Hanging with the Incenter

ID: 11360

Time Required
45 minutes

Activity Overview

In this activity, students will explore the perpendicular bisector theorem and discover that if a point is on the perpendicular bisector of a segment, then the point is equidistant from the endpoints. This is an introductory activity, but students will need to know how to grab and move points, measure lengths, and construct the perpendicular bisector with Cabri Jr.

Topic: Triangles & Their Centers

- *Angle Bisector Theorem*
- *Incenter*

Teacher Preparation and Notes

- *This activity was written to be explored with the Cabri Jr. on the TI-84.*
- *Before beginning this activity, make sure that all students have the Cabri Jr. application, and the Cabri Jr. file AngBis.8xv loaded on their TI-84 calculators.*
- ***To download the Cabri Jr. file and student worksheet, go to education.ti.com/exchange and enter "11360" in the keyword search box.***

Associated Materials

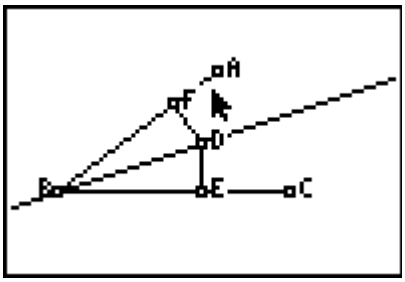
- *HangingWithTheIncenter_Student.doc*
- *AngBis.8xv*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Circumcenter and Incenter (TI-84 Plus family) — 4616*
- *Incenter of a Triangle (TI-84 Plus family) — 6861*
- *Inscribing a Circle in a Triangle (TI-84 Plus family) — 6867*

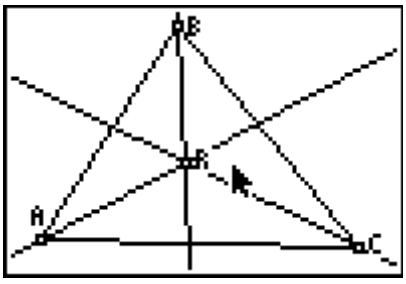
Problem 1 – Exploring the Angle Bisector Theorem



Students will be exploring the distance from a point on the angle bisector to the segment. They will discover that if a point is on the angle bisector of an angle, then it is equidistant from the two segments of the angle.

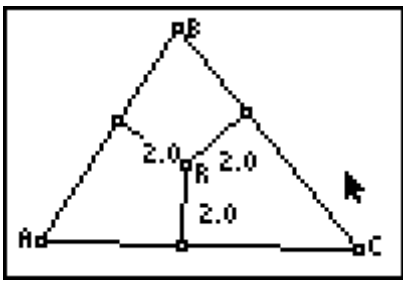
Students will measure the lengths of segments using the **Distance & Length** tool (press GRAPH and select **Measure > D.&Length**). To drag a point, students will move the cursor over the point, press ALPHA, move the point to the desired location, and then press ALPHA again to release the point.

Problem 2 – Exploring the Incenter of a Triangle



Students will need to open a new *Cabri Jr.* file by pressing Y=, selecting **New**, and answer **no** if asked to save.

Students are to create an acute triangle and find the angle bisector of all three angles of the triangle. Students should realize that they are concurrent and answer Questions 4–8 on the accompanying worksheet.



Students will need to find the distance from the incenter to the 3 sides of the triangle. Students may need to be reminded how to find the distance from a point to a line or segment. It is the perpendicular distance from the incenter to the side. Teachers should encourage the students to hide their angle bisectors. Be sure that all students understand that the perpendicular line created from the incenter to a side of the triangle is not the perpendicular bisector.

Students should discover that all of these distances are equal.

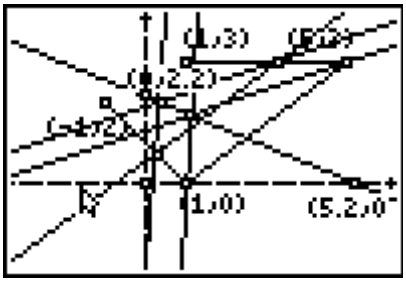
Problem 3 – Extension

Problem 3 is an extension of this activity. Students will use the handheld and the angle bisectors to find the coordinates of fence posts on a plot of land. Note: This problem will be very hard for the average student.

Students must first set up coordinates for the 2 fences at (–1, 2), (1, 0), (1, 3), and (5, 3). Next, students should create segments for the two fences. From here, there are several approaches to solving this problem.

Using the Incenter:

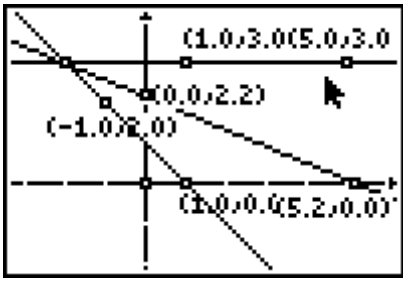
One approach is to find the incenter of the triangle formed by the intersection of the two fences (over the pond) and a segment joining the two fences. Students should construct a segment from (1, 0) to (5, 3) connecting the two fences. This is to create two angles that they can use to find angle bisectors. The point of intersection of the two angle bisectors is the incenter of the triangle. This point is therefore equidistant from the two fences.



However, we need two points to determine the line where the fence will be. Students will need to create a similar triangle that connects the two fences. To guarantee similarity, choose a segment that is parallel to the segment joining (1, 0) and (5, 3) using the **Parallel** tool (**Press** ZOOM, then scroll down to **Parallel**). Find the incenter of the second triangle and you can create the line through those two incenters. One point on the line should be at (5.24, 0) or (5.2, 0) and the other can be any other point on the line connecting the two incenters. The *y*-intercept is another convenient point to find the coordinates of (0, 2.2).

Using Only an Angle Bisector:

Another approach is to find the point of intersection of the fences (if they were continued over the pond). Students can construct lines for the Fence 1 and Fence 2 and plot the intersection point of the lines. Then, students can use the **Angle Bisector** Tool to find the angle bisector of this angle. This ray will be equidistant from Fence 1 and Fence 2. Students can plot a point on this ray and display and record the coordinates of this point. Then, move the point and record the new coordinates.



Student Solutions

1. Sample answers:

Position	1st position	2nd position	3rd position	4th position
DF	2.25473	2.72284	1.85757	1.12521
DE	2.25473	2.72284	1,85757	1.12521

2. They are equal.

3. Equidistant

4. They are concurrent.

5. Not possible

6. Not possible

7. Obtuse, Acute, and Right

8. They are all equal.

9. Sample answer: (5.2, 0) and (0, 2.2)