

# Matrix Theory Assignment 1

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**Abstract**—This document contains the solution to a Lines and planes problem.

Download all python codes from

<https://github.com/abhishekt711/EE5609/codes>

## 1 PROBLEM

60. A person standing at the junction of two straight paths represented by the equations

$$\begin{aligned}(2-3)x &= 4 \\ (3+4)x &= 5\end{aligned}$$

want to reach the path whose equation is

$$(6-7)x = 8$$

in the least time. Find the equation of the path that he should follow.

## 2 SOLUTION

Step1: we need to find the solution of equation:

$$\begin{aligned}(2-3)x &= 4 \\ (3+4)x &= 5\end{aligned}$$

$$\begin{pmatrix} 2 & -3 & 4 \\ 3 & 4 & 5 \end{pmatrix}$$

Transforming the matrix into row-echelon form

$$\begin{pmatrix} 2 & -3 & 4 \\ 3 & 4 & 5 \end{pmatrix} \xrightarrow{R1 \leftarrow \frac{4}{17} * (R1 + \frac{3}{4} R2)} \begin{pmatrix} 1 & 0 & 31/17 \\ 3 & 4 & 5 \end{pmatrix} \quad (2.0.1)$$

$$\begin{pmatrix} 1 & 0 & 31/17 \\ 3 & 4 & 5 \end{pmatrix} \xrightarrow{R2 \leftarrow \frac{1}{4} (R2 - 3 * R1)} \begin{pmatrix} 1 & 0 & 31/17 \\ 0 & 1 & -2/17 \end{pmatrix} \quad (2.0.2)$$

After solving this two equation we will get the junction point, which is intersection of this line segments.

Thus, Junction Point is  $(31/17, -2/17)$ , i.e.,  $(1.82, -0.11)$

To reach in the least time, he should follow the shortest path, i.e, perpendicular from the junction point to the line give by this equation:

$$(6-7)x = 8$$

is in the direction of  $(7,6)$  as

$$\begin{pmatrix} 6 \\ -7 \end{pmatrix} \cdot \begin{pmatrix} 7 & 6 \end{pmatrix} = 0$$

The equation of the line in terms of normal vector passing through a given point is obtained as

$$\mathbf{n}^T(\mathbf{x} - \mathbf{A}) = 0$$

$$\mathbf{n}^T \mathbf{x} = \mathbf{n}^T \mathbf{A}$$

(2.0.3)

Hence, he should follow this path PQ:

$$(7+6)x = 12.05$$

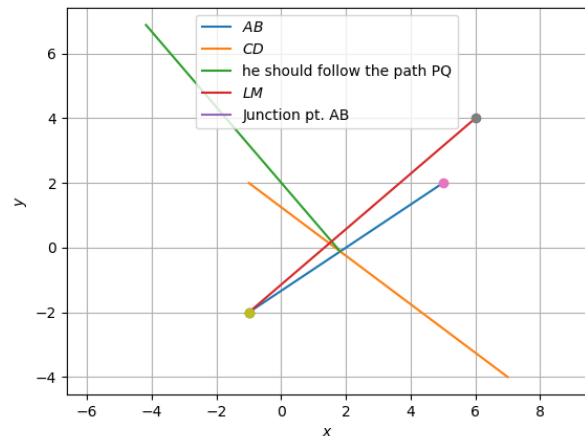


Fig. 1: The Required path is PQ.