

# 1.4.9m

EE24BTECH11017-D.KARTHIK

## Question:

Find the coordinates of the point which divides the line segment joining the points  $(1, -2, 3)$  and  $(3, 4, -5)$  in the ratio  $2 : 3$ :

- 1) internally, and
- 2) externally.

**Solution:** : Let  $\mathbf{A} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$  and  $\mathbf{B} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}$ . The ratio is  $m : n = 2 : 3$ .

### 1) Internal Division:

The coordinates of the point dividing the line internally are given by:

$$\mathbf{P} = \frac{m\mathbf{B} + n\mathbf{A}}{m + n} \quad (1.1)$$

$$= \frac{2 \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix} + 3 \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}}{2 + 3} \quad (1.2)$$

$$= \frac{\begin{pmatrix} 6 \\ 8 \\ -10 \end{pmatrix} + \begin{pmatrix} 3 \\ -6 \\ 9 \end{pmatrix}}{5} \quad (1.3)$$

$$= \frac{\begin{pmatrix} 9 \\ 2 \\ -1 \end{pmatrix}}{5} \quad (1.4)$$

$$\mathbf{P} = \begin{pmatrix} \frac{9}{5} \\ \frac{2}{5} \\ -\frac{1}{5} \end{pmatrix} \quad (1.5)$$

Therefore, the required point dividing the line internally is  $\begin{pmatrix} \frac{9}{5} \\ \frac{2}{5} \\ -\frac{1}{5} \end{pmatrix}$ .

### 2) External Division:

The coordinates of the point dividing the line externally are given by:

$$\mathbf{Q} = \frac{m\mathbf{B} - n\mathbf{A}}{m - n} \quad (2.1)$$

$$= \frac{2 \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix} - 3 \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}}{2 - 3} \quad (2.2)$$

$$= \frac{\begin{pmatrix} 6 \\ 8 \\ -10 \end{pmatrix} - \begin{pmatrix} 3 \\ -6 \\ 9 \end{pmatrix}}{-1} \quad (2.3)$$

$$= \frac{\begin{pmatrix} 3 \\ 14 \\ -19 \end{pmatrix}}{-1} \quad (2.4)$$

$$\mathbf{Q} = \begin{pmatrix} -3 \\ -14 \\ 19 \end{pmatrix} \quad (2.5)$$

Therefore, the required point dividing the line externally is  $\begin{pmatrix} -3 \\ -14 \\ 19 \end{pmatrix}$ .

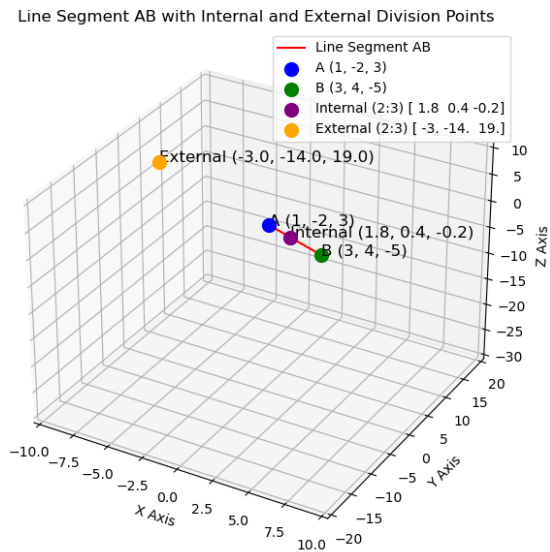


Fig. 2.1: Internal and External Division of Line Segment