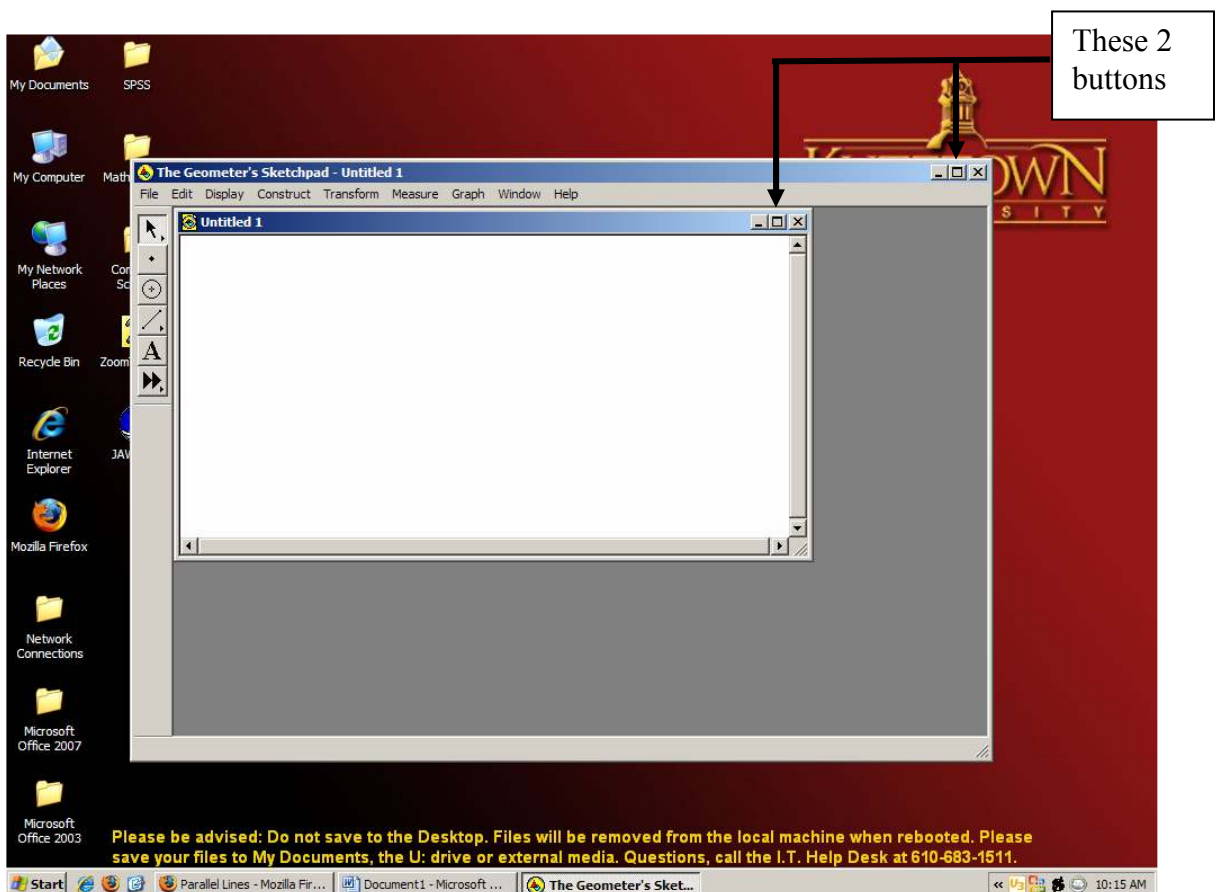


Investigation: Angle relationships with 2 parallel lines and a transversal

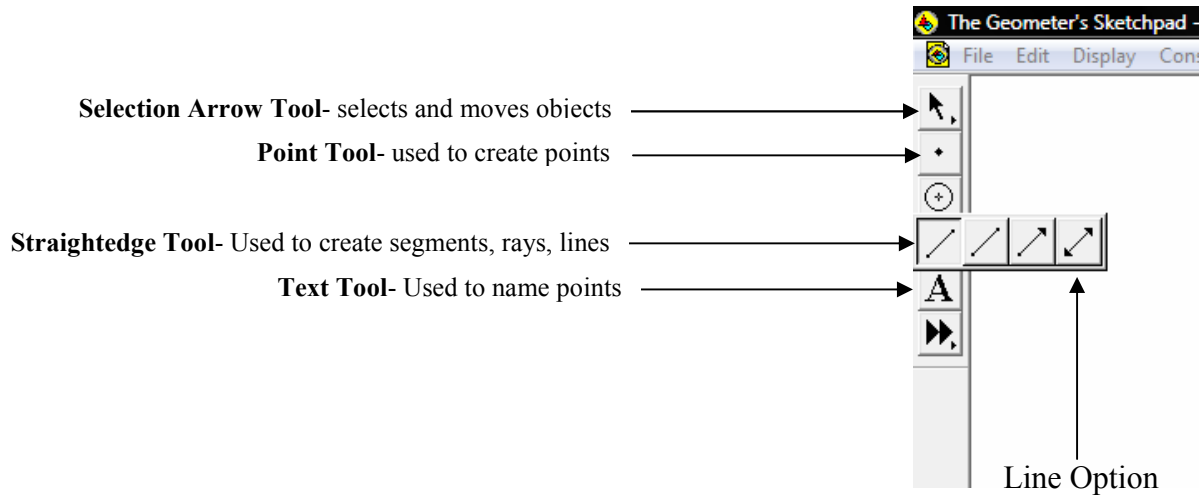
In this investigation, you will discover angle relationships formed by a transversal of 2 parallel lines. Follow the following instructions to create the desired sketch to investigate these relationships. The only thing you need to turn in when completed is the worksheet where you will document your findings.

