

# MATH 341—FALL 2011

## ASSIGNMENT 6

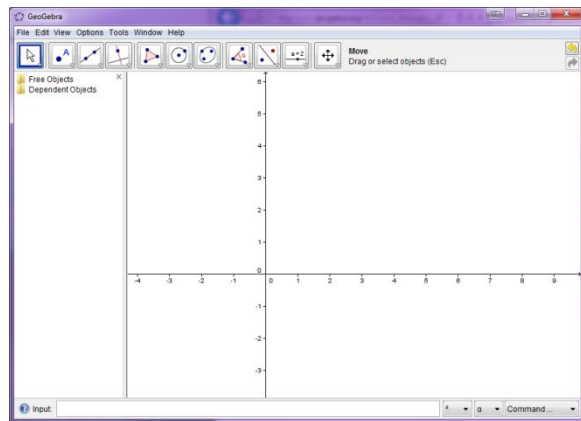
October 3, 2011

Open the document *Getting Started with GeoGebra* and follow the instructions either to download and install it on your computer or to run it as a *Webstart* application.

You are going to be creating a triangle and the four triangle centers and it will be individualized to you.

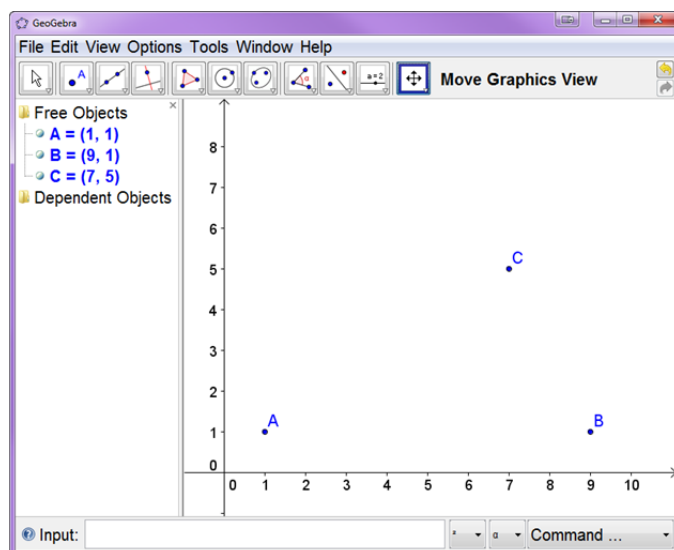
Start with your UKID number and taking the first six digits create three points in the first quadrant. If these three points are not distinct or are collinear, use more digits from your UKID, then from your driver's license number and finally from your SSN. By the time you have gone through those numbers, you should have three distinct, non-collinear points.

Open *GeoGebra*. It should open up in the view similar to Figure 1, with the Algebra View on the left and the plane with a set of axes on the right. Choose the Move Graphics View button and move your plane so that it shows mostly the first quadrant in your window.



You want to enter your three points into *GeoGebra*. Here  $A = (1,1)$ ,  $B = (9,1)$ , and  $C = (7,5)$ . To make sure you have your points, exactly, you will want to enter them into the Input window. These points were entered as  $(1,1)$ , then  $(9,1)$  and  $(7,5)$ .

Note that in the Algebra View you have a listing of the points and their coordinates.

