Question 1-1.10-9

EE24BTECH11015 - Dhawal

1) Find the unit vector in the direction of vector $\overrightarrow{PQ}$, where **P** and **Q** are the points (1, 2, 3) and (4, 5, 6), respectively.

Variable	Description	Values
P	Point given	$\begin{pmatrix}1,2,3\end{pmatrix}$
Q	Point given	$\begin{pmatrix}4,5,6\end{pmatrix}$
A	Unit vector in $\overrightarrow{PQ}$	To Find

TABLE 1: Variables Used

Solution:

As **A** is a unit vector in the direction of $\overrightarrow{PQ}$:

$$\mathbf{A} = \frac{\mathbf{Q}-\mathbf{P}}{\left\|\mathbf{Q}-\mathbf{P}\right\|} \tag{1.1}$$

Finding $\mathbf{Q}-\mathbf{P}$:

$$\mathbf{Q}-\mathbf{P} = \begin{pmatrix}4\\5\\6\end{pmatrix} - \begin{pmatrix}1\\2\\3\end{pmatrix} = \begin{pmatrix}3\\3\\3\end{pmatrix} \tag{1.2}$$

Finding $\left\|\mathbf{Q}-\mathbf{P}\right\|$:

$$\left\|\mathbf{Q}-\mathbf{P}\right\| = \sqrt{\begin{pmatrix}3 & 3 & 3\end{pmatrix}\begin{pmatrix}3\\3\\3\end{pmatrix}} = \sqrt{27} = 3\sqrt{3} \tag{1.3}$$

Putting the values in the equation:

$$\mathbf{A} = \frac{1}{3\sqrt{3}}\begin{pmatrix}3\\3\\3\end{pmatrix} = \begin{pmatrix}\frac{1}{\sqrt{3}}\\\frac{1}{\sqrt{3}}\\\frac{1}{\sqrt{3}}\end{pmatrix} \tag{1.4}$$

Hence unit vector in direction of $\overrightarrow{PQ}$ is $\begin{pmatrix}\frac{1}{\sqrt{3}}\\\frac{1}{\sqrt{3}}\\\frac{1}{\sqrt{3}}\end{pmatrix}$

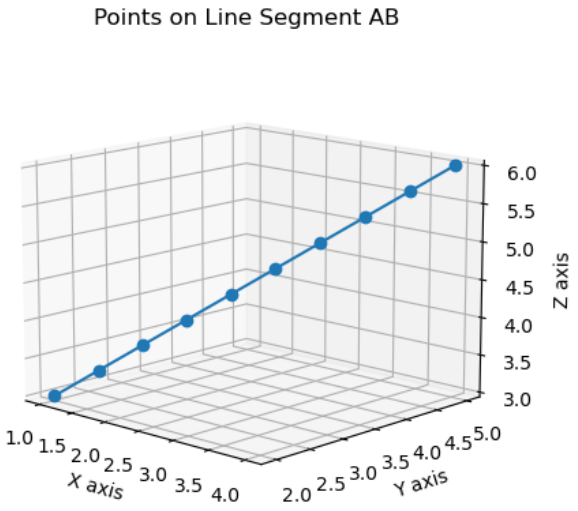

Fig. 1.1: Vector **A**