

**Homework #2: Incircles and Excircles****College Geometry**

In this activity you will carry out some basic constructions using GeoGebra. If you have never used GeoGebra before, don't worry; for what we need it to do, it is fairly straightforward. If you get stuck, ask for help!

Each of the following problems should be constructed on a separate file, and these files should be given descriptive titles **including your name and the activity number**. When you are finished, email the files to me. So I should get four files from you, with names like "Nathan Bloomfield - A1 - construct equilateral triangle.gsp".

Finally, **your constructions must be robust**. Every geometric construction starts with one or more *free elements*; these are points and lines given in the hypotheses of the construction proof. You should be able to **move the free elements around** without destroying your construction.

1. **Construct the bisector of an angle.** Start by placing three free points  $a$ ,  $b$ , and  $o$  and draw rays  $\overrightarrow{oa}$  and  $\overrightarrow{ob}$ . Following the proof we gave in class, construct the bisector of angle  $\angle aob$ .

Make your construction into a GeoGebra tool.

2. **Construct the foot of a point on a line.** Start by placing three free points  $a$ ,  $b$ , and  $p$ , and draw the line  $\overleftrightarrow{ab}$ . Following the proof we gave in class, construct the foot of  $p$  on  $\overleftrightarrow{ab}$ .

Make your construction into a GeoGebra tool.

3. **Construct the incircle of a triangle.** Start by placing three free points  $a$ ,  $b$ , and  $c$ , and draw the sides of triangle  $\triangle abc$ . Following the proof we gave in class, construct (1) the incenter  $o$  of  $\triangle abc$ , (2) the feet of  $o$  on the sides of  $\triangle abc$ , and (3) the incircle of  $\triangle abc$ .

Make your construction into a GeoGebra tool.

4. **Construct the excircles of a triangle.** Start by placing three free points  $a$ ,  $b$ , and  $c$ , and draw the *extended* sides of triangle  $\triangle abc$  – that is, the lines  $\overleftrightarrow{ab}$ ,  $\overleftrightarrow{bc}$ , and  $\overleftrightarrow{ac}$ . Following the proof we gave in class, construct (1) the excenter  $o$  of  $\triangle abc$  at  $a$ , (2) the feet of  $o$  on the extended sides of  $\triangle abc$ , and (3) the excircle of  $\triangle abc$  at  $a$ .

Make your construction into a GeoGebra tool. Use this tool to construct the excircles of  $\triangle abc$  at  $b$  and  $c$ .