Assignment 1

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Download all python codes from

https://github.com/ka−raja−babu/Matrix−Theory/tree/main/Assignment1/Codes

and latex-tikz codes from

https://github.com/ka−raja−babu/Matrix−Theory/tree/main/Assignment1

1 Question No. 24

Construct $\triangle PQR$ right angled at Q such that $QR = 8$ and $PR = 10$.

2 Explanation

Let us assume that:

$$\mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}, \mathbf{P} = \begin{pmatrix} 0 \\ p \end{pmatrix} \tag{2.0.1}$$

Then,

$$\|\mathbf{R} - \mathbf{Q}\|^2 = \|\mathbf{R}\|^2 = 8^2 = 64 \quad (\because \mathbf{Q} = 0) \tag{2.0.2}$$

$$\|\mathbf{P} - \mathbf{Q}\|^2 = \|\mathbf{P}\|^2 = p^2 \quad (\because \mathbf{Q} = 0) \tag{2.0.3}$$

Now,

$$\|\mathbf{P} - \mathbf{R}\|^2 = (\mathbf{P} - \mathbf{R})^T(\mathbf{P} - \mathbf{R}) \tag{2.0.4}$$

$$= \mathbf{P}^T\mathbf{P} + \mathbf{R}^T\mathbf{R} - \mathbf{P}^T\mathbf{R} - \mathbf{R}^T\mathbf{P} \tag{2.0.5}$$

$$= \|\mathbf{P}\|^2 + \|\mathbf{R}\|^2 - 2\mathbf{P}^T\mathbf{R} \quad \left(\because \mathbf{P}^T\mathbf{R} = \mathbf{R}^T\mathbf{P}\right) \tag{2.0.6}$$

$$= \|\mathbf{P}\|^2 + \|\mathbf{R}\|^2 \quad \left(\because \mathbf{R}^T\mathbf{P} = 0\right) \tag{2.0.7}$$

$$= p^2 + 64 \tag{2.0.8}$$

Also,

$$\|\mathbf{P} - \mathbf{R}\|^2 = 10^2 = 100 \tag{2.0.9}$$

Therefore,

$$p^2 + 64 = 100 \tag{2.0.10}$$

$$\implies p^2 = 36 \tag{2.0.11}$$

$$\implies p = 6 \tag{2.0.12}$$

So,the vertices of $\triangle PQR$ in fig. 2.1 are:

$$\mathbf{P} = \begin{pmatrix} 0 \\ 6 \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} 8 \\ 0 \end{pmatrix} \tag{2.0.13}$$

Lines PQ ,QR and RP are then generated and plotted using these coordinates to form $\triangle PQR$.

Plot of the right angle $\triangle PQR$:

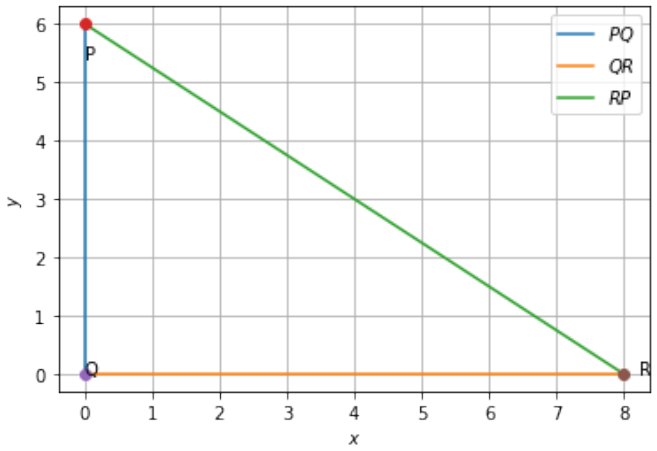

Fig. 2.1: Right Angle $\triangle PQR$