Angle Bisectors in a Triangle

ID: 8892

Time required
40 minutes

Topic: Triangles and Their Centers

- *Use inductive reasoning to postulate a relationship between an angle bisector and the arms of the angle.*
- *Apply the Angle Bisector Theorem and its converse.*

Activity Overview

In this activity, students will explore the relationships between an angle bisector and segments in a triangle. They will determine the distances from an angle bisector to the sides of the bisected angle. In a triangle, proportional relationships occur when an angle bisector divides the opposite side into two parts.

Teacher Preparation

This activity is designed to be used in a high school or middle school geometry classroom.

- *The Angle Bisector Theorem states:*
  "If a point is on the bisector of an angle, then it is equidistant from the sides of the angle.
- *In a triangle, when an angle bisector divides the opposite side into two parts, the segments created are proportional to the adjacent sides. For the diagram used in Problem 2, the following proportions are both true:*

$$\frac{BD}{AB} = \frac{CD}{AC} \quad \text{and} \quad \frac{BD}{CD} = \frac{AB}{AC}$$

- *The screenshots on pages 1–4 demonstrate expected student results.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "8892" in the quick search box.***

Classroom Management

- *This activity is designed to be **teacher-led**, with breaks for individual student work. Use the following pages to present the material to the class and encourage discussion. Students will follow along using their graphing calculators.*
- *The student worksheet helps guide students through the activity and provides a place for students to record their answers and observations.*

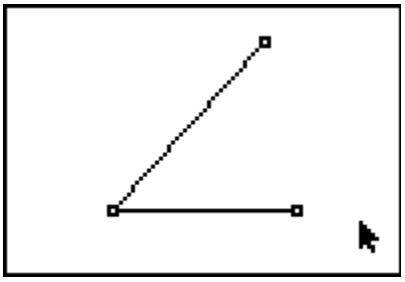
TI-84 Plus Applications

Cabri Jr.

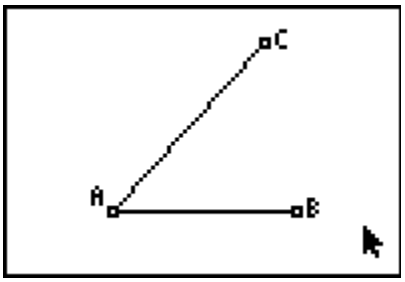
Problem 1 – The Angle Bisector Theorem

Students should open a new Cabri Jr. file.

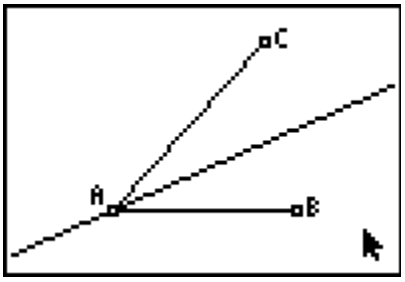
They should first use the **Segment** tool to construct an angle formed by two segments with a common endpoint.



Select the **Alph-Num** tool to label the angle $\angle BAC$ as shown. (Press ENTER to start the label, then press ENTER again to end the label.)

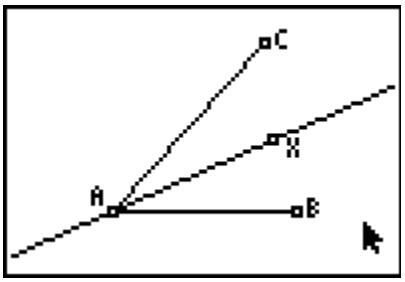


Next, have them construct the angle bisector of $\angle BAC$ using the **Angle Bis.** tool.



Direct students to place a new point on the angle bisector with the **Point > Point On** tool.

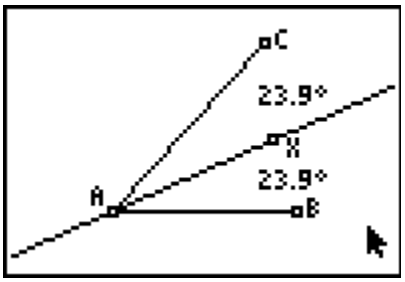
Label this point *X*.



Have students measure angles $\angle BAX$ and $\angle CAX$ using the **Measure > Angle** tool.

Drag point *B* or *C* and observe the results. Ask: *Does your observation confirm the definition of an angle bisector?*

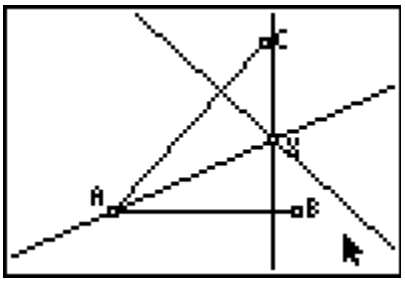
If desired, hide the angle measures with the **Hide/Show** tool (**Hide/Show > Object**).



The distance from point *X* to the sides of the angle must be measured perpendicularly.

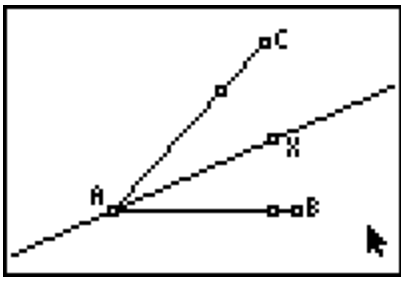
Students will construct a line perpendicular to $\overline{AB}$ through *X* with the **Perp.** tool.