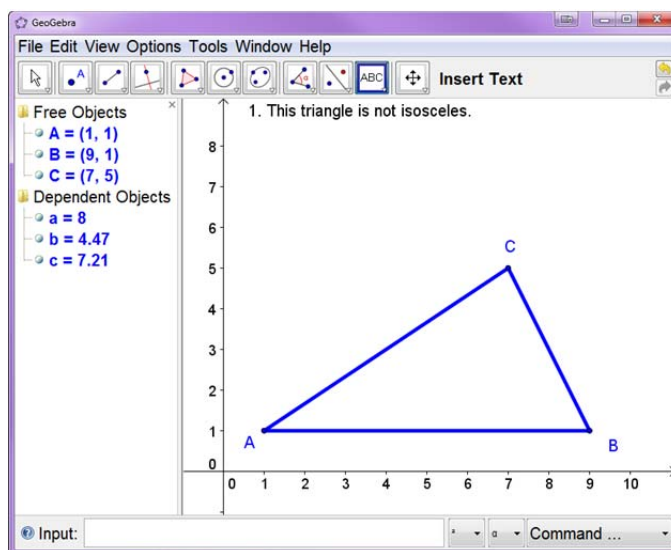
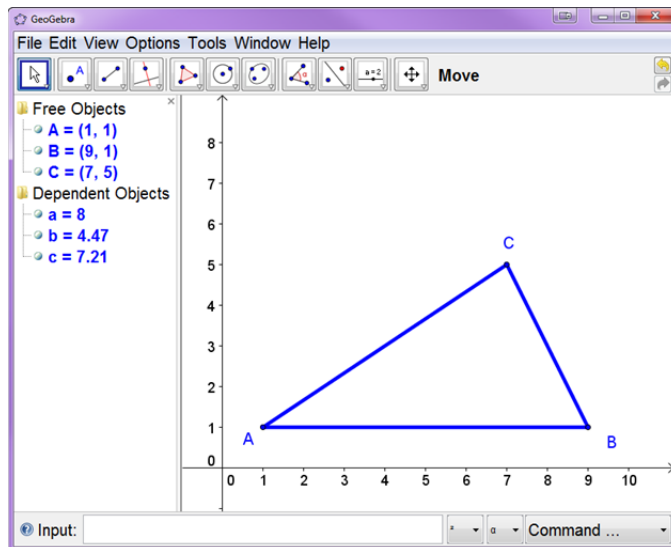


Next choose the Line between Two Points tool and choose *Segment between Two Points* and construct the segments  $AB$ ,  $BC$ , and  $CA$ . You can now see that *GeoGebra* has indicated the lengths of your line segments in the Algebra View.

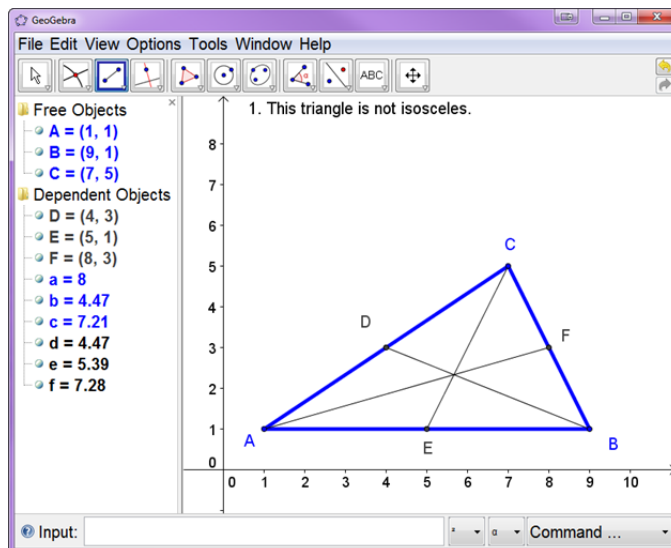
**QUESTION 1: Is your triangle isosceles? Is it an equilateral triangle?**

You can answer this question directly on the *GeoGebra* worksheet using Insert Text tool. Choose the tool, next to the last on the right, and choose *Insert Text*. Click on a spot in the Graphics View that

will allow you to enter your answer to this question without having the answer get in the way of the diagram. An entry box will open up and you can type in "1. The triangle is ...".

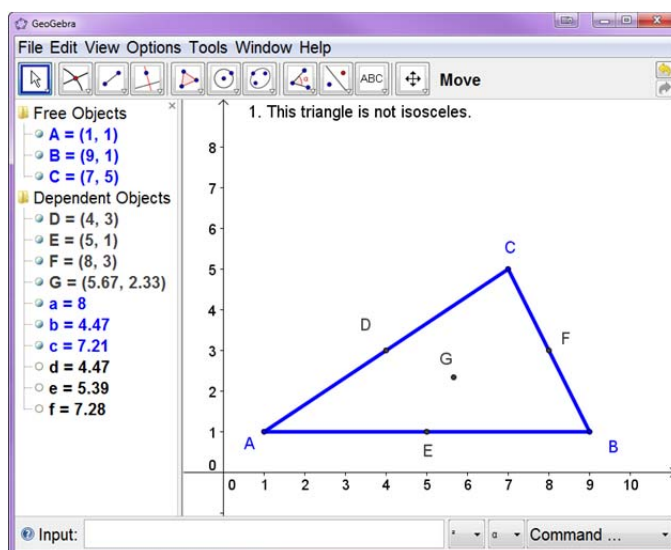


Now you want to find the *centroid* of your triangle. Choose the New Point tool and then choose *Midpoint or Center* within that menu. Then check on each of the three segments to find the midpoints of the three segments. These will most likely be labeled as D, E, and F. Now, construct your medians.

