Lesson Plan for Geometry Labs

Name: Kari Slone **Dates**: 03/07/06-03/09/06

Grade: High School **Subject**: Geometry **# of Students**: ~27 **# of IEP Students**: Zero

Major Content: Triangle Inequality Theorem, Hinge Theorem, Centroids **Unit Title**: Labs

Goals and Objectives:

1.) To understand and use the Triangle Inequality Theorem in a WinGEOM real-life situation.
2.) To understand and use the Hinge Theorem in a WinGEOM real-life situation.
3.) To understand the concept of a Centroid in a WinGEOM application.
4.) My goal for the lesson was to have ninety percent of the students get a B or better on each of the three labs; which will be graded for accuracy, neatness, and correct responses.

Connections:

Kentucky Learner Goals and Academic Expectations:

- ✓ **1.5 – 1.9**: Students use mathematical ideas and procedures to communicate, reason, and solve problems.
- ✓ **1.16**: Students use computers and other kinds of technology to collect, organize, and communicate information and ideas.
- ✓ **2.7**: Students understand number concepts and use numbers appropriately and accurately.
- ✓ **2.8**: Students understand various mathematical procedures and use them appropriately and accurately.
- ✓ **2.9**: Students understand space and dimensionality concepts and use them appropriately and accurately.
- ✓ **2.10**: Students understand measurement concepts and use measurement appropriately and accurately.

Core Content:

- ✓ **MA-H-2.1.2**: Students will define, describe properties of, give examples of, and apply to both real-world and mathematical situations spatial relationships such as betweenness, parallelism, and perpendicularity.
- ✓ **MA-H-2.1.3**: Students will define, describe properties of, give examples of, and apply to both real-world and mathematical situations angle relationships such as linear pairs, vertical, complementary, supplementary, corresponding, and alternate interior angles.
- ✓ **MA-H-2.2.5**: Students will apply the concepts of congruence and similarity to solve real-world and mathematical problems (not including proofs).

Context:

The Triangle Inequality lab will be helpful so that students can rationalize the physical applications of how and why triangles can or cannot exist. The Hinge Theorem lab will help students recognize the fact that the largest interior angle of a triangle always reflects to the

largest side of the triangle. The Centroid lab will help students understand what a Centroid is, where, and why it is located in a triangle.

Resources:
Calculators are optional.
Scratch paper for the laboratory exploration is optional.
Pencils for answering the provided questions on the lab handouts are required.
The computer program WinGEOM, where the students will actually build the requested figures, will be used in the computer lab.

Procedures:
The first day will start with the teacher taking attendance in his regular classroom. After attendance is taken, the class will quietly walk to the computer lab and sit in their seats waiting to receive their laboratory explanations. The students will then receive the appropriate directions as to how to go about accomplishing the Triangle Inequality Lab. After the directions have been stated, student teachers Jamala, Kari, and Jason will circulate the classroom answering questions on a one-on-one basis; while also keeping students on task.

The second day will start with the teacher taking attendance in his regular classroom. After attendance is taken, the class will quietly walk to the computer lab and sit in their seats waiting to receive their laboratory explanations. Then the day's lesson will begin with a brief question and answer session to find out if the students have finished the Triangle Inequality Lab. If students have not completed this lab, they will have to do so in order to continue with the Hinge Theorem Lab. Upon the completion of the question and answer session and the class in general getting situated, the students will then receive the appropriate directions as to how to go about accomplishing the Hinge Theorem Lab. After the directions have been stated, student teachers Jamala, Kari, and Jason will circulate the classroom answering questions on a one-on-one basis; while also keeping students on task.

The third day will start with the teacher taking attendance in his regular classroom. After attendance is taken, the class will quietly walk to the computer lab and sit in their seats waiting to receive their laboratory explanations. Then the day's lesson will begin with a brief question and answer session to find out if the students have finished the Hinge Theorem Lab. If students have not completed this lab, they will have to do so in order to continue with the Centroid Lab. Upon the completion of the question and answer session and the class in general getting situated, the students will then receive the appropriate directions as to how to go about accomplishing the Centroid Lab. After the directions have been stated, student teachers Jamala, Kari, and Jason will circulate the classroom answering questions on a one-on-one basis; while also keeping students on task. When students finish all three of their labs they will keep them and turn them in at a later date, as designated by Mr. Hargis, and the lab grades will be placed on their fourth quarter grades.

Student Assessment:
Student assessment will be done by circulating the room to make sure that the students are on task and doing the assignment correctly. Student assessment, of course, will also be graded based upon completion and accuracy of their lab explorations; scoring guides for the labs are located on the individual labs so that the students are aware of what is expected of them.

