

Assignment 1

AI1110: Probability and Random Variables - ICSE 2019 Grade10

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Question: 6 (a)

In the given figure, $\angle PQR = \angle PST = 90^\circ$, $PQ = 5$ cm and $PS = 2$ cm.

(i) Prove that $\triangle PQR \sim \triangle PST$.

(ii) Find ratio of Area of $\triangle PQR$ and Area of quadrilateral $SRQT$.

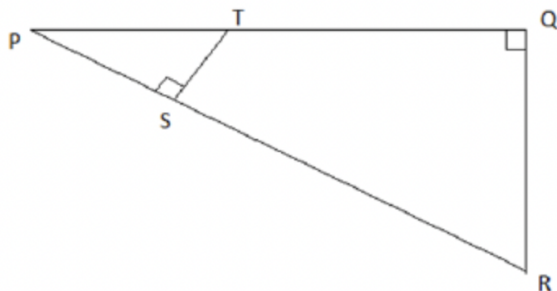


Figure 1: triangle PQR

Solution:-

(i) To prove $\triangle PQR \sim \triangle PST$
consider $\triangle PQR$ and $\triangle PST$
 $\angle PQR = \angle PST = 90^\circ$ (given)
 $\angle P$ is common.

$\therefore \triangle PQR \sim \triangle PST$ (By AAA criterion)

(ii) Now, Area of $\triangle PQR$ is,

From the given diagram we can say

$$\frac{PQ}{PS} = \frac{QR}{ST} \quad (1)$$

$PQ = 5$ cm (given), $QR = 5$ cm (stated above)

$$= \frac{1}{2} \times 5 \times 5 = \frac{25}{2} \quad (2)$$

Area of triangle PST

$$= \frac{1}{2} \times PS \times ST \quad (3)$$

$PS = 2$ cm (given), $ST = 2$ cm (stated above)

$$= \frac{1}{2} \times 2 \times 2 = \frac{4}{2} \quad (4)$$

Area of Quadrilateral $SQRT$ = Area of triangle PQR - Area of triangle PST

$$= \frac{25}{2} - \frac{4}{2} = \frac{21}{2} \quad (5)$$

$$\Rightarrow \frac{25/2}{21/2} = \frac{25}{21} \quad (6)$$

$$\therefore \text{ratio} = \frac{25}{21}$$

METHOD-2: steps for construction;

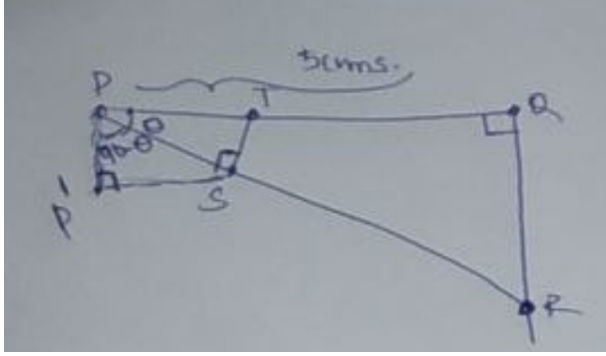


Figure 2: triangle-2

From the above figure;

$$\frac{PQ}{PR} = \cos \theta$$

$$PR = \frac{PQ}{\cos \theta} \quad (7)$$

$$\frac{QR}{PR} = \tan \theta$$

$$QR = \tan \theta PQ \quad (8)$$

Given, PS=2cm PQ=5cm
take an angle; $\angle RPQ = 60^\circ$

$$\text{let } \mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (9)$$

$$\text{P will be; } \mathbf{P} = \begin{pmatrix} -5 \\ 0 \end{pmatrix} \quad (10)$$

$$\text{R will be; } \mathbf{R} = \begin{pmatrix} 0 \\ -\tan \theta PQ \end{pmatrix} \quad (11)$$

(12)

$$\text{PT will be; } \Rightarrow \frac{PS}{PT} = \cos \theta$$

$$\text{T will be; } \mathbf{T} = \begin{pmatrix} -(5 - \frac{PS}{\cos \theta}) \\ 0 \end{pmatrix} \quad (13)$$

(14)

$$\frac{P'S}{PS} = \sin(90 - \theta) \quad (15)$$

$$P'S = PS \sin(90 - \theta) \quad (16)$$

$$\frac{P'P}{PS} = \cos(90 - \theta) \quad (17)$$

$$P'P = PS \cos(90 - \theta) \quad (18)$$

$$\mathbf{S} = \begin{pmatrix} -(5 - PS \cos \theta) \\ -PS \sin \theta \end{pmatrix} \quad (19)$$

(20)

Using the above coordinates,
Generating the figure using python:

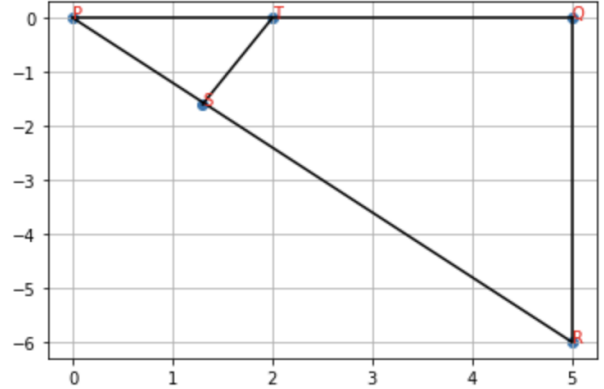


Figure 3: constructed triangle

The input and output parameters required for drawing the figure are available in the below table.

Variable	output paramter
R	5
$\angle RPQ$	$\angle 60^\circ$
P.	$\begin{pmatrix} -5 \\ 0 \end{pmatrix}$
Q	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$
R	$\begin{pmatrix} 0 \\ -8.66 \end{pmatrix}$
T	$\begin{pmatrix} -1 \\ 0 \end{pmatrix}$
S	$\begin{pmatrix} -4 \\ -4.33 \end{pmatrix}$