1.8.4

AI25BTECH110030 - SARVESH TAMGADE

Question:
Find the coordinates of a point on Y axis which is at a distance of $5\sqrt{2}$ from the point $P(3,-2,5)$.
Solution:

Let the required point on Y axis be $\vec{Q} = \begin{pmatrix} 0 \\ y \\ 0 \end{pmatrix}$.

So,

$$\vec{P} - \vec{Q} = \begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix} - \begin{pmatrix} 0 \\ y \\ 0 \end{pmatrix} = \begin{pmatrix} 3 \\ -2-y \\ 5 \end{pmatrix}$$

The desired distance is:

$$d = \|\vec{P} - \vec{Q}\| = 5\sqrt{2}$$

So,

$$(\vec{P} - \vec{Q})^T(\vec{P} - \vec{Q}) = 3^2 + (-2-y)^2 + 5^2 = 9 + (y+2)^2 + 25$$

$$9 + (y+2)^2 + 25 = 50$$

$$(y+2)^2 = 16$$

$$y + 2 = \pm 4$$

Thus, $y = 2$ or $y = -6$

Answer:

The required coordinates are:

$$\overrightarrow{Q_1} = \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix} \qquad \text{and} \qquad \overrightarrow{Q_2} = \begin{pmatrix} 0 \\ -6 \\ 0 \end{pmatrix}$$

Graph:

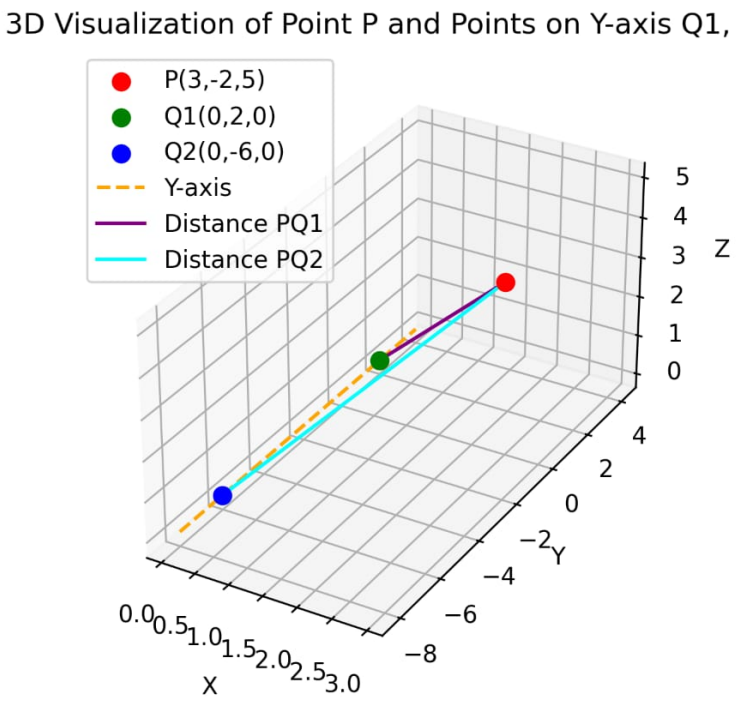

Fig. 1: 3D Visualization of Point P and Points on Y-axis Q1,Q2