Math Document Template

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***Abstract*—This is a document explaining for a question on the concept of triangles.**

Download all python codes from

```
svn co https://github.com/Ashuwin/Summer_2020/
    trunk/triangle/codes
```

and latex-tikz codes from

```
svn co https://github.com/Ashuwin/Summer_2020/
    trunk/triangle/figs
```

1 Problem

In $\triangle PQR$, $PR > PQ$ and PS bisects $\angle QPR$. Prove that $\angle PSR > \angle PSQ$

2 Construction

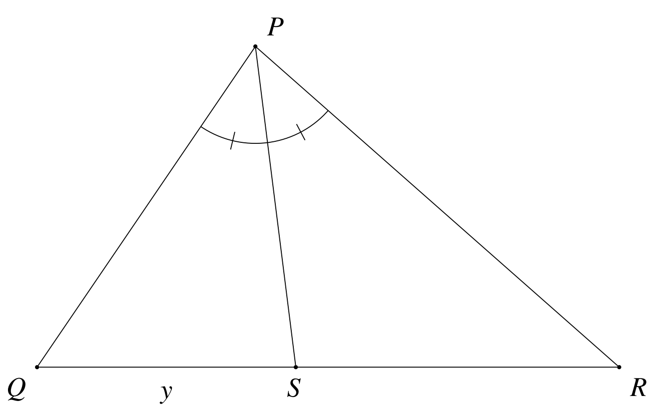

Fig. 2.0: Quadilateral by Latex-Tikz

2.1. The figure obtained looks like Fig. 2.0. $PR > PQ$, $\angle QPS = \angle SPR = x$

2.2. The design parameters used for construction

Solution: See Table. 2.2.

2.3. Find the coordinates of various points:

Design Parameters	
Parameters	Value
PQ	4
PR	5
QR	6

TABLE 2.2: Triangle PQR

Solution: From the given information,

$$\mathbf{P} = \begin{pmatrix} a \\ b \end{pmatrix} \tag{2.3.1}$$

$$\mathbf{Q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \tag{2.3.2}$$

$$\mathbf{R} = \begin{pmatrix} p \\ 0 \end{pmatrix} \tag{2.3.3}$$

$$\mathbf{S} = \begin{pmatrix} y \\ 0 \end{pmatrix} \tag{2.3.4}$$

where

$$a = (p^2 + r^2 - q^2)/2p$$

$$b = \sqrt{r^2 - a^2}$$

2.4. Point S can be found by Triangle angle bisector theorem.

$$\frac{|\mathbf{QS}|}{|\mathbf{PQ}|} = \frac{|\mathbf{SR}|}{|\mathbf{PR}|}$$

$$\frac{y}{4} = \frac{6-y}{5}$$

$$5y = 24 - 4y$$

$$9y = 24$$

$$y = \frac{8}{3}$$

2.5. The derived parameters used for construction

Solution: From the given information, The values are listed in 2.5

2.6. Draw fig. 2.6.
Solution: The following Python code generates

Derived values	
Parameter	values
P	$\begin{pmatrix} 2.25 \\ 3.3072 \end{pmatrix}$
S	$\begin{pmatrix} 8/3 \\ 0 \end{pmatrix}$

TABLE 2.5: $TrianglePQR$

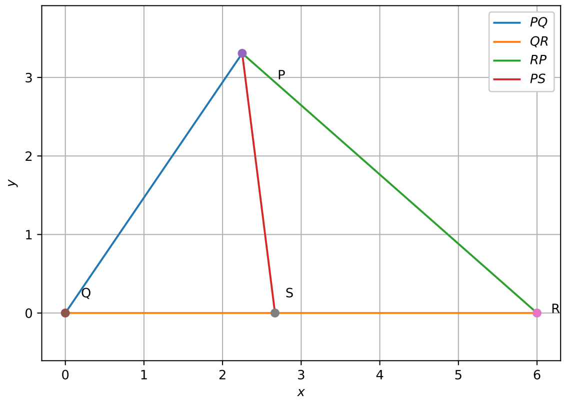

Fig. 2.6: Triangle generated using python

Fig. 2.6

```
codes/tri.py
```

and the equivalent latex-tikz code generating Fig. 2.6 is

```
figs/triangle.tex
```

3 Solution

PS is the bisector of $\angle QPR$.
Therefore, $\angle QPS = \angle SPR = x$
In $\triangle PQS$,

$$\angle PSR = \angle PQR + \angle QPS$$

(Exterior angle is sum of interior opposite angles)
In $\triangle PSR$,

$$\angle PSQ = \angle PRQ + \angle SPR$$

(Exterior angle is sum of interior opposite angles)
Given

$$PR > PQ$$

Therefore, $\angle PQR > \angle PRQ$ (Angle opposite to the longer side is greater)

Adding x to both sides,

$$\angle PQR + x > \angle PRQ + x$$

$$\angle PSR > \angle PSQ$$

Hence proved.