Reflection/Analysis of Teaching/Learning:
Overall the entire unit went smoothly; however, when concerning the individual labs the majority of the students had the same questions that I had to respond too, therefore, for future teaching of these labs I will make modifications to them in order to reduce the confusion for future classes. In addition, I think that the students really enjoyed working in the lab because it gave them a break from the everyday classroom environment.

Lesson Extension/Follow Up:
To reinforce and extend understanding for those who did not make adequate progress with the individual labs; the decision for further work and assignments will be after the assessment has been conducted. This is because individualized methods of instruction should be used to see if more book work is needed or if more one-on-one tutoring is needed.

Geometry Computer Lab
Triangle Inequality

Name: _____ **Date**: _____

Objective: To understand the triangle inequality theorem.

KERA Goals and Academic Expectations: 1.5 → 1.9, 2.7, 2.9, 2.10

KY Core Concepts: MA-H-2.1.2

Scoring Guide:

Points:	**Criteria**:
6	- Table 1, is completed neatly and correctly.
2	- Correct answer to number 2.).
20	- Table 2, is complted correctly with **four points** for each part, a-e.
5	- Complete and accurate description for question 4.).
17	- Full participation in the activity.
50	TOTAL

In WINGEOM click 2-Dim, POINT, COORDINATE. Create the following points:
A, x = 0 and y = 0
B, x = 9 and y = 0

****You will use this procedure several times to create the centers of your circles.****

Close coordinate box.

Click CIRCLE, RADUIS CENTER. Enter A in the center box and tab twice to the radius and enter 7. Click on DRAW. This will construct a circle with center at A and radius 7 with point C on the circle. Tab once to center box and center B, tab to radius and enter 5. Click on DRAW. You should now have two circles. The second one has a center B and point D on the circle. Close the DRAW CIRCLE OR ARC box.

Click on POINT, INTERSECTION, CIRC-CIRC. Click on MARK for radius AC and BD, you will have to choose from A to C in the top box and from B to D in the bottom box. Close the INTERSECT box. To measure distance click on MEAS and type in AE (the endpoints of the segment you wish to measure) and press enter.

1.) Now complete the following:

AB =	**AB + BE =**	**AE =**	**BA + AE =**	**BE =**

2.) Does AE = BE? ***Yes*** or ***No***

Close the measurements box.

Now Draw the circles that appear on your screen below labeling points A, B, and the values of k, r_1, and r_2. *Be as neat and accurate as possible*. Once you have completed your drawing check to see if a triangle could be constructed from segments k, r_1, and r_2. (In case you are not aware of the segments that k, r_1, and r_2 represent you can refer to the chart at the bottom of the page).

3.)

	AB	**AC**	**BD**	**$r_1 + r_2$**	**k**	**$k + r_2$**	**r_2**	**$k + r_1$**	**r_1**	**Can you construct a triangle using k, r_1, and r_2?**
	k	**r_1**	**r_2**	**AC + BD**	**AB**	**AB + BD**	**BD**	**AB + AC**	**AC**	
a.										
b.										
c.										
d.										
e.										

From the chart above choose one part, a – e, and draw segment AB with the given length k. Draw the circle center at A with the given radius r_1, and another circle at B with the given radius r_2. Label a point E, when the circles intersect (if they do).

4.) What must be true about r_1, r_2, and k, for them to be the lengths of the sides of the triangle? (Hint: think what the lab is about)

Geometry Computer Lab
Centroids

Name: _____ **Date:**_____

Objective: To understand what a centroid is.

KERA Goals and Academic Expectations: 1.5---1.9, 2.9, 2.10

KY Core Concepts: MA-H-2.1.2

Scoring Guide:

Points:	**Criteria**:
7	- Questions 6, and 8 – 10 are answered correctly.
20	- The Table is filled out correctly and neatly.
8	- The questions following the table are correct.
7	- Questions 12 and 13 are answered correctly
8	- Full participation in the activity.
50	- Total -

1) In WINGEOM click **Window\2-dim**. Items in boldface are meant to be clicked with the mouse.

2) Click **Units|Random|Triangle** to make triangle *ABC* appear in the window.

3) Mark the midpoints *D* and *E* of *AB* and *BC*: To do this, click **Point|on Segment**, type the list *AB,BC* into the *segment* box, and click **mark**.

4) With the mouse in **Btns|Segments** mode, use the left button to draw the medians AE and CD. Then right-click the label F onto the intersection of AE and CD.

5) Extend *FD* and *FE* their own lengths to points *G* and *H*, respectively. (In other words, we want *FD = DG* and *FE = EH*.) To do this, click **Point|on Segment** (this dialog might still be open from step 2). Then type the list *FD, FE* into the *segment* box, 2 into the *coordinate* box, and click **mark**.

6) Click **Measure**, type *AF/FE* and press *Enter*.
What is the measure of AF/FE? _____ Close the dialog box.

