

# Assignment 1

K.A. Raja Babu

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:

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

Then,

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

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

Now,

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

$$= \mathbf{P}^T \mathbf{P} + \mathbf{R}^T \mathbf{R} - \mathbf{P}^T \mathbf{R} - \mathbf{R}^T \mathbf{P} \quad (2.0.5)$$

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

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

$$= p^2 + 64 \quad (2.0.8)$$

Also,

$$\|\mathbf{P} - \mathbf{R}\|^2 = 10^2 = 100 \quad (2.0.9)$$

Therefore,

$$p^2 + 64 = 100 \quad (2.0.10)$$

$$\implies p^2 = 36 \quad (2.0.11)$$

$$\implies p = 6 \quad (2.0.12)$$

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

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

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

Plot of the right angle  $\triangle PQR$ :

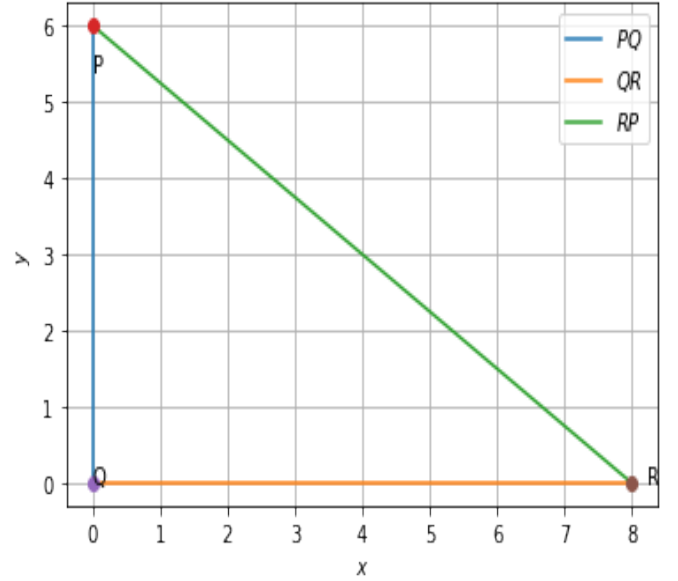


Fig. 2.1: Right Angle  $\triangle PQR$