11.10.2.6

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Class 11, Chapter 10, Exercise 2.6

Q6.Find the equation of the line which satisfy the given conditions: Intersecting the y-axis at a distance of 2 units above the origin and making an angle of 30° with positive direction of the x-axis.
Solution: The direction vector of the line is given by

$$\mathbf{m} = \begin{pmatrix} 1 \\ \tan(30^\circ) \end{pmatrix} = \begin{pmatrix} 1 \\ \frac{1}{\sqrt{3}} \end{pmatrix} \tag{1}$$

The normal vector $\mathbf{n}$ to the line is given by

$$\mathbf{n} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ \frac{1}{\sqrt{3}} \end{pmatrix} = \begin{pmatrix} -\frac{1}{\sqrt{3}} \\ 1 \end{pmatrix} \tag{2}$$

The line is passign through point $\mathbf{A}$ which is at a distance of 2 units above the origin.

$$\mathbf{A} = \begin{pmatrix} 0 \\ 2 \end{pmatrix} \tag{3}$$

The equation of the line is given by

$$\mathbf{n}^\top (\mathbf{x} - \mathbf{A}) = 0 \tag{4}$$

$$\implies \begin{pmatrix} -\frac{1}{\sqrt{3}} & 1 \end{pmatrix} \left(\mathbf{x} - \begin{pmatrix} 0 \\ 2 \end{pmatrix} \right) = 0 \tag{5}$$

$$\text{or, } \begin{pmatrix} -\frac{1}{\sqrt{3}} & 1 \end{pmatrix} \mathbf{x} = 2 \tag{6}$$

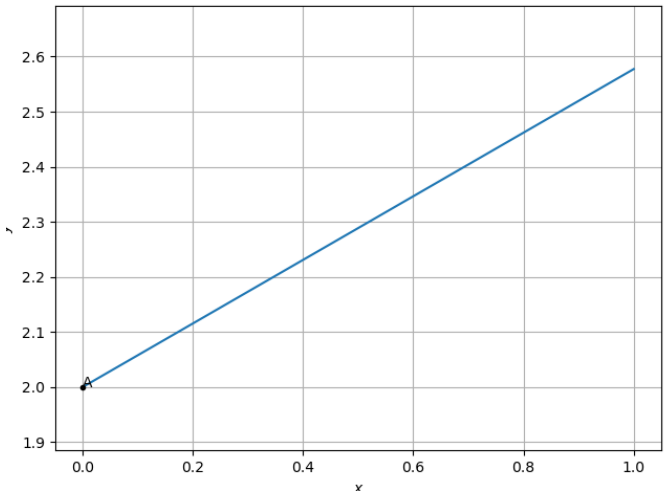

Fig. 1: Line passing through (0,2)