

# 1.11.8

AI24BTECH11019-KOTHA PRATHEEK REDDY

**Question:**

Find the direction cosines of the line joining points  $\mathbf{P} (4, 3, -5)$  and  $\mathbf{Q} (-2, 1, 8)$ .

**Solution:** Let the unit vector in the direction of the vector  $\mathbf{PQ}$  be  $\hat{a}$ . Then

$$\hat{a} = \frac{\mathbf{Q} - \mathbf{P}}{\|\mathbf{Q} - \mathbf{P}\|} \quad (0.1)$$

$$\mathbf{P} = \begin{pmatrix} 4 \\ 3 \\ -5 \end{pmatrix} \quad (0.2)$$

$$\mathbf{Q} = \begin{pmatrix} -2 \\ 1 \\ 8 \end{pmatrix} \quad (0.3)$$

$$\mathbf{Q} - \mathbf{P} = \begin{pmatrix} -6 \\ -2 \\ 13 \end{pmatrix} \quad (0.4)$$

$$\begin{aligned} \|\mathbf{Q} - \mathbf{P}\| &= \sqrt{(-6)^2 + (-2)^2 + 13^2} \\ &= \sqrt{209} \end{aligned} \quad (0.5)$$

From the above equations,

$$\hat{a} = \begin{pmatrix} \frac{-6}{\sqrt{209}} \\ \frac{-2}{\sqrt{209}} \\ \frac{13}{\sqrt{209}} \end{pmatrix} \quad (0.6)$$

The direction vectors of the the line joining  $\mathbf{A}$  and  $\mathbf{B}$  are the elements of  $\hat{a}$  i.e.  $\frac{-6}{\sqrt{209}}$ ,  $\frac{-2}{\sqrt{209}}$ ,  $\frac{13}{\sqrt{209}}$

| Point        | Coordinate   |
|--------------|--------------|
| $\mathbf{P}$ | $(4, 3, -5)$ |
| $\mathbf{Q}$ | $(-2, 1, 8)$ |

TABLE 0: Coordinates

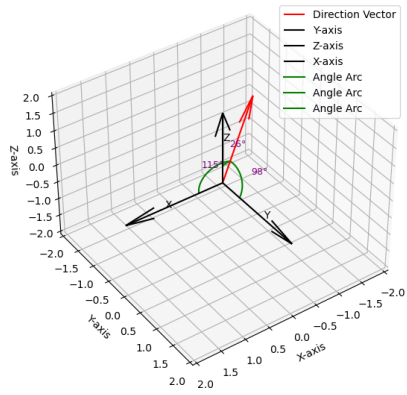


Fig. 0.1: Line joining **P** and **Q**