

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

$$(2 - 3)x = 4$$

$$(3 4)x = 5$$

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:

$$(2 - 3)x = 4$$

$$(3 4)x = 5$$

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

Transforming the matrix into row-echelon form

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

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

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:

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

normal to the line

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

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

$$(6, -7) \cdot (7, 6) = 0$$

so the the direction of path he should follow is $(7, 6)$

To find the constant c

$$c = (7, 6) \cdot (31/17, -2/17) = 7 * \frac{31}{17} + 6 * \frac{-2}{17}$$

$$c = 12.05$$

Hence, he should follow this path PQ:

$$(7 6)x = 12.05$$

