments/blob/
5b65abbbf8e5e3c803b1bff8cf4a95092e100de75/
Assignment-4(Matrices-line)/codes/Assignment4.py
```

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 .