**Supplementary Activities**

**Unit 5 Investigation 5**

**Definition of Angle Bisector**

Open the file: http: www.geogebra.org/m/yAzAHMCg

Observe the blue ray that bisects $∠BAC.$

Move each of the sliders and observe what happens.

1. From what you've seen, describe what it means for a **ray** to **bisect** an angle.

 In your description, avoid using the words or phrases *middle, down-the-middle, half*.

2. Use the **Point on Object** tool to plot a point *F* anywhere on the **angle bisector**. Draw a sketch showing what appears on the screen.

3. Use the **Angle** tool to find and display the measure of $∠$*BAF* and $∠$*CAF*. Record your measurements here.

$m∠$*BAF* = \_\_\_\_\_\_\_\_\_\_\_ m$∠$*CAF* = \_\_\_\_\_\_\_\_\_\_\_

4. Do these results agree with your response to question 1?

5. What happens when you slide the slider on the right?

**Properties of Angle Bisectors**

Open the file: <http://tube.geogebra.org/material/simple/id/2506403>

In the applet notice that point *E* is equidistant from the sides of $∠$ *BAC.* Move the purple slider to adjust point *E*'s distance from the sides of the angle*.*  As you do, you'll notice that all possible locations of point *E* will be traced out

1. What does the locus (set) of points in the plane equidistant from the sides of an angle  look like?   *Be specific!*

Now move points *A* and *B* around to change the initial measure of the displayed angle.  After doing so, hit the "clear trace" button to clear the previous traces of *E*. Move the slider again.

2. Does your response for question 1 above still seem valid?

3. Use the measurement tools of GeoGebra to test your conjecture.

4. Use your observations to complete the following statement:

**If a point is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the \_\_\_\_\_\_\_\_\_\_\_\_ of an \_\_\_\_\_\_\_\_\_\_\_\_\_\_, then that   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ lies on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

5. Now prove your conjecture.

Now open the file: <http://tube.geogebra.org/material/simple/id/2506499>

In the applet the **angle bisector** of $∠$ *BAC* is shown.   Point *E* is a point that lies on this angle bisector.  (Feel free to drag it around.) Before completing the directions below, move/drag points *B*, *A,* and/or *C* around to verify that the **pink ray** still remains an **angle bisector** of $∠$ *BAC*.

Use the tools of GeoGebra to measure the distance from *E* to each side (ray) of $∠$ *BAC.*  (Note: It should be obvious to you that this is **not** the same as finding *EB* and *EC*.      Think about what you need to do.)

1. What do you notice?

Now move point *E* along this angle bisector.

1. Does your observation in question 6 still hold true?

Now move points *B*, *A,*and/or *C* around.

8. Does your observation in question 7 still hold true?

9. Use your observations above to complete the following statement:       **If a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ lies on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then that     \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the \_\_\_\_\_\_\_\_\_\_ of that \_\_\_\_\_\_\_\_\_\_\_.**

10. Now prove your conjecture.

**Center of the Circle Inscribed in a Triangle** (aka the “incircle”)

Open the file: <http://tube.geogebra.org/material/simple/id/1468741>

Recall that 3 or more lines are said to be concurrent if and only if they intersect at exactly one point. The angle bisectors of a triangle's 3 interior angles are all concurrent. Their point of concurrency is called the i**ncenter** of the triangle. In the applet below, **point I** is the triangle's i**ncenter**. Use the tools of GeoGebra in the applet to complete the activity. *Be sure to answer each question fully as you proceed.*

Click the checkbox that says "Drop Perpendicular Segments from I to sides. Now, use the **Distance** tool to measure and display the lengths *IG*, *IH*, and *IJ*.

1. What do you notice?

Experiment a bit by moving any one (or more) of the triangle's vertices around.

2. Does your initial observation in question still hold true? Why is this?

Construct a circle centered at I that passes through *G*.

3. What else do you notice?

Experiment by moving any one (or more) of the triangle's vertices around. This circle is said to be the triangle's *incircle*, or *inscribed circle*

4. Explain why this circle is tangent to all three sides.

5. Do the angle bisectors of a triangle's interior angles also bisect the sides opposite theses angles? Use the **Distance** tool to help you answer this question.

6. Is it ever possible for a triangle's incenter to lie outside the triangle? If so, under what condition(s) will this occur?

7. Is it ever possible for a triangle's incenter to lie on the triangle itself? If so, under what condition(s) will this occur?