Straight Lines Assignment

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***Abstract*—This document contains the solution to Question 4 of Exercise 2 in Chapter 10 of the class 11 NCERT textbook.**

1) Find the equation of the line passing through $\mathbf{A} = \begin{pmatrix} 2 \\ 2\sqrt{3} \end{pmatrix}$ and inclined with the x-axis at an angle of 75°.

Solution: Since $\tan 75^\circ = 2 + \sqrt{3}$, the direction vector of the line is

$$\mathbf{m} = \begin{pmatrix} 2 + \sqrt{3} \\ 1 \end{pmatrix} \tag{1}$$

and hence the normal vector is

$$\mathbf{n} = \begin{pmatrix} -1 \\ 2 + \sqrt{3} \end{pmatrix} \tag{2}$$

The equation of the line is

$$\mathbf{n}^\top (\mathbf{x} - \mathbf{A}) = 0 \tag{3}$$

$$\implies \mathbf{n}^\top \mathbf{x} = \mathbf{n}^\top \mathbf{A} = 4\left(\sqrt{3} + 1\right) \tag{4}$$

$$\implies \begin{pmatrix} -1 & 2 + \sqrt{3} \end{pmatrix} \mathbf{x} = 4\left(\sqrt{3} + 1\right) \tag{5}$$

The line is plotted in Fig. 1 generated by the Python code `codes/line.py`

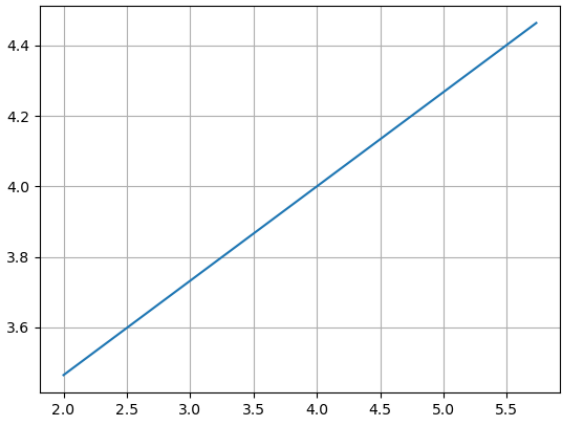

Fig. 1: Line represented by (5).