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# Matrix 1.11.2

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## Question

Find the unit vector along $\mathbf{PQ}$, where $P = (2, 1, -1)$ and $Q = (4, 4, -7)$.

## Solution

### Step 1: Vector PQ

The given points are

$$P = \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}, \quad Q = \begin{pmatrix} 4 \\ 4 \\ -7 \end{pmatrix}.$$

Hence,

$$\mathbf{PQ} = Q - P = \begin{pmatrix} 4 \\ 4 \\ -7 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ -6 \end{pmatrix}. \tag{1}$$

### Step 2: Magnitude of PQ

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

### Step 3: Unit vector along PQ

The unit vector is

$$\mathbf{OA} = \frac{\mathbf{PQ}}{\|\mathbf{PQ}\|} = \frac{1}{7} \begin{pmatrix} 2 \\ 3 \\ -6 \end{pmatrix}. \tag{3}$$

## Final Answer

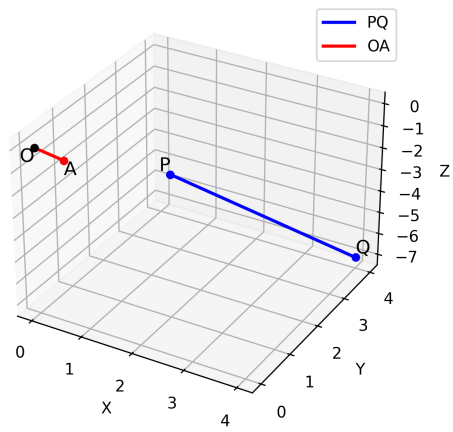$$\boxed{\mathbf{OA} = \frac{1}{7} \begin{pmatrix} 2 \\ 3 \\ -6 \end{pmatrix}}$$

Figure 1: Unit vector **OA** along **PQ**