MATH 5335 FALL 2009: INSTALLING AND USING GEOGEBRA

This semester you will have a number of "lab assignments" which require you to use GeoGebra, a dynamic geometry program. GeoGebra lets you explore geometric ideas and constructions on your computer. It's free and is written in Java, so it will run on any computer platform which runs Java applets. That includes Windows, Macintosh or Linux computers. You can also run it in a web browser in any computer lab on campus.

The instructions below show you how to install GeoGebra and use some of the tools you'll need to complete your homework assignments. The GeoGebra website has extensive documentation and is a good resource if you need to look something up. You **don't** have to turn anything in based on these instructions; your homework will be posted separately.

1. INSTALLING GEOGEBRA

Use a web browser to go to `http://www.geogebra.org`. The recommended way to install GeoGebra on your own computer is with Webstart. To do this, click the `Webstart` button on the homepage *and* on the next page. This will download GeoGebra to your machine and place an icon on the desktop. If that fails, click `Download` on the home page and follow the directions on that page to get the correct package for your computer.

If you are using GeoGebra on a library computer you can also run it as a java applet by clicking `Webstart` on the homepage and then the `Applet Start` button.

2. GETTING STARTED

When you start GeoGebra, you will see the following window. (This screenshot is from the GeoGebra Quickstart guide, available at the homepage.)
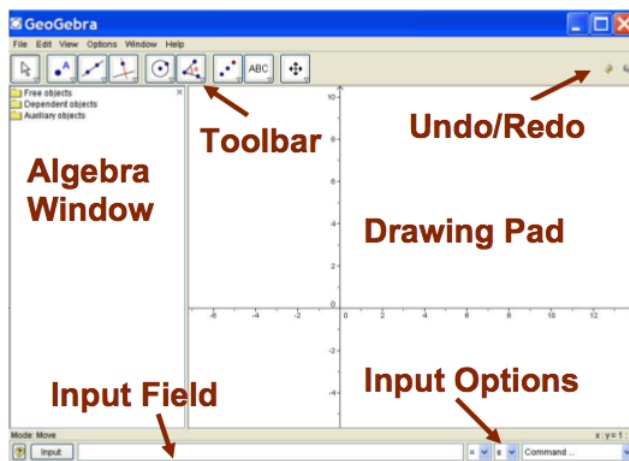

By selecting tools from the Toolbar, you can use your mouse to create things in the Drawing Pad. Equations and coordinates for all of your points, lines, circles, and so on will be displayed in the Algebra Window. You can also use the Input area at the bottom to create things with typed commands instead of using your mouse. Also note the important Undo and Redo buttons!

To see how everything works, try the following steps.

(1) Select the **Point** tool, which looks like a point labeled with the letter A. Click two different locations in the Drawing Pad. GeoGebra will create two points labeled A and B in the Drawing Pad. Their coordinates will also appear in the Algebra Window.

(2) You can also create points with specific coordinates using the Input Field. Type $C = (4, 1)$ in the Input Field – use a capital C! – and you should see a third point appear in the Drawing Pad. If it doesn't work, make sure you typed everything *exactly* as shown, including the round parentheses.

(3) Now click the **Polygon** tool, which is the shaded triangle near the middle of the toolbar. In order, click on A, B, C and A. GeoGebra will create a polygon (in this case, a triangle) using those points

as the corners. Notice GeoGebra automatically creates and labels the edges of the triangle. In the Algebra Window it lists the edges and shows you the side lengths. For example, in the triangle below, the side a which is opposite the point A is 3.06 units long.
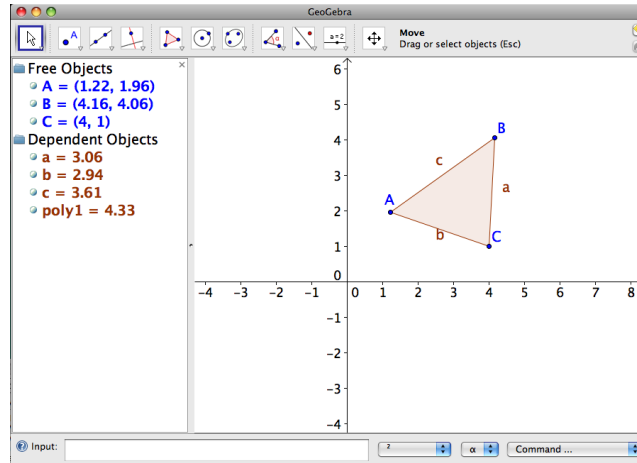
Also notice that GeoGebra has created an object called $poly1$. This is the triangle itself, and its value in the Algebra Window is the polygon's area – 4.33 in this case.