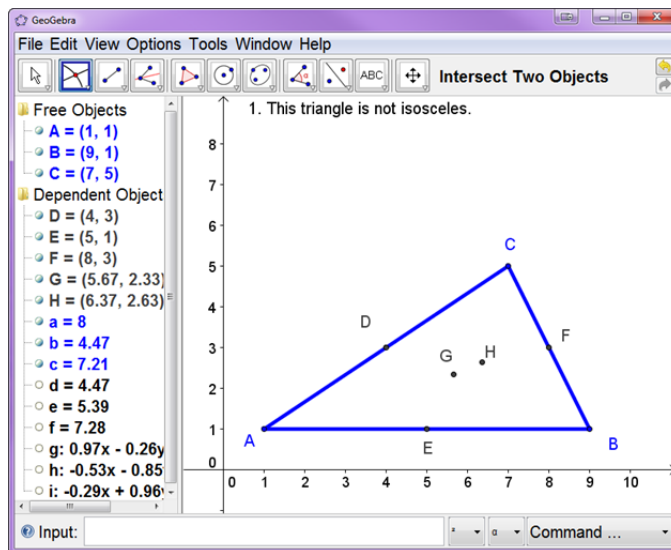


Now choose the second button (New Point tool) and choose the *Intersect Two Objects*. Click on two of the medians and you will get the Centroid and its coordinates. Hide your medians by clicking on the radio buttons next to the labels for your medial segments.

**QUESTION 2:** *Using the information from class, compute the centroid of your triangle? Do you get the same answer as GeoGebra? (If not, check that your points are correct and not just approximates.)*



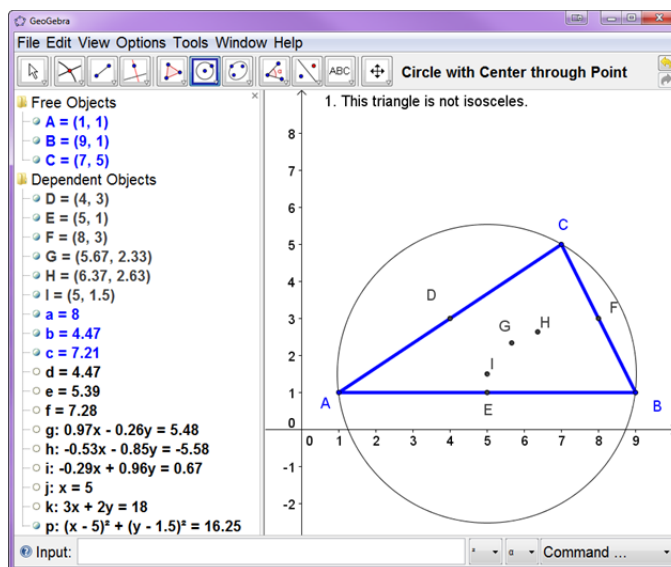
Next, we want to find the *Incenter* of the triangle. This means we need the Angle Bisectors from the Perpendicular Line tool and then *Angle Bisector*. Using the same process as above, find the *Incenter* and its coordinates. Find the inradius of your triangle.



**QUESTION 3:** What are the coordinates of the incenter of your triangle? What is the inradius of your triangle.

Next, find the *Circumcenter* of the triangle, the circumcircle and the equation of the circumcircle. For the circumcenter you need the perpendicular bisectors of the sides and you need to choose the Perpendicular Line tool and choose *Perpendicular line*. After finding the Circumcenter and hiding the perpendicular bisectors, choose the Circle with Center through Point tool and construct the circumcircle. You will see near the bottom of Algebra View an equation for the circle. For this triangle we get that the equation of the circle is

