Matrix Theory Assignment 1

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

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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

$$\begin{pmatrix} 2 & -3 & 4 \\ 3 & 4 & 5 \end{pmatrix} \xleftarrow{R1\leftarrow\frac{4}{17}*(R1+\frac{3}{4}R2)}$$

$$\begin{pmatrix} 1 & 0 & 31/17 \\ 3 & 4 & 5 \end{pmatrix} \qquad (2.0.1)$$

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

$$\begin{pmatrix} 1 & 0 & 31/17 \\ 0 & 1 & -2/17 \end{pmatrix} \qquad (2.0.2)$$

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

Thus, Junction Point is [[1.82352941]
[-0.11764706]]

Step 2: 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:

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

Step 3: Now we have coordinates of foot of perpendicular on the desired path and the coordinates of junction point.
using this two given point we will construct the equation of path which he should follow.
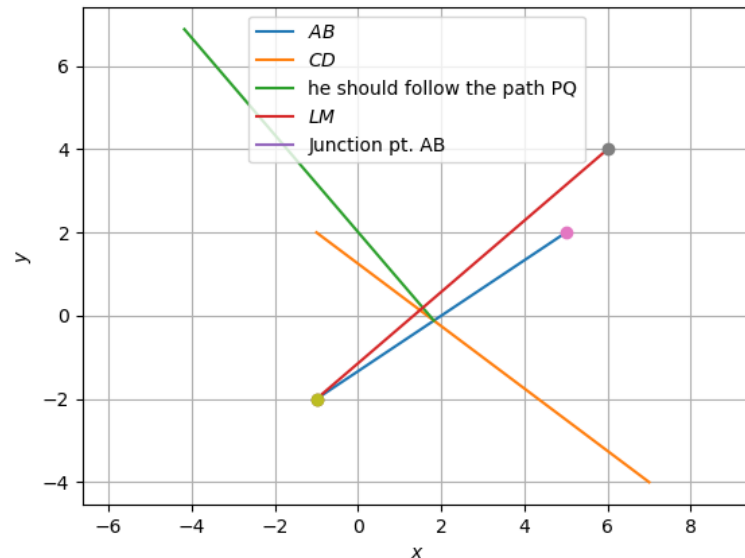
Hence, he should follow the path PQ to reach in least time, i.e, The line passing through points P and Q is:

$$7x + 6y = 12.05882353$$