# Quiz 4

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*Abstract*—This document contains the solution of the question from NCERT 11th standard chapter 10 exercise 10.1 problem 7

## 1 EXERCISE 10.1

1) Find the slope of the line, which makes an angle of 30 degrees with the positive direction of y-axis measures anticlockwise.

Let the direction vector of y-axis be,

$$\mathbf{m_1} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \tag{1.0.1}$$

and the direction vector of the line be,

$$\mathbf{m_2} = \begin{pmatrix} 1 \\ m \end{pmatrix} \tag{1.0.2}$$

where m is the slope of the line.

The cosine of the angle between the line and the y-axis is given by,

$$\cos(\phi) = \frac{\mathbf{m_1}^\top \mathbf{m_2}}{\|\mathbf{m_1}\| \, \|\mathbf{m_2}\|} \tag{1.0.3}$$

$$\mathbf{m_1}^\top \mathbf{m_2} = \begin{pmatrix} 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ m \end{pmatrix} = m \tag{1.0.4}$$

$$\|\mathbf{m_1}\| = \sqrt{0^2 + 1^2} = 1 \tag{1.0.5}$$

$$\|\mathbf{m_2}\| = \sqrt{1^2 + m^2} = \sqrt{1 + m^2} \tag{1.0.6}$$

$$\cos(\phi) = \frac{m}{\sqrt{1 + m^2}} \tag{1.0.7}$$

We are given that the angle between the line and the y-axis is 30 degrees.

$$\phi = 30 \Rightarrow \cos(\phi) = \frac{\sqrt{3}}{2} \tag{1.0.8}$$

$$\frac{\sqrt{3}}{2} = \frac{m}{\sqrt{1 + m^2}} \tag{1.0.9}$$

$$2m = \sqrt{3}\sqrt{1 + m^2} \tag{1.0.10}$$

$$4m^2 = 3(1 + m^2) \Rightarrow m^2 = 3 \tag{1.0.11}$$

$$m = \sqrt{3} \text{ or } -\sqrt{3} \tag{1.0.12}$$

Out of this $m = \sqrt{3}$ is the correct slope as it makes 30 degrees with the positve direction of y-axis where as $m = -\sqrt{3}$ makes 30 degrees with the negative direction of y-axis.