(4) You can create polygons triangles and other shapes without creating the corners first. Still using the **Polygon** tool, click four different places in the Drawing Pad and then one more time at the first point to finish your shape. GeoGebra will create another polygon named $poly2$ and show you its area and its side lengths in the Algebra Window. See below.
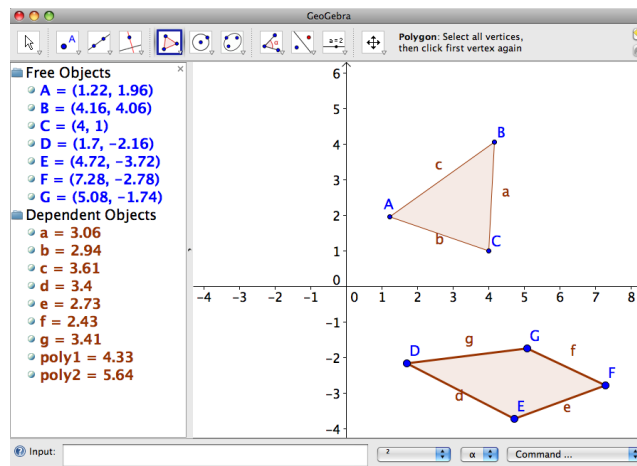
(5) The Algebra Window shows "Free Objects" and "Dependent Objects." The free objects are the ones you created – the seven points in the Drawing Pad. The dependent objects are constructed automatically. The power of GeoGebra is that you can change the free objects and the dependent objects will change automatically. Try it! Choose the **Move** tool (the arrow / mouse cursor on the left of the toolbar), click on point A, and drag it around.

You can also click in the middle of a polygon and drag it around. GeoGebra automatically moves the points and updates their coordinates in the Algebra Window.

Finally, although you won't often need to do this, you can move a point by redefining it in the Input Field. Type $A = (0, 2)$ (or some other coordinates), hit return, and the point and the triangle will be updated.

You may have noticed that the toolbar icons have little arrows on them. If you click on the bottom of these icons you can choose from many more tools. Most of them are fairly self explanatory, and once you've

chosen a tool brief instructions for using it appear to the right of the toolbar. One of your first technology problems requires you to work with lines, rays, and intersections; to practice using those tools try these following steps.

(1) Create a new, empty Drawing Pad by choosing `File > New`.

(2) A ray has a starting point and continues forever in one direction. To create a ray, choose the **Ray through Two Points** tool (which is in the drop down list below the picture of a line; click where you want it to begin, and then click again to show GeoGebra which direction the ray should extend.

(3) In the same drop down menu, choose the **Segment Between Two Points** tool and click on two new points in the Drawing Pad to create a line segment. Then use the **Line Between Two Points** tool to create an infinite line through two more points. Try to make the line cross your segment and your ray. If necessary, use the **Move** tool to move the points around until your picture looks something like this:
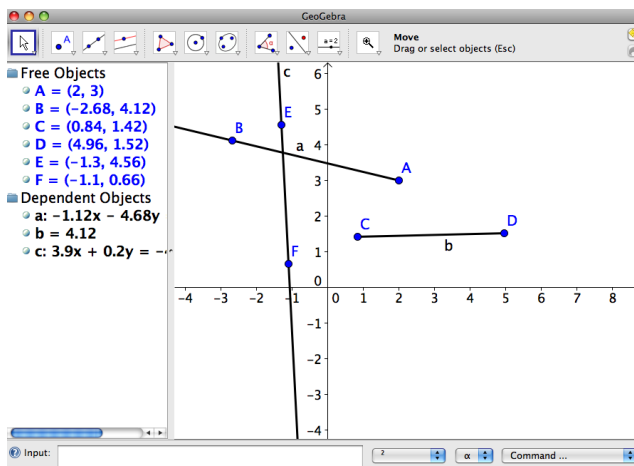
(4) Under the **Point** tool, select the **Intersect Two Objects** tool. Click on your ray and then your line. GeoGebra should create a point G which marks the intersection of the ray and line. G is a dependent object – you can't change it with the **Move** tool. But if you move the ray or line, G will automatically change!

