EE5609: MATRIX THEORY
Assignment 1

Sneha Konduru
ee19acmtech11009

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1 Question (3.7.39)

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

2 Solution

Directional vector of line passing through points $\mathbf{A}$=$\begin{pmatrix} h \\ 3 \end{pmatrix}$ and $\mathbf{B}$=$\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ is

$$\mathbf{P} = \mathbf{B} - \mathbf{A} \tag{1}$$

$$\mathbf{P} = \begin{pmatrix} h-4 \\ 2 \end{pmatrix} \tag{2}$$

Directional vector of the line $\begin{pmatrix} a & b \end{pmatrix}\mathbf{x}$=c is

$$\mathbf{Q} = \begin{pmatrix} b \\ -a \end{pmatrix} \tag{3}$$

From (3.7.39.3) direction vector of line $\begin{pmatrix} 7 & -9 \end{pmatrix}\mathbf{x}$=19 is

$$\mathbf{Q} = \begin{pmatrix} -9 \\ -7 \end{pmatrix} \tag{4}$$

If two straight lines intersects at right angles then inner product of their directional vectors $\mathbf{P}$ and $\mathbf{Q}$ is zero.

$$\mathbf{P^T Q} = 0 \tag{5}$$

$$\begin{pmatrix} h-4 \\ 2 \end{pmatrix}^{\mathbf{T}} \begin{pmatrix} -9 \\ -7 \end{pmatrix} = 0 \tag{6}$$

$$(h-4)(-9)+2(-7)=0 \tag{7}$$

$$h=\frac{22}{9} \tag{8}$$