4.7.56

EE25BTECH11059 - Vaishnavi Ramkrishna Anantheertha

Question: Find the equation of the line whose perpendicular distance from the origin is 4 units and the angle which the normal makes with positive direction of x-axis is 15°

Solution 1:

Variable	Value
d	4
m	$-2-\sqrt{3}$

TABLE 0: Variables Used

Let eq of line be

$$\mathbf{n}^{\mathbf{T}}\mathbf{x} = c \tag{0.1}$$

where,

$$\mathbf{n} = \begin{pmatrix} -m \\ 1 \end{pmatrix} \tag{0.2}$$

$$\mathbf{n} = \begin{pmatrix} 2+\sqrt{3} \\ 1 \end{pmatrix} \tag{0.3}$$

Hence eq of line is

$$\begin{pmatrix} 2+\sqrt{3} & 1 \end{pmatrix}\mathbf{x} = c \tag{0.4}$$

$$\tag{0.5}$$

As distance from origin=4 units

$$\frac{|c|}{\|n\|} = 4 \tag{0.6}$$

$$\frac{|c|}{2\sqrt{2+\sqrt{3}}} = 4 \tag{0.7}$$

$$c = \pm 8\sqrt{2+\sqrt{3}} \tag{0.8}$$

Hence eq of line is

$$\begin{pmatrix} 2+\sqrt{3} & 1 \end{pmatrix}\mathbf{x} = \pm 8\sqrt{2+\sqrt{3}} \tag{0.9}$$

Refer to Figure

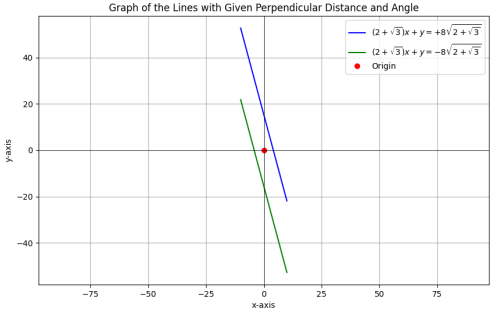
Graph of the Lines with Given Perpendicular Distance and Angle
$(2+\sqrt{3})x+y=+8\sqrt{2+\sqrt{3}}$
$(2+\sqrt{3})x+y=-8\sqrt{2+\sqrt{3}}$
Origin
y-axis
x-axis
40
20
0
−20
−40
−75
−50
−25
0
25
50
75

Fig. 0.1