# EE5609 Assignment 5

Vimal K B
Roll No - AI20MTECH14002

***Abstract*—This assignment involves proving the equivalence of 2 lines that are formed inside an isosceles triangle because of certain given conditions via vector representation.**

Download all latex-tikz codes from

https://github.com/vimalkb007/EE5609/tree/master/Assignment_5

## 1 Problem Statement

In an isosceles $\triangle ABC$ with $AB = AC$, D and E are points on $BC$ such that $BE = CD$. Show that $AD = AE$.

## 2 Solution

In the given $\triangle ABC$, let $D$ and $E$ be any arbitrary points on the side $BC$ such that $\mathbf{BE} = \mathbf{CD}$.

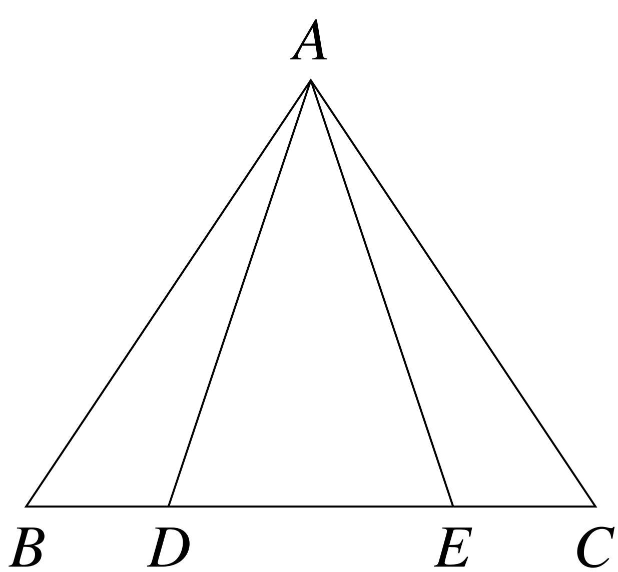


Fig. 1: Isosceles Triangle with sides AB = AC

We are given that the sides $AB = AC$, and $BE = CD$. These two can be represented as

$$(\mathbf{A} - \mathbf{B}) = (\mathbf{A} - \mathbf{C}) \tag{2.0.1}$$

$$(\mathbf{E} - \mathbf{B}) = (\mathbf{C} - \mathbf{D}) \tag{2.0.2}$$

The vectors $\mathbf{AD}$ and $\mathbf{AE}$, can be represented as

$$(\mathbf{A} - \mathbf{D}) = (\mathbf{A} - \mathbf{B}) + (\mathbf{D} - \mathbf{B}) \tag{2.0.3}$$

$$(\mathbf{A} - \mathbf{E}) = (\mathbf{A} - \mathbf{C}) + (\mathbf{C} - \mathbf{E}) \tag{2.0.4}$$

From (2.0.2), we can further write it as

$$(\mathbf{E} - \mathbf{B}) = (\mathbf{D} - \mathbf{B}) + (\mathbf{E} - \mathbf{D}) \tag{2.0.5}$$

$$(\mathbf{C} - \mathbf{D}) = (\mathbf{C} - \mathbf{E}) + (\mathbf{E} - \mathbf{D}) \tag{2.0.6}$$

From equations (2.0.2), (2.0.5) and (2.0.6) we can equate the L.H.S and get

$$(\mathbf{D} - \mathbf{B}) = (\mathbf{C} - \mathbf{E}) \tag{2.0.7}$$

Comparing equations (2.0.1), (2.0.3), (2.0.4) and (2.0.7), We see that the R.H.S components are getting equated to each other, then we can equate the L.H.S as well

$$(\mathbf{A} - \mathbf{D}) = (\mathbf{A} - \mathbf{E}) \tag{2.0.8}$$

Therefore, we can say that $AD = AE$.