Matrix Theory EE5609 - Assignment 3
Find if a triangle is isosceles triangle.

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***Abstract*—This document provides a solution for finding if a traingle is isosceles given two equal altitudes of the triangle**

I. Problem Statement

BE and CF are two equal altitudes of a triangle ABC. Prove that the triangle ABC is isosceles.

II. Solution

Given that BE and CF are two equal altitudes of a triangle ABC.

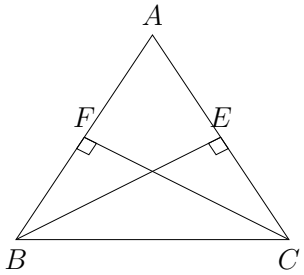

Fig. 1: Triangle with equal altitudes on two sides

Given that ,

$$\|(\mathbf{B}-\mathbf{E})\| = \|(\mathbf{C}-\mathbf{F})\| \tag{1}$$

$$\|(\mathbf{B}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{E})\| = \|(\mathbf{C}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{F})\| \tag{2}$$

$$\|(\mathbf{B}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{B})\| + \|(\mathbf{B}-\mathbf{E})\| = \|(\mathbf{C}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{C})\| + \|(\mathbf{C}-\mathbf{F})\| \tag{3}$$

$$\|(\mathbf{B}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{B})\| = \|(\mathbf{C}-\mathbf{A})\| + \|(\mathbf{A}-\mathbf{C})\| \tag{4}$$

$$2 \times \|(\mathbf{B}-\mathbf{A})\| = 2 \times \|(\mathbf{C}-\mathbf{A})\| \tag{5}$$

$$\|(\mathbf{B}-\mathbf{A})\| = \|(\mathbf{C}-\mathbf{A})\| \tag{6}$$

Therefore, the sides AB and AC of the $\triangle ABC$ are of the same magnitude. Hence $\triangle ABC$ is an isosceles triangle with equal sides AB and AC.