# Assignment 4

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Download all python codes from

https://github.com/SavaranaDatta/EE3900/tree/main/Assignment4/codes/Assingment4.py

and latex codes from

https://github.com/SavaranaDatta/EE3900/tree/main/Assignment4/Assignment4.tex

## 1 Linear forms 2.88

Find the angle between the following pair of lines

a)

$$\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3} \tag{1.0.1}$$

$$\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4} \tag{1.0.2}$$

b)

$$\frac{x}{2} = \frac{y}{2} = \frac{z}{1} \tag{1.0.3}$$

$$\frac{x-5}{4} = \frac{y-4}{1} = \frac{z-3}{8} \tag{1.0.4}$$

## 2 Solution(Linear forms 2.88)

1) The direction vectors $\mathbf{a}$ and $\mathbf{b}$ of the two lines are

$$\mathbf{a} = \begin{pmatrix} 2 \\ 5 \\ -3 \end{pmatrix} \tag{2.0.1}$$

$$\mathbf{b} = \begin{pmatrix} -1 \\ 8 \\ 4 \end{pmatrix} \tag{2.0.2}$$

Let $\theta$ be the angle between the vectors,

$$cos\theta = \frac{\mathbf{a}^\top \mathbf{b}}{\|\mathbf{a}\|\|\mathbf{b}\|} \tag{2.0.3}$$

$$\mathbf{a}^\top \mathbf{b} = \begin{pmatrix} 2 & 5 & -3 \end{pmatrix} \begin{pmatrix} -1 \\ 8 \\ 4 \end{pmatrix} \tag{2.0.4}$$

$$= 26 \tag{2.0.5}$$

$$\|\mathbf{a}\| = \sqrt{38} \tag{2.0.6}$$

$$\|\mathbf{b}\| = 9 \tag{2.0.7}$$

$$\implies cos\theta = \frac{26}{9\sqrt{38}} \tag{2.0.8}$$

$$\theta = \arccos\left(\frac{26}{9\sqrt{38}}\right) \tag{2.0.9}$$

$$= 62.053^\circ \tag{2.0.10}$$

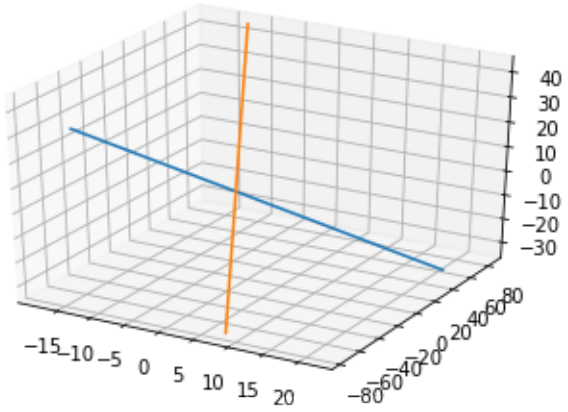


Fig. 1: The plot of the lines

2) The direction vectors $\mathbf{a}$ and $\mathbf{b}$ of the two lines are

$$\mathbf{c} = \begin{pmatrix} 2 \\ 2 \\ 1 \end{pmatrix} \tag{2.0.11}$$

$$\mathbf{d} = \begin{pmatrix} 4 \\ 1 \\ 8 \end{pmatrix} \tag{2.0.12}$$

Let $\theta$ be the angle between the vectors,

$$cos\theta = \frac{\mathbf{c}^\top \mathbf{d}}{\|\mathbf{c}\|\|\mathbf{d}\|} \tag{2.0.13}$$

$$\mathbf{c}^\top \mathbf{d} = \begin{pmatrix} 2 & 2 & 1 \end{pmatrix} \begin{pmatrix} 4 \\ 1 \\ 8 \end{pmatrix} \tag{2.0.14}$$

$$= 18 \tag{2.0.15}$$

$$\|\mathbf{c}\| = 3 \tag{2.0.16}$$

$$\|\mathbf{d}\| = 9 \tag{2.0.17}$$

$$\implies cos\theta = \frac{18}{9 \times 3} \tag{2.0.18}$$

$$\theta = \arccos\left(\frac{2}{3}\right) \tag{2.0.19}$$

$$= 48.189^\circ \tag{2.0.20}$$

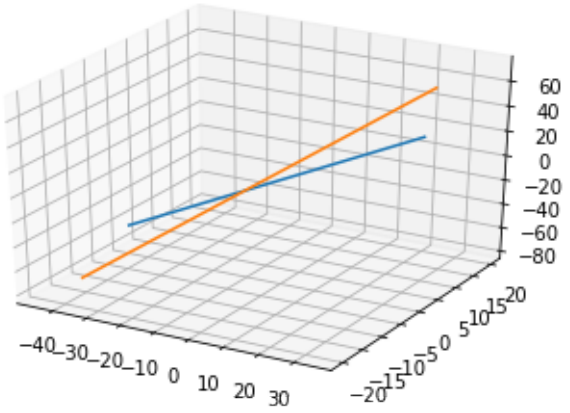


Fig. 2: The plot the lines