2.3.12

EE25BTECH11009 - Anshu kumar ram

Question:
Find the angle which the line $\frac{x}{1} = \frac{y}{-1} = \frac{z}{0}$ makes with the positive direction of the Y axis.
Solution:

$$Line = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} + k \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$$

Hence its direction vector is

$$\mathbf{v} = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} \tag{0.1}$$

$$\mathbf{v}^T \mathbf{e_2} = \begin{pmatrix} 1 & -1 & 0 \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = -1 \tag{0.2}$$

$$\|\mathbf{v}\| = \sqrt{\mathbf{v}^T \mathbf{v}} = \sqrt{\begin{pmatrix} 1 & -1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}} = \sqrt{2} \tag{0.3}$$

$$\|\mathbf{e_2}\| = 1 \tag{0.4}$$

$$\cos\theta = \frac{\mathbf{v}^T \mathbf{e_2}}{\|\mathbf{v}\|\|\mathbf{e_2}\|} = \frac{-1}{\sqrt{2}} \tag{0.5}$$

$$\theta = \cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) \tag{0.6}$$

Therefore, $\boxed{\theta = \cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) \approx 135^\circ}$

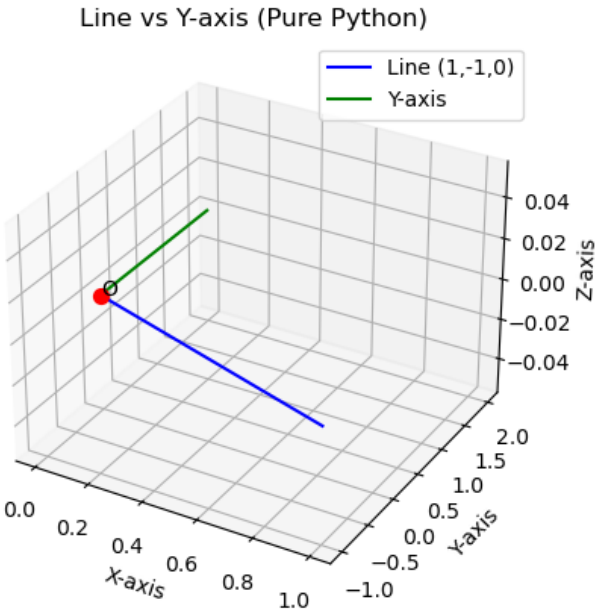
Line vs Y-axis (Pure Python)
Line (1,-1,0)
Y-axis
0.04
0.02
0.00
−0.02
−0.04
Z-axis
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
Y-axis
0.0
0.2
0.4
0.6
0.8
1.0
X-axis

Fig. 0.1: Graph