

ASSIGNMENT 1

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

Download all python codes from

https://github.com/EE20MTECH14019/EE5609/tree/master/Assignment_1/Codes

and latex-tikz codes from

https://github.com/EE20MTECH14019/EE5609/tree/master/Assignment_1

The line $(1 \ 1)\mathbf{x}=4$ 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 $k=1/2$

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

$$(1 \ 1)\mathbf{x} = 4 \quad (1.0.1)$$

2 EXPLANATION

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

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

3 SOLUTION

From the equation (2.0.1)

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

Let $\mathbf{n}=\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

$$\Rightarrow (k + 1)\mathbf{n}^T \mathbf{X} = \mathbf{n}^T (k\mathbf{B} + \mathbf{A}) \quad (3.0.2)$$

$$\Rightarrow k(\mathbf{n}^T \mathbf{X} - \mathbf{n}^T \mathbf{B}) = \mathbf{n}^T \mathbf{A} - \mathbf{n}^T \mathbf{X} \quad (3.0.3)$$

$$\Rightarrow k = \frac{\mathbf{n}^T \mathbf{A} - \mathbf{n}^T \mathbf{X}}{\mathbf{n}^T \mathbf{X} - \mathbf{n}^T \mathbf{B}} \quad (3.0.4)$$

Hence on solving the equation (3.0.4) using

$$\mathbf{n}^T \mathbf{X} = 4 \quad (3.0.5)$$

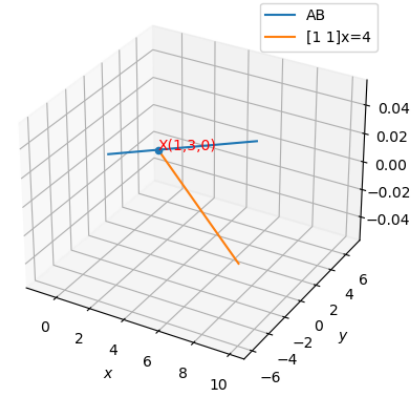


Fig. 0: Line as $(1 \ 1)\mathbf{x}=4$ intersecting the line joining points A and B