Question 1 Exercise(8.1)

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***Abstract*—A question based on properties of triangles.**

Download all python codes from

svn co https://github.com/Srihari123456/Summer−2020/tree/master/geometry/triangle/codes

Download all LaTeX-Tikz codes from

svn co https://github.com/Srihari123456/Summer−2020/tree/master/geometry/triangle/figs

1 Question

1.1. Show that each angle in an equilateral triangle is 60°.

2 Construction

2.1. The figure for a triangle obtained in the question looks like Fig. 1, with equal sides a,b,c.

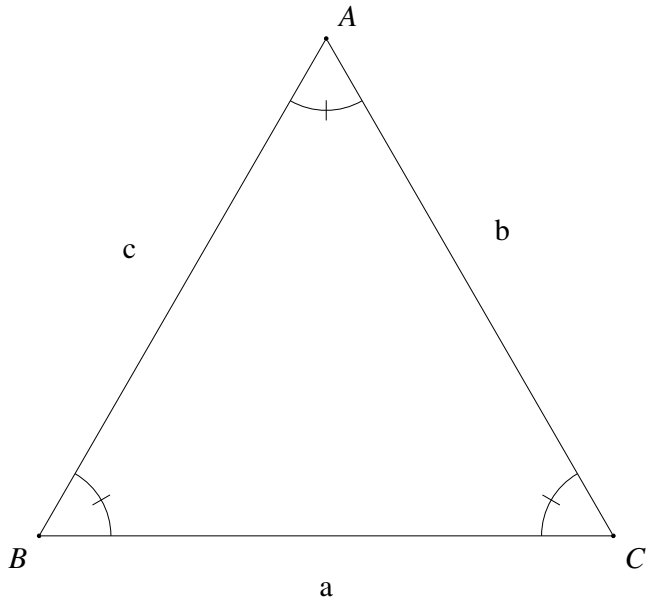

Fig. 1: Triangle by Latex-Tikz

The values used for constructing the triangles in both Python and LaTeX-Tikz is in Table I:

Initial Input Values	
Parameter	**Value**
a	**4**
b	**4**
c	**4**

TABLE I: To construct $\triangle ABC$

2.2. Finding the coordinates of various points of Fig. 1 :
From the information provided in the Table I: let

$$\mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}\mathbf{C} = \begin{pmatrix}a\\0\end{pmatrix}\mathbf{A} = \begin{pmatrix}p\\q\end{pmatrix} \quad (2.2.1)$$

The derived value of **p** and **q** is available in Table II.

Derived Values	
Parameter	**Value**
p	**2**
q	**3.46**

TABLE II: To construct $\triangle ABC$

The following Python code generates Fig. 2

./codes/eqtri.py

The equivalent LaTeX- tikz code generating Fig. 1 is

./figs/constructionpic.tex

The above LaTeX code can be compiled as a standalone document as

./figs/constructionpic_standalone.tex

To Show:: We need to prove that $\angle BAC = \angle ACB = \angle CBA$

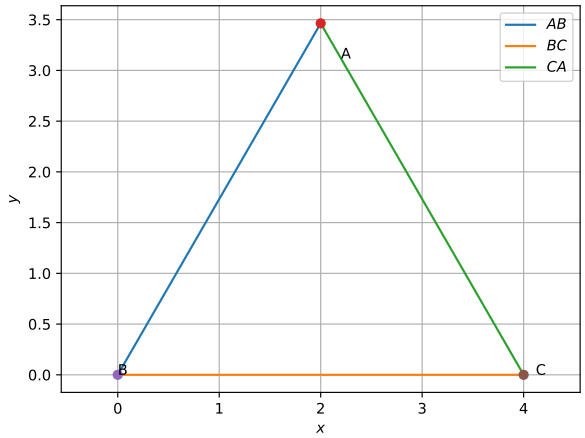

Fig. 2: Triangle generated using python

3 Solution

3.1.

$$\mathbf{a} = \mathbf{b} \implies \angle BAC = \angle CBA$$
$$\mathbf{c} = \mathbf{b} \implies \angle ACB = \angle CBA$$

(Angles opposite to equal sides are equal) (3.1.1)

$\therefore$ From the above equations,

$$\angle ACB = \angle BAC = \angle CBA \quad (3.1.2)$$

3.2.

$$\because \angle ACB + \angle BAC + \angle CBA = 180^\circ$$

(Angle sum property of triangles) (3.2.1)

And from (3.1.2)

$$3\,(\angle BAC) = 180^\circ \quad (3.2.2)$$
$$\implies \angle BAC = 60^\circ \quad (3.2.3)$$

3.3.

$$\angle ACB = \angle BAC = \angle CBA = 60^\circ \quad (3.3.1)$$

Hence proved.