

ASSIGNMENT 1

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Download all python codes from

<https://github.com/vaibhavchhabra25/EE3900-course/blob/main/Assignment-1/codes/figure.py>

and latex-tikz codes from

<https://github.com/vaibhavchhabra25/EE3900-course/blob/main/Assignment-1/main.tex>

For YZ plane, $n = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $d = 0$. So,

$$(1 \ 0 \ 0)\mathbf{A} + k(1 \ 0 \ 0)\mathbf{B} = 0 \quad (2.0.7)$$

$$\Rightarrow (1 \ 0 \ 0)\begin{pmatrix} 4 \\ 8 \\ 10 \end{pmatrix} + k(1 \ 0 \ 0)\begin{pmatrix} 6 \\ 10 \\ -8 \end{pmatrix} = 0 \quad (2.0.8)$$

$$\Rightarrow 4 + 6k = 0 \quad (2.0.9)$$

$$\Rightarrow k = -2/3 \quad (2.0.10)$$

1 PROBLEM

(Vectors-2.19) Find the ratio in which the line segment joining the points $\begin{pmatrix} 4 \\ 8 \\ 10 \end{pmatrix}$ and $\begin{pmatrix} 6 \\ 10 \\ -8 \end{pmatrix}$ is divided by the YZ plane.

So, YZ plane divides line segment \mathbf{AB} externally in the ratio 2:3.

2 SOLUTION

Let $\mathbf{A} = \begin{pmatrix} 4 \\ 8 \\ 10 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 6 \\ 10 \\ -8 \end{pmatrix}$.

Let \mathbf{P} be the intersecting point of line \mathbf{AB} and the YZ plane. Let the ratio in which \mathbf{P} divides \mathbf{AB} be $k : 1$.

Then,

$$\mathbf{P} - \mathbf{A} = k(\mathbf{B} - \mathbf{P}) \quad (2.0.1)$$

$$\mathbf{P} = \frac{\mathbf{A} + k\mathbf{B}}{k + 1} \quad (2.0.2)$$

Vector equation of YZ plane with normal vector n and perpendicular distance from origin d is

$$n^T \mathbf{X} = d \quad (2.0.3)$$

Since \mathbf{P} lies on YZ plane,

$$n^T \mathbf{P} = d \quad (2.0.4)$$

$$\Rightarrow n^T \left(\frac{\mathbf{A} + k\mathbf{B}}{k + 1} \right) = d \quad (2.0.5)$$

$$\Rightarrow n^T \mathbf{A} + kn^T \mathbf{B} = d(k + 1) \quad (2.0.6)$$

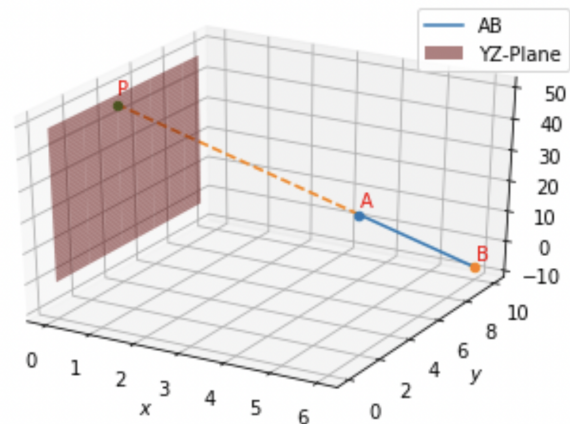


Fig. 0: 3D plot