

4.3.25

EE25BTECH11036 - M Chanakya Srinivas

PROBLEM

Find the ratio in which the YZ plane divides the line segment joining the points

$$\mathbf{A} = \begin{pmatrix} -2 \\ 4 \\ 7 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 3 \\ -5 \\ 8 \end{pmatrix}.$$

SOLUTION

The line joining \mathbf{A} and \mathbf{B} can be written in parametric form as

$$\mathbf{R} = \mathbf{A} + \lambda(\mathbf{B} - \mathbf{A}) \quad (1)$$

Substitute \mathbf{A} and \mathbf{B} :

$$\mathbf{R} = \begin{pmatrix} -2 \\ 4 \\ 7 \end{pmatrix} + \lambda \left(\begin{pmatrix} 3 \\ -5 \\ 8 \end{pmatrix} - \begin{pmatrix} -2 \\ 4 \\ 7 \end{pmatrix} \right) \quad (2)$$

$$= \begin{pmatrix} -2 \\ 4 \\ 7 \end{pmatrix} + \lambda \begin{pmatrix} 5 \\ -9 \\ 1 \end{pmatrix} \quad (3)$$

So

$$\mathbf{R} = \begin{pmatrix} -2 + 5\lambda \\ 4 - 9\lambda \\ 7 + \lambda \end{pmatrix} \quad (4)$$

The YZ -plane has the equation

$$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \mathbf{R} = 0 \quad (5)$$

Substituting \mathbf{R} :

$$\begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} -2 + 5\lambda \\ 4 - 9\lambda \\ 7 + \lambda \end{pmatrix} = 0 \quad (6)$$

$$-2 + 5\lambda = 0 \quad (7)$$

$$\lambda = \frac{2}{5} \quad (8)$$

Thus, the point of intersection is

$$\mathbf{P} = \mathbf{A} + \frac{2}{5}(\mathbf{B} - \mathbf{A}) \quad (9)$$

$$= \frac{3}{5}\mathbf{A} + \frac{2}{5}\mathbf{B} \quad (10)$$

Therefore, the ratio in which the YZ -plane divides AB is

$$AP : PB = 2 : 3 \quad (11)$$

ANSWER

The YZ -plane divides the line segment internally in the ratio $\boxed{2 : 3}$.

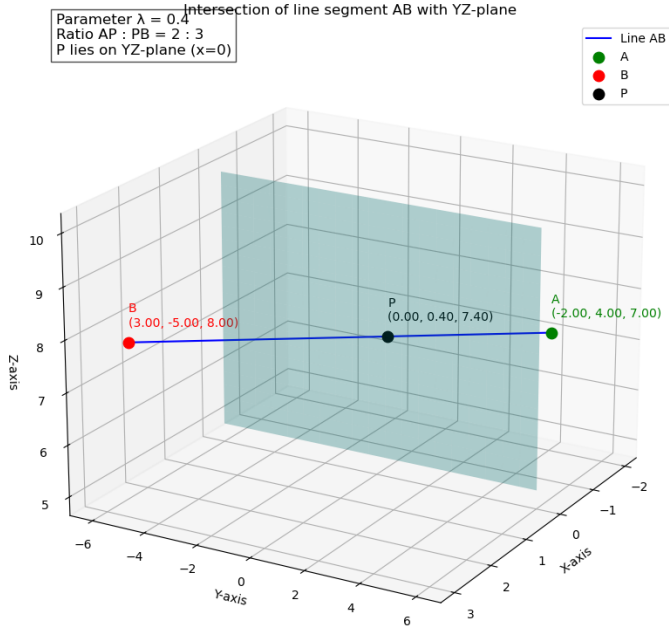


Fig. 1

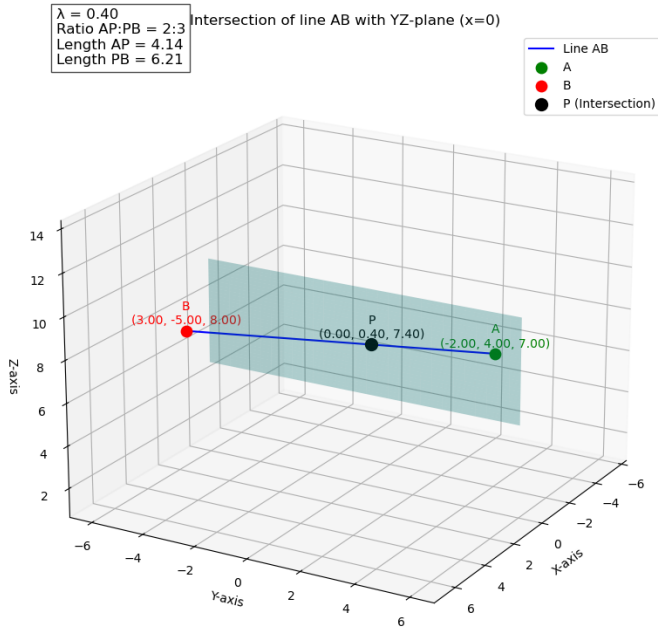


Fig. 2