1.11.2

EE25BTECH11065 - Yoshita

Question:

Unit vector along PQ, where coordinates of P and Q respectively are $\begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 4 \\ -7 \end{pmatrix}$ is.

Solution:
Let the coordinates of the points be $\mathbf{P}(2, 1, -1)$ and $\mathbf{Q}(4, 4, -7)$.

Point	**Name**
$\begin{pmatrix} 2 \\ 2 \\ -1 \end{pmatrix}$	P
$\begin{pmatrix} 4 \\ 4 \\ -7 \end{pmatrix}$	Q

TABLE 0: Vectors

We find the vector **PQ** by subtracting the coordinates of P from the coordinates of Q.

$$\mathbf{PQ} = \mathbf{Q} - \mathbf{P} \tag{1}$$
$$= (4-2)\mathbf{i} + (4-1)\mathbf{j} + (-7-(-1))\mathbf{k} \tag{2}$$
$$= 2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k} \tag{3}$$

Magnitude (or norm) of the vector **PQ**,

$$\|\mathbf{PQ}\| = \sqrt{(2)^2 + (3)^2 + (-6)^2} \tag{4}$$
$$= \sqrt{4 + 9 + 36} \tag{5}$$
$$= \sqrt{49} \tag{6}$$
$$= 7 \tag{7}$$

The unit vector in the direction of **PQ**, denoted as $\hat{\mathbf{u}}$, is found by dividing the vector by its magnitude.

$$\hat{\mathbf{u}} = \frac{\mathbf{PQ}}{\|\mathbf{PQ}\|} \tag{8}$$
$$= \frac{1}{7}(2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}) \tag{9}$$
$$= \frac{2}{7}\mathbf{i} + \frac{3}{7}\mathbf{j} - \frac{6}{7}\mathbf{k} \tag{10}$$

Thus, the unit vector along PQ is $\frac{1}{7}(\mathbf{2i} + \mathbf{3j} - \mathbf{6k})$.

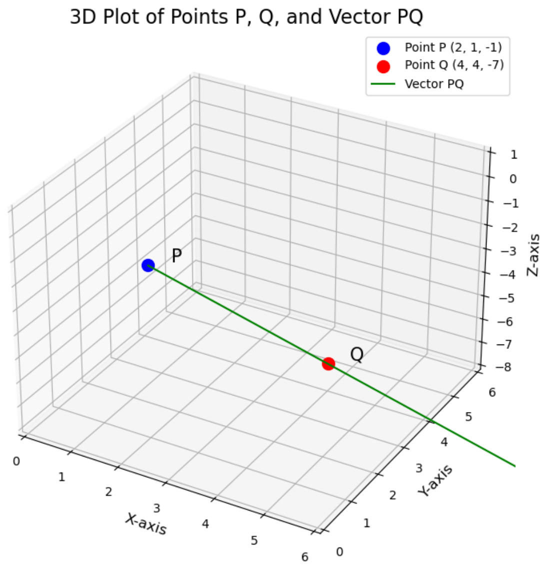

Fig. 0