ASSIGNMENT 1

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Abstract—**This document illustrates the ratio in which a line divides another line joining two points**

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1 PROBLEM

In what ratio is the line joining $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ is divided by the line

$$\begin{pmatrix} 1 & 1 \end{pmatrix} \mathbf{x} = 4 \qquad (1.0.1)$$

2 EXPLANATION

The point X divides the line segment joining the two points $A=\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $B=\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ in ratio k : 1. Then,

$$\mathbf{X} = \frac{(k\mathbf{B} + \mathbf{A})}{(k + 1)} \qquad (2.0.1)$$

3 SOLUTION

From the equation (2.0.1)

$$(k + 1)\mathbf{X} = k\mathbf{B} + \mathbf{A} \qquad (3.0.1)$$

Let U=$\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

$$\implies (k + 1)\mathbf{U}^T\mathbf{X} = \mathbf{U}^T(k\mathbf{B} + \mathbf{A}) \qquad (3.0.2)$$
$$\implies k(\mathbf{U}^T\mathbf{X} - \mathbf{U}^T\mathbf{B}) = \mathbf{U}^T\mathbf{A} - \mathbf{U}^T\mathbf{X} \qquad (3.0.3)$$
$$\implies k = \frac{\mathbf{U}^T\mathbf{A} - \mathbf{U}^T\mathbf{X}}{\mathbf{U}^T\mathbf{X} - \mathbf{U}^T\mathbf{B}} \qquad (3.0.4)$$

Hence on solving the equation (3.0.4) using

$$\mathbf{U}^T\mathbf{X} = 4 \qquad (3.0.5)$$

The line $\begin{pmatrix} 1 & 1 \end{pmatrix}$**X**=4 divides the line joining points $\mathbf{A}=\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\mathbf{B}=\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ in the ratio k=1/2
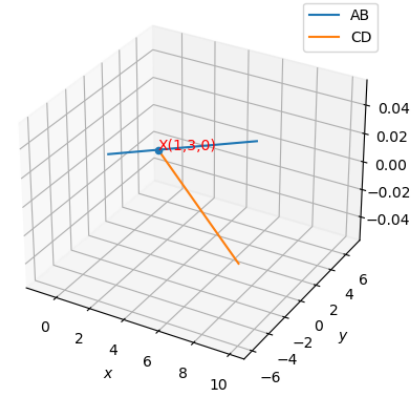

Fig. 0: Line CD as (1 1)X=4 intersecting the line joining points A and B