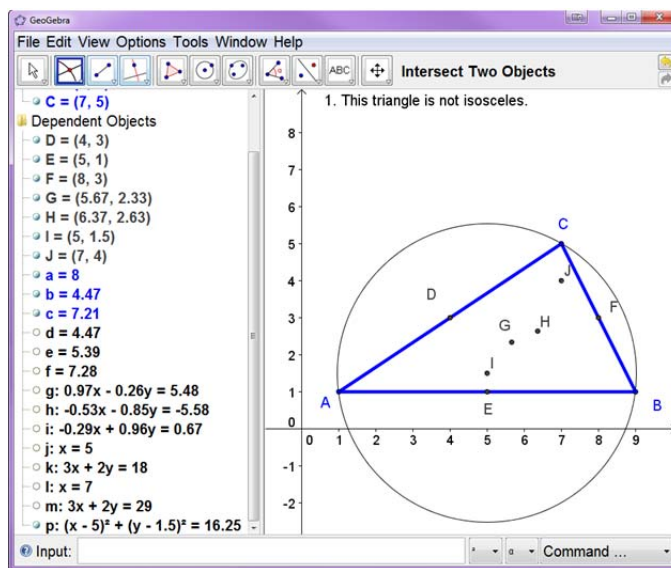
$$(x-5)^2 + \left(y - \frac{3}{2}\right)^2 = \frac{65}{4}.$$



**QUESTION 4:** What are the coordinates of the circumcenter of your triangle? What is the equation of the circumcircle? What is the circumradius of your triangle?

Now find the *Orthocenter* of the triangle. For the orthocenter you need the altitudes. After finding the Orthocenter and hiding the altitudes, find the coordinates of the Orthocenter. Also, check that the slopes of the altitudes are the negative reciprocals of the slopes of the appropriate sides.

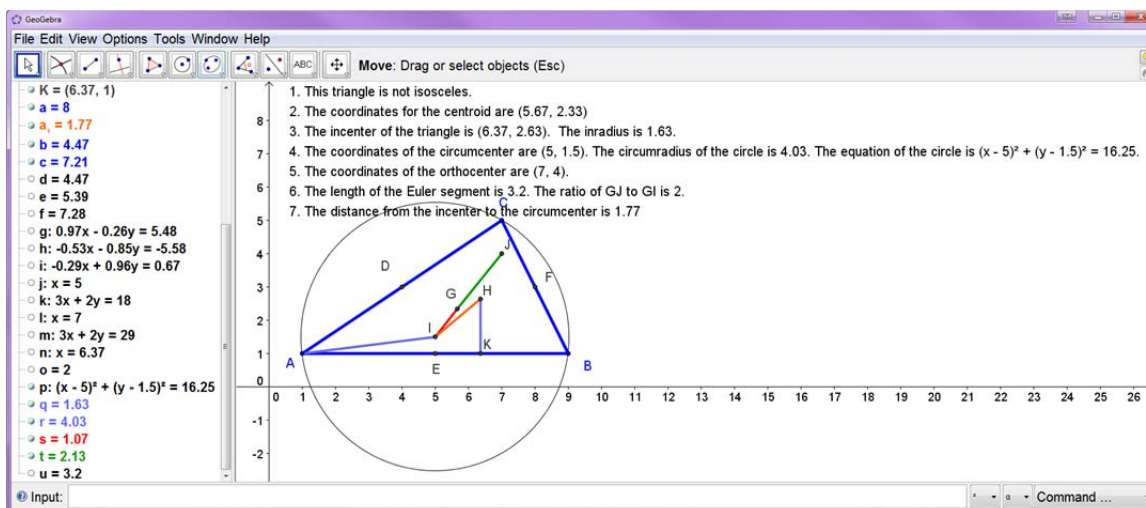
**QUESTION 5:** *What are the coordinates of the orthocenter of your triangle? What are the slopes of the lines that contain the sides of your triangle? What are the slopes of the lines of your altitudes?*



Now, construct the Euler segment of your triangle. What is the length of the Euler segment.

**QUESTION 6:** *What is the length of the Euler segment? What is the length of the segment from the circumcenter to the centroid? What is the length of the segment from the orthocenter to the centroid? Is their ratio correct in your triangle?*

**QUESTION 7:** *What is the length of the segment from the circumcenter to the incenter? Is this consistent with the formula that we have for the distance from the circumcenter to the incenter?*



Choose File ... Save As... and name the file with LastnameFirstname.ggb. Upload the *GeoGebra* file to Blackboard.