

1.4.20

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Question

Find the coordinates of the point which divides the line segment joining the points $(-2, 3, 5)$ and $(1, -4, 6)$ in the ratio

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

Solution

Let the two points be

$$A = \begin{pmatrix} -2 \\ 3 \\ 5 \end{pmatrix}, \quad B = \begin{pmatrix} 1 \\ -4 \\ 6 \end{pmatrix}$$

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

$$P = \frac{mB + nA}{m + n}$$

Substituting $m = 2, n = 3$:

$$P = \frac{2 \begin{pmatrix} 1 \\ -4 \\ 6 \end{pmatrix} + 3 \begin{pmatrix} -2 \\ 3 \\ 5 \end{pmatrix}}{5}$$
$$P = \frac{\begin{pmatrix} 2 \\ -8 \\ 12 \end{pmatrix} + \begin{pmatrix} -6 \\ 9 \\ 15 \end{pmatrix}}{5} = \frac{\begin{pmatrix} -4 \\ 1 \\ 27 \end{pmatrix}}{5} = \begin{pmatrix} -\frac{4}{5} \\ \frac{1}{5} \\ \frac{27}{5} \end{pmatrix}$$

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

$$Q = \frac{mB - nA}{m - n}$$

Substituting $m = 2, n = 3$:

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

$$Q = \frac{\begin{pmatrix} 2 \\ -8 \\ 12 \end{pmatrix} - \begin{pmatrix} -6 \\ 9 \\ 15 \end{pmatrix}}{-1} = \frac{\begin{pmatrix} 8 \\ -17 \\ -3 \end{pmatrix}}{-1} = \begin{pmatrix} -8 \\ 17 \\ 3 \end{pmatrix}$$

Internal point: $\begin{pmatrix} -0.80 \\ 0.20 \\ 5.40 \end{pmatrix},$	External point: $\begin{pmatrix} -8 \\ 17 \\ 3 \end{pmatrix}$
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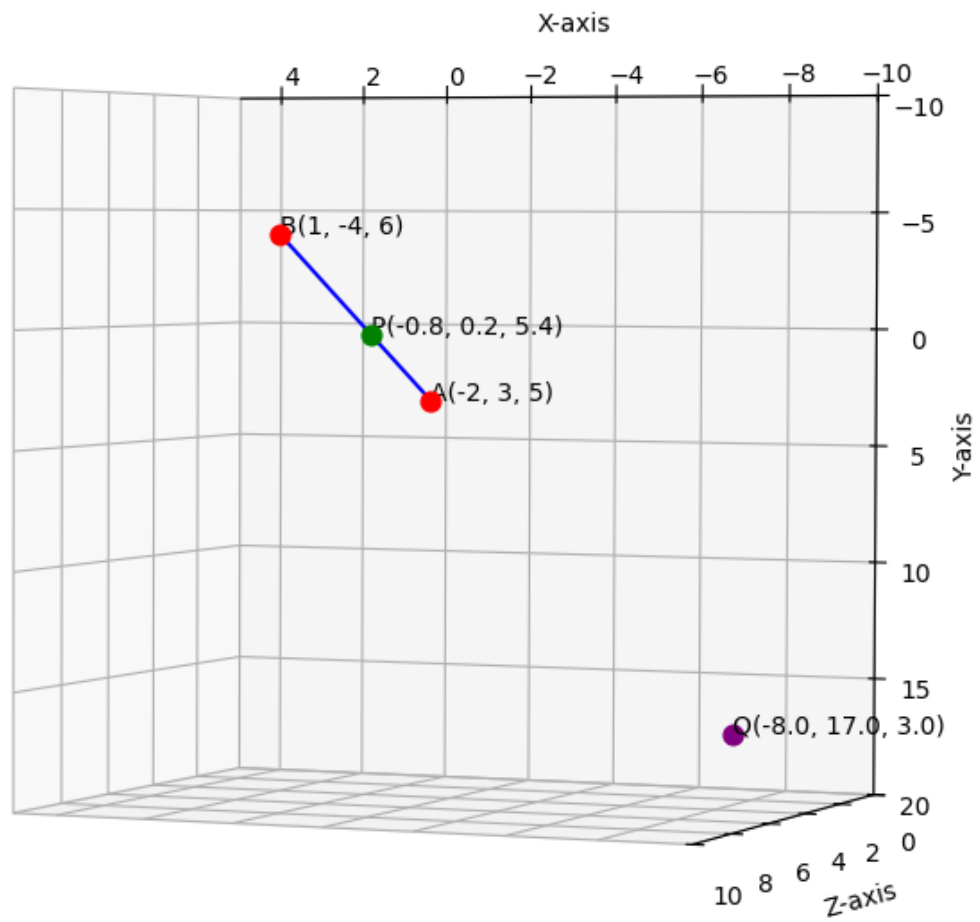


Figure 1: 3D Plot