Assignment 1

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1 QUESTION No.2.16

Construct an isosceles triangle in which the lengths of the equal sides is 6.5 and the angle between them is 110°.

2 SOLUTION

The vertices are:

$$\mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} ld \\ 0 \end{pmatrix}, \mathbf{O} = \begin{pmatrix} p1 \\ q1 \end{pmatrix} \tag{2.0.1}$$

Finding $\angle O$ and $\angle D$:

In $\triangle OLD$,

$$\angle O + \angle L + \angle D = 180^{\circ} \quad (\because \angle O = \angle D = x) \tag{2.0.2}$$

$$x + 110^{\circ} + x = 180^{\circ} \tag{2.0.3}$$

$$2x = 180^{\circ} - 110^{\circ} \tag{2.0.4}$$

$$2x = 70^{\circ} \tag{2.0.5}$$

$$x = 35^{\circ} \quad \left(\because \angle O = \angle D = 35^{\circ}\right) \tag{2.0.6}$$

Now, Lines od , ol and ld Can be plotted.

$$\mathbf{OD} = 2a\cos(35) \quad (\because a = ol = 6.5) \tag{2.0.7}$$

$$= (13)\cos(35) \tag{2.0.8}$$

$$= 10.6 \tag{2.0.9}$$

Coordinates of O(p1,q1)

$$\mathbf{p1} = \frac{ld^2 + ol^2 - od^2}{2(ld)} \tag{2.0.10}$$

$$= \frac{(6.5)^2 + (6.5)^2 - (10.6)^2}{2(6.5)} \tag{2.0.11}$$

$$= \frac{42.25 + 42.25 - 112.36}{13} \tag{2.0.12}$$

$$= -2.14 \tag{2.0.13}$$

$$\mathbf{q1} = \sqrt{(ol)^2 - (p1)^2} \tag{2.0.14}$$

$$= \sqrt{(6.5)^2 - (-2.14)^2} \tag{2.0.15}$$

$$= 6.13 \tag{2.0.16}$$

The vertex O can be expressed in polar coordinate form as

$$\mathbf{O} = ol \begin{pmatrix} \cos \theta \\ \sin \theta \end{pmatrix} \tag{2.0.17}$$

O can be expressed as

$$\mathbf{O} = ol \begin{pmatrix} cosO \\ sinO \end{pmatrix} \quad (\because a = ol = 6.5) \tag{2.0.18}$$

$$= 6.5 \begin{pmatrix} cos35 \\ sin35 \end{pmatrix} \tag{2.0.19}$$

$$= 6.5 \begin{pmatrix} 0.819 \\ 0.573 \end{pmatrix} \tag{2.0.20}$$

$$= \begin{pmatrix} 5.324 \\ 3.728 \end{pmatrix} \tag{2.0.21}$$

So, the vertices of $\triangle OLD$ are

$$\mathbf{L} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 6.5 \\ 0 \end{pmatrix}, \mathbf{O} = \begin{pmatrix} 5.324 \\ 3.728 \end{pmatrix} \tag{2.0.22}$$

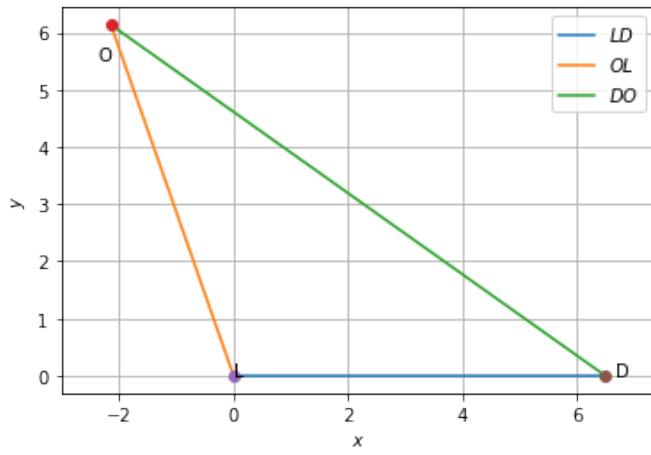Now, Isosceles $\triangle OLD$ can be plotted using vertices LD ,OL and DO.

Plot of the Isosceles $\triangle OLD$:

Fig. 2.1: Isosceles triangle $\triangle OLD$