

# Assignment 4

Gaydhane Vaibhav Digraj  
RollNo : AI20MTECH11002

**Abstract**—This document solves the isosceles triangle problem.

Download all latex-tikz codes from

[https://github.com/Vaibhav11002/EE5609/tree/master/Assignment\\_4](https://github.com/Vaibhav11002/EE5609/tree/master/Assignment_4)

## 1 PROBLEM

Prove that sides opposite to equal angles of a triangle are equal.

## 2 SOLUTION

Let's consider  $\triangle ABC$  where  $\angle ABC = \angle ACB = \theta$ ,

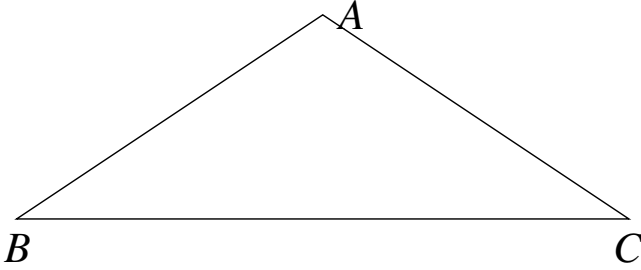


Fig. 2: Triangle by Latex-Tikz

Taking the inner product of sides  $AB, BC$  and sides  $CA, BC$ .

$$(\mathbf{A} - \mathbf{B})^T (\mathbf{B} - \mathbf{C}) = \|\mathbf{A} - \mathbf{B}\| \|\mathbf{B} - \mathbf{C}\| \cos \theta \quad (2.0.1)$$

$$(\mathbf{A} - \mathbf{C})^T (\mathbf{B} - \mathbf{C}) = \|\mathbf{A} - \mathbf{C}\| \|\mathbf{B} - \mathbf{C}\| \cos \theta \quad (2.0.2)$$

The cosine from the both the equations is,

$$\Rightarrow \cos \theta = \frac{(\mathbf{A} - \mathbf{B})^T (\mathbf{B} - \mathbf{C})}{\|\mathbf{A} - \mathbf{B}\| \|\mathbf{B} - \mathbf{C}\|} \quad (2.0.3)$$

$$\Rightarrow \cos \theta = \frac{(\mathbf{A} - \mathbf{C})^T (\mathbf{B} - \mathbf{C})}{\|\mathbf{A} - \mathbf{C}\| \|\mathbf{B} - \mathbf{C}\|} \quad (2.0.4)$$

Equating (2.0.3),(2.0.4)

$$\frac{(\mathbf{A} - \mathbf{B})^T (\mathbf{B} - \mathbf{C})}{\|\mathbf{A} - \mathbf{B}\|} = \frac{(\mathbf{A} - \mathbf{C})^T (\mathbf{B} - \mathbf{C})}{\|\mathbf{A} - \mathbf{C}\|} \quad (2.0.5)$$