7) So that we do not lose sight of the triangle during the following construction, let us highlight it. Click **Edit|Highlight|Line attributes**. Type the list *AB*,*BC*,*CA* into the *lines* box, 2 into the *thickness* box, and click **apply**. Close the dialog.

8) Click **Line|Segments**, type *AGBF* into the box, and press *Enter*. Put the mouse into **Btns|Drag vertices** mode and use the left button to move the Vertex A of triangle ABC around the screen. Can you move A around to where *AGBF* forms:
(a) a square? Yes No

(b) a rectangle? Yes No
(c) a rhombus? Yes No
(d) a trapezoid? Yes No

9) Draw *BH* and *HC*. Put the mouse into **Btns|Drag vertices** mode and use the left button to move the B. Can you move B around to where BHCF forms:

(a) a square? Yes No
(b) a rectangle? Yes No
(c) a rhombus? Yes No
(d) a trapezoid? Yes No

10) Is FH parallel to GB? _____ Is FG parallel to HB? _____

11) Find the measure of the following segments: (click **Measure,** type the segment and press *Enter*).

NOTE: Everyone's measurements will be different.

Segment	Measure
AF	
BG	
AD	
CF	
EF	
AC	
FG	
CE	
FH	
BE	
DF	
EH	
BH	

What two segments have the same length as AF? _____ and _____
What two segments have the same length as CF? _____ and _____
How do the lengths of AF and EF compare? _____
How do the lengths of CF and DF compare? _____

12) What would happen if the median from B to AC were now drawn? How do you know?_____
_____
_____.

13) Point F is called the *centroid* of triangle ABC. Summarize in a couple of sentences what you have learned about this point. _____
_____
_____

Geometry Computer Lab
Exploring the Hinge Theorem

Name: _____ **Date**: _____

Objective: To understand the hinge theorem.

KERA Goals and Academic Expectations: 1.5 – 1.9, 1.16, 2.7, 2.8, 2.9, 2.10

Kentucky Core Content: MA-H-2.1.3, MA-H-2.2.5

The **Hinge Theorem** states the following:

If two sides of one triangle are congruent to two sides of another triangle, and the included angle of the first triangle is greater than the included angle of the second triangle, then the third side of the first triangle is greater than the third side of the second triangle.

Scoring Guide:

Points:	**Criteria**:
14	- Questions 1 – 5 are answered correctly.
20	- Your four drawings are completed correctly and neatly.
16	- Full participation in the activity.
50	- Total -

In WINGEOM click **Window** then **2-Dim**, and then click **Units, Random, and Circle**. A circle *B*, with center *A* should appear on the screen.

Use your **right mouse button** and click anywhere on the circle creating points *C* and *D*. At this point you should have a circle, *B*, centered at *A*, with points *C* and *D* on the circle.

Next you want to draw the line segments *AC*, *AD*, and *CD* by using your **left mouse button** and clicking on *A* and dragging the line to *C*, then click on *A* again and drag the line to *D*, and finally click on *C* and drag the line to *D*. You should now have a circle with the triangle *ACD* inside.

Now go to **Btns** then **Drag Vertices**. Then grab point *C* or point *D* and drag it around the circle watching what happens to the length of segment *CD* and also the measure of angle *A*.

****For the following, circle the choice that you think best completes the statement****

1.) If segment *CD* is made longer, by dragging either point *C* or point *D*, then the size of angle *A*:

(a.) **increases in size.**
(b.) **decreases in size.**

Draw below, as neatly as possible, the circle and corresponding triangles that represents the answer you have for question 1.)

2.) If segment *CD* is shorten, by dragging either point *C* or point *D*, then the size of angle *A*:

(a.) **increases in size.**

(b.) **decreases in size.**

Draw below, as neatly as possible, the circle and corresponding triangles that represents the answer you have for question 2.)

Click on **Btns** then **Segments**. Next, use your **right mouse button** and click anywhere on the *same* circle as before, creating points *E* and *F*. Next you want to draw the line segments *AE*, *AF*, and *EF* by using your **left mouse button** click on *A* and drag the line to *E*, then click on *A* again and drag the line to *F*, and finally click on *E* and drag the line to *F*. You should now have a circle *B*, centered at *A*, with triangles *ACD* and *AEF* inside.

Click on **Btns** then **Drag Vertices**. Now grab the points necessary and move them so that angle *CAD* is larger than angle *EAF*.

3.) Is segment *CD* **longer** or **shorter** then segment *EF*? _____

Draw below, as neatly as possible, the circle and corresponding triangles that represents the answer you have for question 3.)

Now grab the points necessary and move them so that angle *EAF* is larger than angle *CAD*.

4.) Now, is segment *CD* **longer** or **shorter** then segment *EF*? _____

Draw below, as neatly as possible, the circle and corresponding triangles that represents the answer you have for question 4.)

5.) Please state, **in your own words**, what the Hinge Theorem means: _____
_____.