Assignment 1

Ritesh Kumar
(EE20RESCH1105)
Communication and Signal Processing

1 Abstract

This document demonstrate to find the ratio of line segment if a line joining by two points and is divided by another line.

Problem Statement

In what ratio is the line joining $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ divided by the line $\begin{bmatrix} 1 & 1 \end{bmatrix} x = 4$

2 Theory

We can solve these types of problems using following method :

Using basic coordinate geometary i.e division of a line by another line. We can find point of intersection of two line and the by using basic division formula we can find the ratio. Suppose a point **P (x,y)** is lies on line and divide the line in the ratio of m:n then,

$$x = \frac{x_2 m + x_1 n}{m + n} \tag{1}$$

$$y = \frac{y_2 m + y_1 n}{m + n} \tag{2}$$

We can find the equation of line using two point formula given as:

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1} \tag{3}$$

With above equations we can have two equation and two unknown and we can solve the quadratic equation and get the appropriate ration.

3 Solution

Using equation 3 :

$\frac{y-1}{x+1} = \frac{7-1}{5+1}$

$\Rightarrow (y-1)6 = 6(x+1)$

$\Rightarrow y - x = 2$
Hence,

$$y - x = 2 \tag{4}$$

And,

$$y + x = 4 \tag{5}$$

Solving above these two equations, we get $x = 1$ and, $y = 3$

Now, applying section formula on line $y - x = 2$,

Let $\frac{m}{n}$ = k , then,

$$\frac{kx_2 + x_1}{k + 1} = x \tag{6a}$$

$$\frac{5k - 1}{k + 1} = 1 \tag{6b}$$

$\Rightarrow$ k $= -\frac{1}{2}$, Similarly,

$$\frac{ky_2 + y_1}{k + 1} = y \tag{6c}$$

$$\frac{7k + 1}{k + 1} = 3 \tag{6d}$$
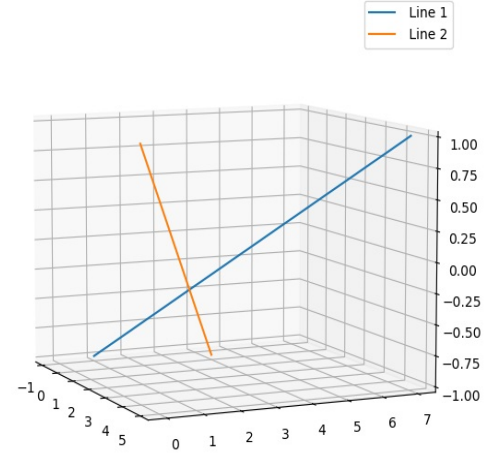
$\Rightarrow$ k $= -\frac{1}{2}$

Figure 1: Intersection of two lines

Hence, the line joining $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ will be divided by the line $\begin{bmatrix} 1 & 1 \end{bmatrix} x = 4$ in the ration of 1 : 2.