

L^AT_EX 11.10.1.7

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CLASS 11, EXERCISE 10.1

Q7. Find the slope of the line, which makes an angle of 30° with the positive direction of y-axis measured anticlockwise.

Solution: Direction vector of y-axis is $\mathbf{e}_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ and

direction vector of line is $\mathbf{m} = \begin{pmatrix} 1 \\ m \end{pmatrix}$.

$$\cos(30^\circ) = \frac{\mathbf{m}^T \mathbf{e}_2}{\|\mathbf{m}\| \|\mathbf{e}_2\|} = \frac{m}{\sqrt{1+m^2}} \quad (1)$$

$$\frac{m}{\sqrt{1+m^2}} = \frac{\sqrt{3}}{2} \quad (2)$$

$$m = \pm \sqrt{3} \quad (3)$$

Let's take the both values of m and verify the result.

Case 1: $m = \sqrt{3}$

$$\frac{\mathbf{m}^T \mathbf{e}_2}{\|\mathbf{m}\| \|\mathbf{e}_2\|} = \frac{\sqrt{3}}{\sqrt{1+\sqrt{3}^2}} = \frac{\sqrt{3}}{2} \quad (4)$$

$$\Rightarrow \frac{\mathbf{m}^T \mathbf{e}_2}{\|\mathbf{m}\| \|\mathbf{e}_2\|} = \cos(30^\circ) \quad (5)$$

Case 2: $m = -\sqrt{3}$

$$\frac{\mathbf{m}^T \mathbf{e}_2}{\|\mathbf{m}\| \|\mathbf{e}_2\|} = \frac{-\sqrt{3}}{\sqrt{1+\sqrt{3}^2}} = -\frac{\sqrt{3}}{2} \quad (6)$$

$$\Rightarrow \frac{\mathbf{m}^T \mathbf{e}_2}{\|\mathbf{m}\| \|\mathbf{e}_2\|} = -\cos(30^\circ) \quad (7)$$

$$\Rightarrow m = \sqrt{3}$$

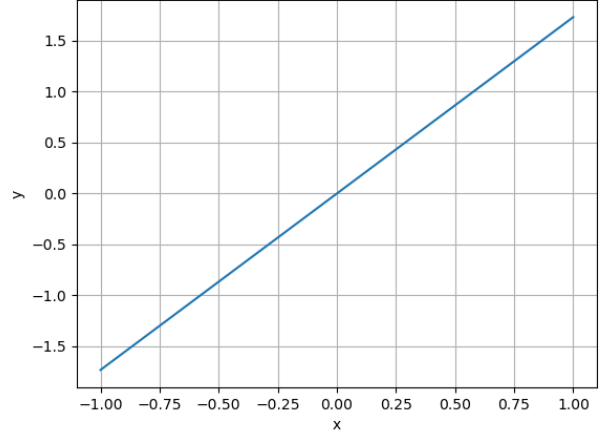


Fig. 1: Line with slope $m = \sqrt{3}$