(5) Below the **Perpendicular Line** tool (the fourth icon in the toolbar) is the **Parallel Line** tool. Select it, then click on A and your line through EF. GeoGebra will create a line through A which is parallel to the line. Your Drawing Pad should resemble the following:

3
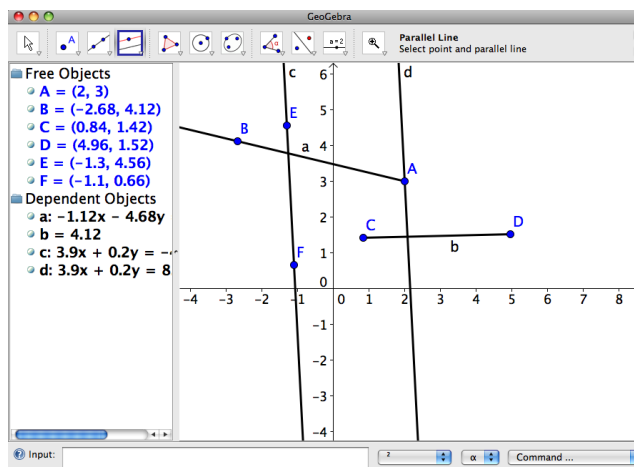
Use the **Move** tool to drag A around and see how the automatically constructed objects (like G or the perpendicular and parallel lines) are updated.

Later in the semester you will need to use some of the more complicated transformation tools in GeoGebra. We'll post additional instructions online as appropriate to help you understand those tools. For now, explore with the simpler tools in the toolbar to see what GeoGebra can do.

3. The Finer Points

To become an advanced GeoGebra user you'll want to learn some of the finer points in this section.

Label, Names and Appearances. As you went through the instructions above, you saw that every new point and line segment was labeled on the screen. Sometimes these labels can cover up a line segment or other object. You can use the **Move** tool to click on labels and drag them around.

If your picture gets too cluttered, you might want to turn off the labels altogether. To do this, right-click on an object and uncheck `Show Label` in the popup menu. Using this menu, you can also hide the object, delete it, or rename it. If you want to avoid clutter in the future, the `View > Labeling` menu gives you different options; for example, you can tell GeoGebra to label all new points, but not the sides of any polygons you create with them.

Right-click on a side of a polygon and choose `Object Properties`.[1] This window lets you change a number of things:

- Under `Basic` you can turn off the label or have GeoGebra display the value of the side (i.e. its length) instead of its name. (Or both!) You can also have GeoGebra show a Caption which you type in the field above.
- Use the `Color`, `Style` and `Decoration` menus to change how the object looks. Note that if you want to change all of the sides of a polygon, you should select the polygon itself (perhaps under the "Triangle" or "Quadrilateral" drop down lists on the left of the Object Properties window). Any changes you make the style of a shape will be inherited by its edges.

Grid and Axes. . Under the `View` menu you can turn the Axes and a Grid on and off. For most of your constructions you don't need to use coordinates, so you'll generally want to turn both of them off.

Shortcuts. A few of the most-used tools have keyboard shortcuts. `Esc` will always return you to the **Move** tool. `Shift+Click and Drag` on the Drawing Pad will slide the entire pad around. If your mouse has a scroll wheel, you can scroll up and down to zoom out and in.

Printing. Many of the technology problems will ask you to print a sample of your GeoGebra work. You can print a copy of the Drawing Pad from the `File` menu.

Screenshots. You can use the `File > Export` menu to copy the graphics in your Drawing Pad to the clipboard. Then you can paste it into an email (if you're required to send me a picture to get credit for the assignment) or into another application, like a word processor. You can also use this menu to save your Drawing Pad to a graphics or PDF file.

---

[1]If you can't right-click with your mouse, you can go to `Object Properties` in the Edit menu and choose the side by clicking on its label in the resulting list.