

**Homework #1: Basic Constructions****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 an equilateral triangle.** Start by placing two free points  $X$  and  $Y$  in the plane, as well as the segment  $\overline{XY}$ . Following the proof we gave in class, construct two points  $Z_1$  and  $Z_2$ , on the opposite sides of  $\overleftrightarrow{XY}$ , such that  $\triangle XYZ_1$  and  $\triangle XYZ_2$  are equilateral.

Make a GeoGebra tool which constructs an equilateral triangle from two of its vertices.

2. **Copy a line segment.** Start by placing four free points  $X$ ,  $Y$ ,  $O$ , and  $P$  in the plane, as well as the segment  $\overline{XY}$  and the ray  $\overrightarrow{OP}$ . Following the proof we gave in class, construct a point  $Z$  on  $\overrightarrow{OP}$  such that  $\overline{OZ} \equiv \overline{XY}$ .

Make a GeoGebra tool which copies a line segment onto a ray.

3. **Copy an angle.** Start by placing five free points  $A$ ,  $O$ ,  $B$ ,  $P$ , and  $X$  in the plane, as well as the rays  $\overrightarrow{OA}$ ,  $\overrightarrow{OB}$ , and  $\overrightarrow{PX}$ . Following the proof we gave in class, construct two points  $Y_1$  and  $Y_2$ , on opposite sides of  $\overleftrightarrow{OX}$ , such that  $\angle XPY_1 \equiv \angle AOB$  and  $\angle XPY_2 \equiv \angle AOB$ .

Make a GeoGebra tool which copies an angle onto a ray.

4. **Construct a midpoint.** Start by placing two free points  $X$  and  $Y$  in the plane, as well as the segment  $\overline{XY}$ . Construct a point  $Z \in \overline{XY}$  such that  $\overline{XZ} \equiv \overline{ZY}$ . Can you prove that the point you constructed has this property?

Make a GeoGebra tool which constructs the midpoint of a given segment.