

Assignment 4

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Abstract—This document uses the concepts of Intercept theorem, Isosceles triangle in proving a statement.

Download the python code from

https://github.com/Sairam13001/AI5006/blob/master/Assignment_2/assignment_2.py

and latex-tikz codes from

https://github.com/Sairam13001/AI5006/blob/master/Assignment_2/assignment_2.tex

1 PROBLEM

D is a point on side BC of a $\triangle ABC$ such that $\frac{BD}{CD} = \frac{AB}{AC}$. Prove that \overline{AD} is the bisector of $\angle BAC$

2 EXPLANATION

If two sides of a triangle are equal, then the corresponding angles are also equal.

$$\triangle ABC, \overline{AB} = \overline{AC} \implies \angle ABC = \angle ACB \quad (2.0.1)$$

From The Intercept or Thales' theorem, we can infer that - Lines cutting intercepts in equal ratio on two intersecting lines are parallel.

3 SOLUTION

Given that :

$$\frac{BD}{CD} = \frac{AB}{AC} \quad (3.0.1)$$

Extend \overline{BA} to E such that $\overline{AE} = \overline{AC}$. From properties of Isosceles triangle we can say that,

$$\overline{AE} = \overline{AC} \implies \angle AEC = \angle ACE \quad (3.0.2)$$

Using equation 3.0.2, we can re-write equation 3.0.1 as :

$$\frac{BD}{CD} = \frac{AB}{AE} \quad (3.0.3)$$

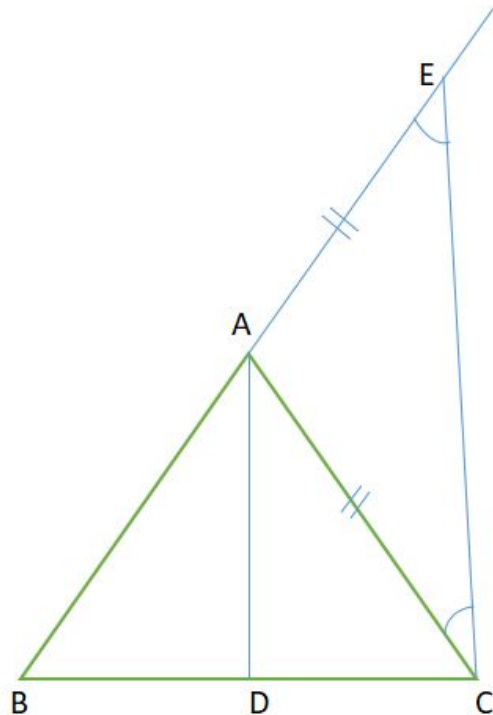


Fig. 0: Construction

From Thales' theorem, we can now say that :

$$\overline{AD} \parallel \overline{EC} \quad (3.0.4)$$

Consecutive Interior Angles :

$$\angle CEA = \angle DAB \quad (3.0.5)$$

Alternate Interior Angles :

$$\angle ECA = \angle CAD \quad (3.0.6)$$

But We already know that :

$$\angle CEA = \angle ECA \quad (3.0.7)$$

So,

$$\angle DAB = \angle DAC \quad (3.0.8)$$

Hence it is proved that AD is the bisector of $\angle BAC$