

EE5609: MATRIX THEORY

Assignment 1

Sneha Konduru
ee19acmtech11009

Abstract—This document contains the solution to find value of h when two straight lines intersect at right angles using the concept of directional vectors and inner product.

Git link for python code

https://github.com/ee19acmtech11009/EE5609/tree/master/Assignment1/Assignment1_method2/Codes

Git link for latex code

https://github.com/ee19acmtech11009/EE5609/tree/master/Assignment1/Assignment1_method2

1 PROBLEM STATEMENT

The line through the points $\begin{pmatrix} h \\ 3 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ intersects the line $(7 \ -9)\mathbf{x}=19$ at right angle. Find the value of h .

2 SOLUTION

Let the given points

$$\mathbf{A} = \begin{pmatrix} h \\ 3 \end{pmatrix} \quad (2.0.1)$$

$$\mathbf{B} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (2.0.2)$$

Directional vector of line passing through points A and B is

$$\mathbf{P} = \mathbf{B} - \mathbf{A} \quad (2.0.3)$$

$$\mathbf{P} = \begin{pmatrix} h-4 \\ 2 \end{pmatrix} \quad (2.0.4)$$

Directional vector of the line $(a \ b)\mathbf{x}=c$ is

$$\mathbf{Q} = \begin{pmatrix} b \\ -a \end{pmatrix} \quad (2.0.5)$$

From 2.0.5 direction vector of line $(7 \ -9)\mathbf{x}=19$ is

$$\mathbf{Q} = \begin{pmatrix} -9 \\ -7 \end{pmatrix} \quad (2.0.6)$$

If two straight lines intersect at right angles then inner product of their directional vectors is zero.

$$\mathbf{P}^T \mathbf{Q} = 0 \quad (2.0.7)$$

$$\begin{pmatrix} h-4 \\ 2 \end{pmatrix}^T \begin{pmatrix} -9 \\ -7 \end{pmatrix} = 0 \quad (2.0.8)$$

$$(h-4 \ 2) \begin{pmatrix} -9 \\ -7 \end{pmatrix} = 0 \quad (2.0.9)$$

$$(h-4)(-9) + 2(-7) = 0 \quad (2.0.10)$$

$$h = \frac{22}{9} \quad (2.0.11)$$

3 VERIFICATION

Python Plot used to verify the result obtained from 2.0.11.

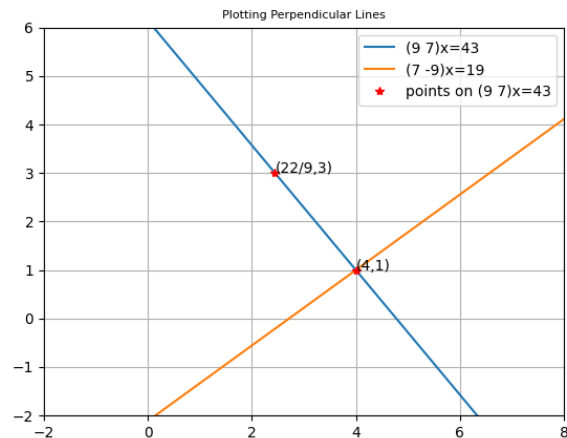


Fig. 0: Figure showing given data and corresponding results

According to the problem statement, equation of line passing through the point $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and perpendicular to the line $(7 \ -9)\mathbf{x}=19$ is

$$(9 \ 7)\mathbf{x} = 43 \quad (3.0.1)$$

Fig.0 shows that equation 3.0.1 passes through the point $\begin{pmatrix} \frac{22}{9} \\ 3 \end{pmatrix}$