Repeat to construct a line perpendicular to $\overline{AC}$. through *X*



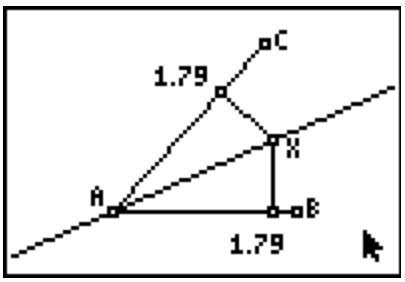
Students should use the **Point > Intersection** tool to place points at the intersection of $\overline{AB}$ and its perpendicular line and the intersection of $\overline{AC}$ and its perpendicular line.

Hide the perpendicular lines (**Hide/Show > Object**).

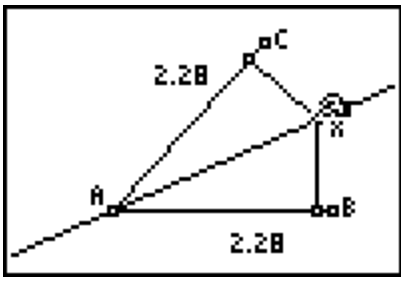


Have students use the **Segment** tool to connect *X* to each intersection point.

Measure the lengths of each segment using the **Measure > D. & Length** tool.

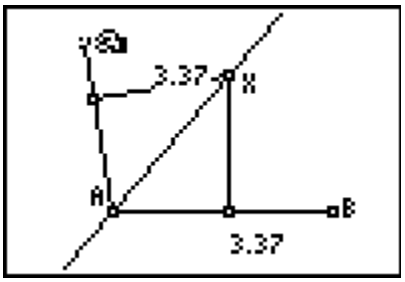


Students should drag point *X* and observe the changes in the measurements.



Then drag point *B* or *C* to change the size of the angle and observe the results.

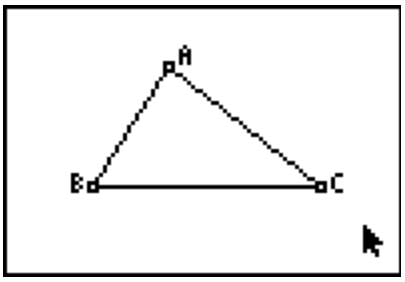
Record observations on the worksheet.



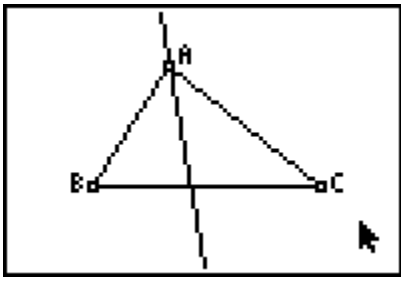
Problem 2 – One Angle Bisector in a Triangle

Students should open a new Cabri Jr. file.

With the **Triangle** tool, construct a triangle. Label its vertices *A*, *B*, and *C* with the **Alph-Num** tool.

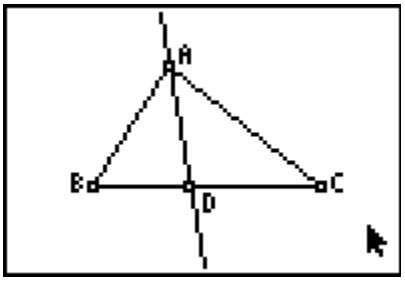


Students are to construct the angle bisector of $\angle BAC$ using the **Angle Bis.** tool.



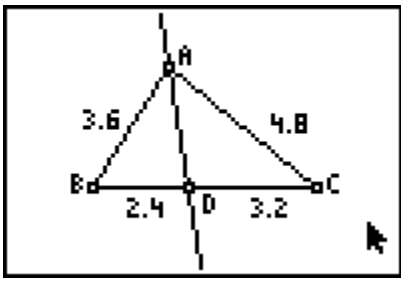
Have students plot the intersection point of the angle bisector and side $\overline{BC}$.

Label this point *D*.



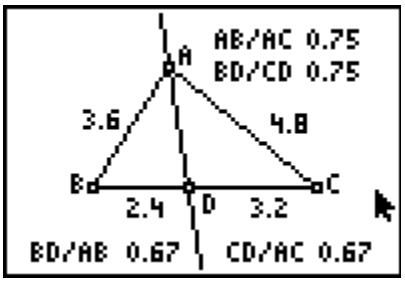
Direct students to measure the lengths of $\overline{AB}$, $\overline{AC}$, $\overline{BD}$, and $\overline{CD}$ using the **Measure > Length** tool.

Record these values on the worksheet. Drag a vertex of the triangle and record more data.



Have students use the **Calculate** tool to calculate ratios of the measurements.

Divide pairs of the measurements. Examine the ratios that result.



Drag a vertex of $\triangle ABC$ and examine the ratios again. What do you notice?

Ask students to identify a pair of ratios that are equal. Then have them drag a vertex of the triangle to see if the equalities remain true.

Record observations on the worksheet.