

# 3.3.20

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## Question:

Draw a triangle  $PQR$  in which  $QR = 3$  cm,  $QP - PR = 6$  cm, and  $\angle PQR = 45^\circ$ .

## Solution:

For triangle  $PQR$  with  $QR = 3$  cm,  $QP - PR = 6$  cm, and  $\angle PQR = 45^\circ$ .

From the Law of Cosines(3.1.1.1)

$$QP^2 = QR^2 + PR^2 - 2(QR)(PR)\cos(\angle PQR) \quad (0.1)$$

Let  $k$  be defined as:

$$k = QP - PR \quad (0.2)$$

So, the expression for  $QP$  in terms of  $k$  is:

$$QP = \frac{k^2 + QR^2}{2 * (k - QR \cos(\angle PR))} \quad (0.3)$$

$$QP = \frac{90}{12 - 3\sqrt{2}}$$

where  $\angle PR$  is the angle opposite side  $QR$ .

The coordinates of  $\triangle PQR$  can be expressed as

$$\mathbf{P} = QP \begin{pmatrix} \cos Q \\ \sin Q \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \quad (0.4)$$

$$\mathbf{P} = \frac{11.60}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (0.5)$$

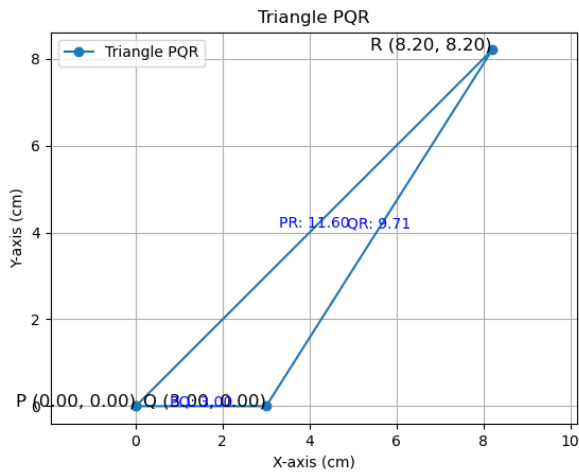


Fig. 0.1: Triangle  $PQR$