Quiz 7

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Abstract—**This document contains the solution of the question from NCERT 11th standard chapter 10 exercise 10.2 problem 8**

1 EXERCISE 10.2

1) Perpendicular distance from the origin in 5units and the angle made by the perpendicular with the positive x-axis is 30 degrees.
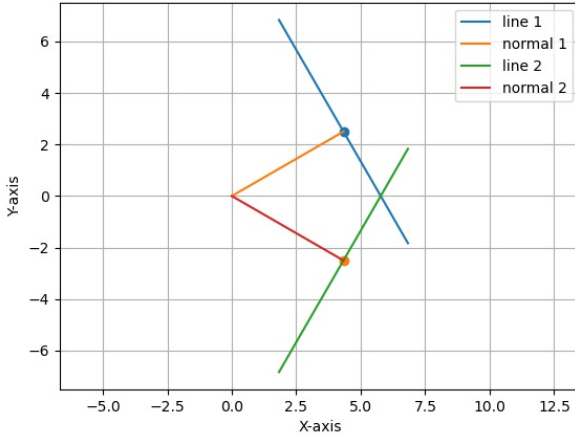

Fig. 1: Triangle ABC

The normal vector to the given lines are,

$$\mathbf{n_1} = \begin{pmatrix} \cos(30) \\ \sin(30) \end{pmatrix} = \begin{pmatrix} \frac{\sqrt{3}}{2} \\ \frac{1}{2} \end{pmatrix} \tag{1.0.1}$$

$$\mathbf{n_2} = \begin{pmatrix} \cos(-30) \\ \sin(-30) \end{pmatrix} = \begin{pmatrix} \frac{\sqrt{3}}{2} \\ \frac{-1}{2} \end{pmatrix} \tag{1.0.2}$$

$$\tag{1.0.3}$$

The perpendicular distance to the line is,

$$d = 5 \tag{1.0.4}$$

Let the equation of the line be,

$$\mathbf{n}^\top \mathbf{x} - c = 0 \tag{1.0.5}$$

Then, the perpendicular distance to the line from any point x is,

$$d = \frac{\left| \mathbf{n_1}^\top \mathbf{x} - c \right|}{\|\mathbf{n1}\|} \tag{1.0.6}$$

$$5 = \frac{\left| \begin{pmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 0 \\ 0 \end{pmatrix} - c \right|}{\left\| \begin{pmatrix} \frac{\sqrt{3}}{2} \\ \frac{1}{2} \end{pmatrix} \right\|} \tag{1.0.7}$$

$$5 = \frac{c}{1} \tag{1.0.8}$$

$$c = 5 \tag{1.0.9}$$

Similarly we can show that $c = 5$ for $\mathbf{n_2}$.
Hence, the equation of the line is,

$$\begin{pmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix} \mathbf{x} - 5 = 0 \tag{1.0.10}$$

$$\begin{pmatrix} \frac{\sqrt{3}}{2} & \frac{-1}{2} \end{pmatrix} \mathbf{x} - 5 = 0 \tag{1.0.11}$$