

1.4.21

ee25btech11006 - ADUDOTLA SRIVIDYA

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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

- (a) $2 : 3$ internally,
- (b) $2 : 3$ externally.

Solution

Let the two points be

$$\mathbf{A} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix} \quad (1)$$

(a) **Internal Division:** If P divides AB in the ratio $k : 1$ internally, then

$$\mathbf{P} = \frac{k\mathbf{B} + \mathbf{A}}{k + 1} \quad (2)$$

Substituting $k = \frac{2}{3}$:

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

$$\mathbf{P} = \frac{\begin{pmatrix} 2 \\ 8 \\ \frac{3}{3} \\ -10 \\ \frac{3}{3} \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}}{\frac{5}{3}} = \frac{\begin{pmatrix} 3 \\ 2 \\ \frac{3}{3} \\ -1 \\ \frac{3}{3} \end{pmatrix}}{\frac{5}{3}} = \begin{pmatrix} \frac{9}{5} \\ \frac{2}{5} \\ 1 \\ -\frac{3}{5} \\ 1 \end{pmatrix} \quad (4)$$

(b) External Division: If Q divides AB in the ratio $k : 1$ externally, then

$$\mathbf{Q} = \frac{k\mathbf{B} - \mathbf{A}}{k - 1} \quad (5)$$

Substituting $k = \frac{2}{3}$:

$$\mathbf{Q} = \frac{\frac{2}{3} \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix} - \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}}{\frac{5}{3}} \quad (6)$$

$$\mathbf{Q} = \frac{\begin{pmatrix} 2 \\ 8 \\ \frac{3}{3} \\ -10 \\ \frac{3}{3} \end{pmatrix} - \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}}{\frac{-1}{3}} = \frac{\begin{pmatrix} 1 \\ 14 \\ \frac{3}{3} \\ -19 \\ \frac{3}{3} \end{pmatrix}}{\frac{-1}{3}} = \begin{pmatrix} -3 \\ -14 \\ 19 \end{pmatrix} \quad (7)$$

Internal point: $\begin{pmatrix} 1.8 \\ 0.40 \\ -0.20 \end{pmatrix}$,	External point: $\begin{pmatrix} -3 \\ -14 \\ 19 \end{pmatrix}$
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(8)

3D Division of Line Segment

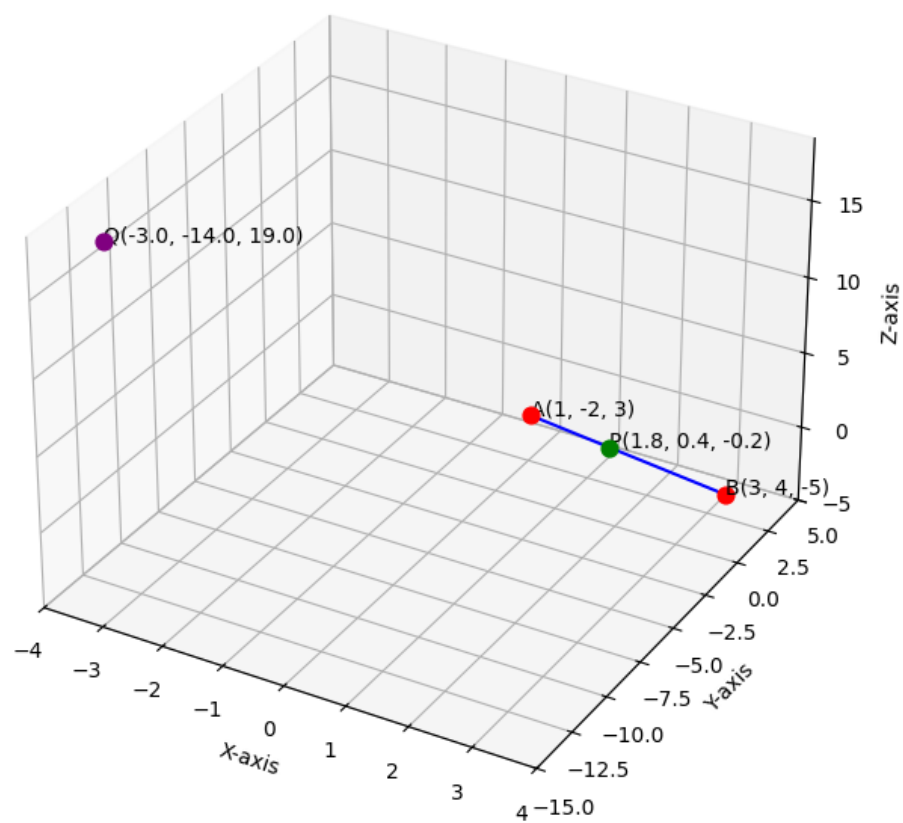


Figure 1: 3D Plot