Introduction to GeoGebra:

GeoGebra makes Algebraic Geometry easy to visualize. Algebraic Geometry is Geometry and a liberal dose of Algebra. It makes it easy to talk about numbers and shapes, which is really handy when you want to work on proofs or come up with exact results. However, the interface of GeoGebra isn't entirely friendly.

The Interface

The bar across the top has 11 icons. Each icon represents a group of similar tasks. Just click the downward facing triangle to see the entire task group. Lines and segments are grouped under the same icon, and creating points and points of intersection share the same space. Once you select a task, text appears to the right of the icon bar to tell you how to use that function. For example, if you select "Line through two points", it tells you how to use it "Select two points." This will save you tons of fruitless clicking.

Dependent Vs Free Objects

Free Objects are lines, points or other object that you defined. These can be moved anywhere and manipulated in any way. Dependent Objects are less 'objects' in the traditional sense and more a statement of the relationship between Free Objects. For instance, if you have free two points A (-1,2) and B(4,2), you might have a dependent object, line *l* which is between A and B. If you get rid of point A, line *l* will also disappear. Dependent Objects rely on Free Objects.

Input

Last section: The input bar at the bottom can be a shortcut to entering in either algebraic equations or keywords. y =3x + 1 gives you a line, and e = Segment[A, B] gives you a new segment e between points A and B. This is faster and more precise than placing points manually. If you can't remember a keyword, try typing one: it will suggest options, and hit enter to auto complete. Another option: double click on an object you created and see the keywords it uses.

- **Here are your tasks:**
  Insert points A (-2, 2), B(-1, 0), Origin(0,0) and C(-1.74,3.9).
  Create a Triangle DEF D(-0.61, 2.74), E(0, 2) and F(0, 3).
  Reflect every shape over the line x = 0.

  What does you result sort of look like? (Drag the point named Origin around to get a better idea.)

  Look at the naming conventions (the typical way something is named). Look for patterns where they get upper case, lower case, italic, bold etc. What naming conventions do you see? (focus on points, line segments, polygons and reflections)

<u>Save</u> the previous exercise, then start a new one (Apple + N, or File >> New Window).

- **Thinking about Proof:**

GeoGebra can be used to 'build' proofs. It cannot prove things for you, but can help you think how to do the proof.

Create two parallel lines *a, b*. Create a line *c* that is perpendicular to *a* at point P. Measure each of the resulting angles between *a* and *c.* (You should notice that all those angles are right). Measure the resulting angles between *b* and *c.* What do you notice about these angles? Move the lines and Point P around. Focus on the angles.

Try to write what you just figured out in the form of a conditional (if-then) statement.

<u>Save</u> the previous exercise, then start a new one (Apple + N, or File >> New Window)

- **Still Thinking about Proof:**

Think back to Algebra and recall that the equations of lines take the form of y = mx + b. m is the slope, and b in the y intercept.

What you need to investigate is: how do the slopes of parallel lines compare (different, same, always off by one, a multiple of the other, etc) and how do the slopes of perpendicular lines compare? Use GeoGebra to create parallel and perpendicular lines, and look at their equations to form your conclusions.

IF you need help, ask me and I can give you a more structured walkthrough.

Write a conditional about the relationship you observe between the slope of parallel lines.

Write a conditional about the relationship you observe between the slope of perpendicular lines.

- **Challenge:**

(This is optional. However, your other option is a worksheet, and doing these, at any level is impressive.)

Construct a line *a*. Place another point B, not on *a.* Create a line *l,* through B, parallel to *a.*

1) How many lines can you construct through B, parallel to *a?*

2) Imagine constructing multiple lines through B, parallel to *a.* Draw a sketch or describe what happens to the lines to that they remain parallel while passing through that point?

3) Imagine lines on the globe. How many parallel lines can you construct? (Try to think that is critical about lines.)