# Matrix Theory Assignment 1

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***Abstract*—This documnet 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

$$(2\ \text{-}3)\mathbf{x} = 4$$
$$(3\ 4)\mathbf{x} = 5$$

want to reach the path whose equation is

$$(6\ \text{-}7)\mathbf{x} = 8$$

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:

$$(2\ \text{-}3)\mathbf{x} = 4$$
$$(3\ 4)\mathbf{x} = 5$$

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

Transforming the matrix into row-echelon form

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

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

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:

$$(6\ \text{-}7)\mathbf{x} = 8$$

normal to the line

$$(6\ \text{-}7)\mathbf{x} = 8$$

is in the direction of (7,6) as

$$(6, -7).(7, 6) = 0$$

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

$$n^T(x - A) = 0$$
$$n^T x = n^T A \tag{2.0.3}$$

Hence, he should follow this path PQ:

$$(7\ 6)\mathbf{x} = 12.05$$

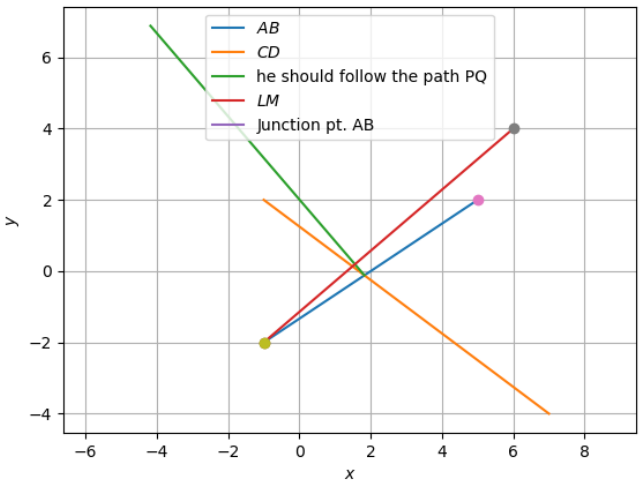


Fig. 1: The Required path is PQ.