

# 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  $30^\circ$  with positive direction of the x-axis.

**Solution:** The direction vector of the line is given by

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

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

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

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

$$\mathbf{A} = \begin{pmatrix} 0 \\ 2 \end{pmatrix} \quad (3)$$

The equation of the line is given by

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

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

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