ASSIGNMENT-1

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1 QUESTION NO-2.23

Construct $\triangle LMN$ right angled at M such that $LN = 5$ and $MN = 3$.

2 SOLUTION

Let

$$\mathbf{L} = \begin{pmatrix} 0 \\ l \end{pmatrix}, \mathbf{M} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{N} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \qquad (2.0.1)$$

Now,

$$\|\mathbf{N} - \mathbf{M}\|^2 = \|\mathbf{N}\|^2 = 3^2 = 9 \qquad (2.0.2)$$
$$\|\mathbf{L} - \mathbf{M}\|^2 = \|\mathbf{L}\|^2 = l^2 \qquad (2.0.3)$$

We know,

$$\|\mathbf{L} - \mathbf{N}\|^2 = (\mathbf{L} - \mathbf{N})^T(\mathbf{L} - \mathbf{N}) \qquad (2.0.4)$$
$$= \mathbf{L}^T\mathbf{L} + \mathbf{N}^T\mathbf{N} - \mathbf{L}^T\mathbf{N} - \mathbf{L}^T\mathbf{L} \qquad (2.0.5)$$
$$= \|\mathbf{L}\|^2 + \|\mathbf{L}\|^2 - 2\mathbf{L}^T\mathbf{N} \qquad (2.0.6)$$
$$= \|\mathbf{L}\|^2 + \|\mathbf{N}\|^2 - 2.0 \qquad (2.0.7)$$
$$= l^2 + 3^2 \qquad (2.0.8)$$
$$= l^2 + 9 \qquad (2.0.9)$$

But we know LN=5

$$\|\mathbf{L} - \mathbf{N}\|^2 = 5^2 = 25 \qquad (2.0.10)$$
$$l^2 + 9 = 25 \qquad (2.0.11)$$
$$l^2 = 25 - 9 \qquad (2.0.12)$$
$$l^2 = 16 \qquad (2.0.13)$$
$$l = \pm 4 \qquad (2.0.14)$$

As we consider $\triangle LMN$ in first quadrant we consider $l=4$

$$\therefore l = 4 \qquad (2.0.15)$$

Now, Vertices of given $\triangle LMN$ can be written as,

$$\mathbf{L} = \begin{pmatrix} 0 \\ l \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}, \mathbf{M} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{N} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \qquad (2.0.16)$$

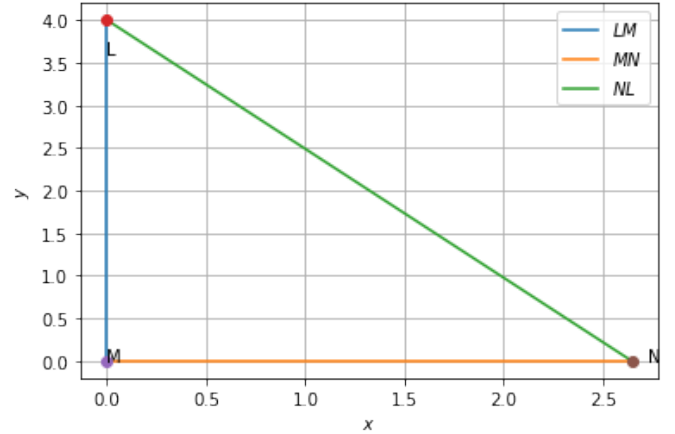Now, $\triangle LMN$ can be plotted using vertices LM , MN and LN .

Plot of the Right angle $\triangle PQR$:

Fig. 2.1: Right Angle $\triangle LMN$