Question 2.8.38

EE25BTECH11048 - Revanth Siva Kumar D

Question: If the direction cosines of a line are (k, k, k), then find the value of k.

Solution: The direction cosines of a line are denoted by k, k, k. So, the direction cosine vector becomes

$$\mathbf{d} = \begin{pmatrix} k \\ k \\ k \end{pmatrix} \tag{1}$$

since d is a unit vector

$$\|d\| = 1 \tag{2}$$

Applying condition (1),

$$\left\| \begin{pmatrix} k \\ k \\ k \end{pmatrix} \right\| = \|d\| \tag{3}$$

$$(from(2)\, \|d\| = 1) \tag{4}$$

$$\left\| \begin{pmatrix} k \\ k \\ k \end{pmatrix} \right\| = 1 \tag{5}$$

$$\sqrt{3k^2} = 1 \tag{6}$$

$$3k^2 = 1 \tag{7}$$

$$k^2 = \frac{1}{3} \tag{8}$$

Hence,

$$k = \pm\frac{1}{\sqrt{3}} \tag{9}$$

So, the line vectors are

$$\mathbf{v}_1 = \begin{pmatrix} \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \end{pmatrix}, \quad \mathbf{v}_2 = \begin{pmatrix} -\frac{1}{\sqrt{3}} \\ -\frac{1}{\sqrt{3}} \\ -\frac{1}{\sqrt{3}} \end{pmatrix}$$

Answer:

$$k = \frac{1}{\sqrt{3}} \quad \text{or} \quad k = -\frac{1}{\sqrt{3}}$$

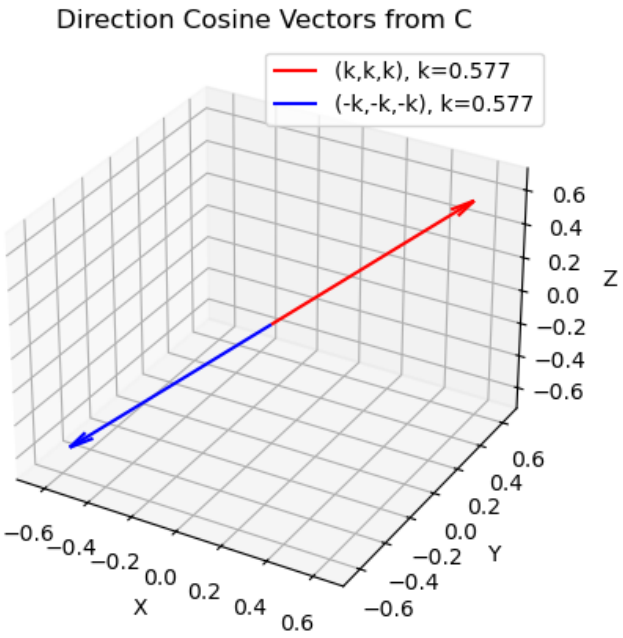

Fig : PLOT BY SHARED OUTPUT

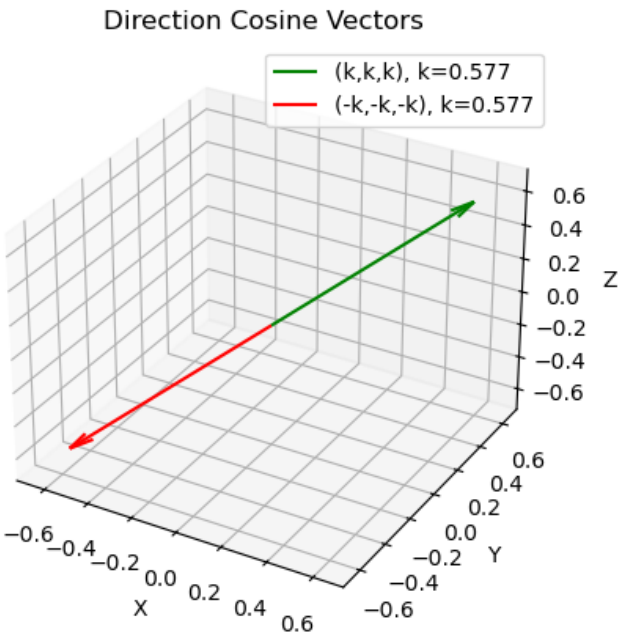

Fig : PLOT BY DIRECT PYTHON CODE