Let's Get Investigating:

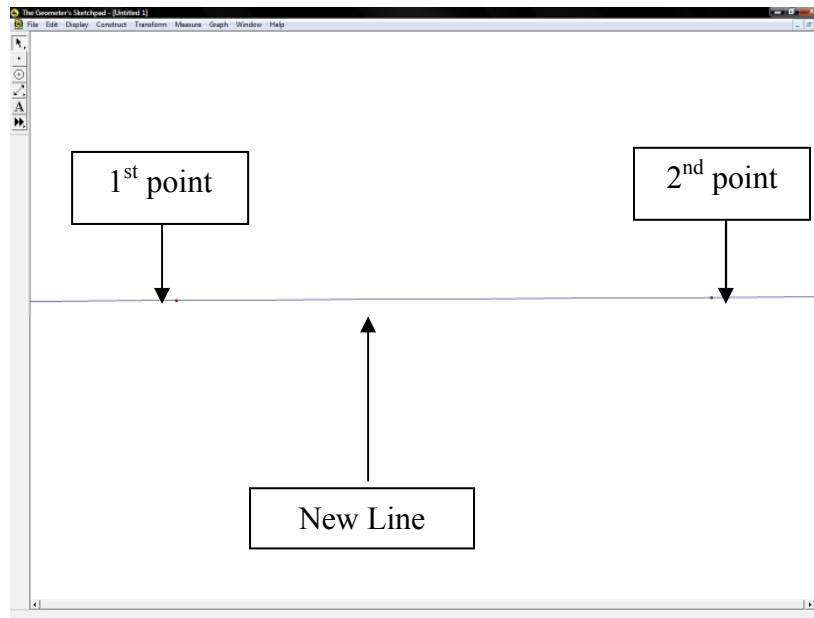
1. Open up Geometer's Sketchpad and maximize the inside and outside screens by clicking on the maximize button located on the top right of each of the screens. This will resize the windows so that they take up the entire screen.



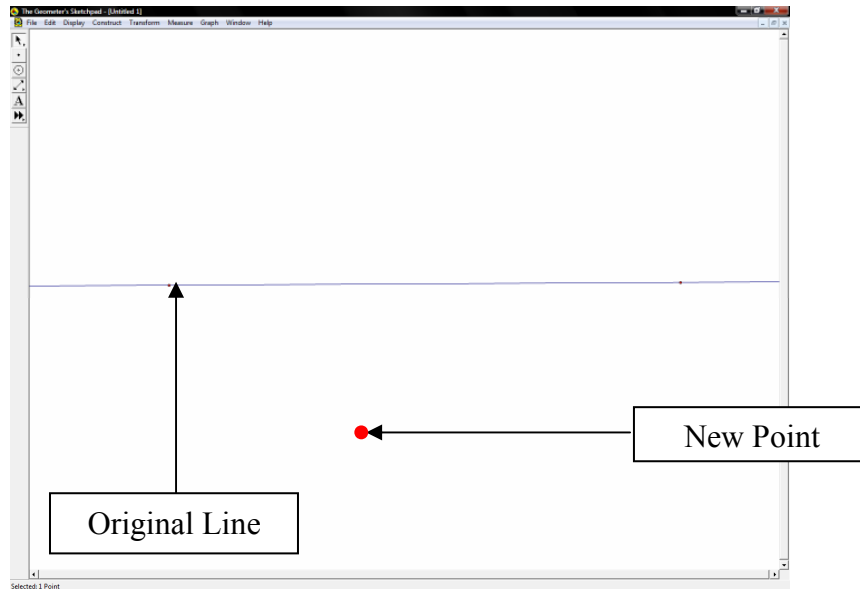
2. Now that we have Geometer's Sketchpad maximized lets look at the tools we will be using.



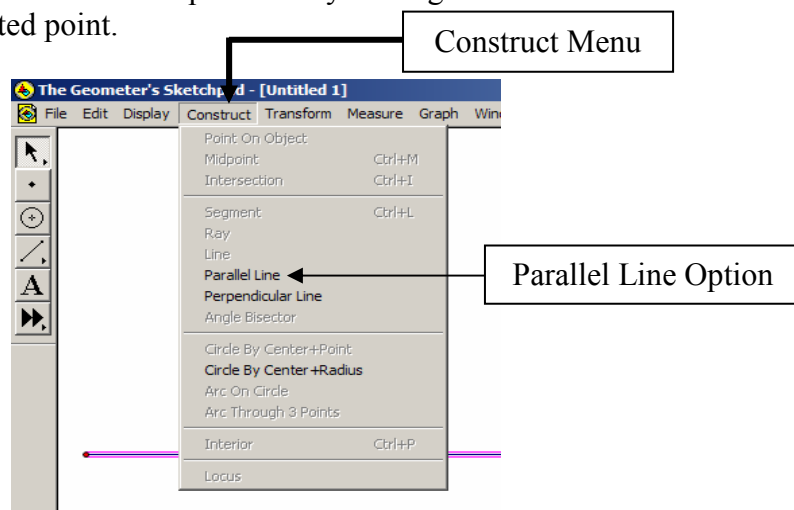
3. The first step in the creation of our drawing is to draw a horizontal line. You will need to left click and hold the **Straightedge Tool** button until the 3 options appear. Then while still holding the mouse button down move the pointer and chose the line option. Now move the pointer into the drawing area left click and hold where you want your first point on the line to be located and then drag it across the screen to where you want the second point on the line to be located. Once you have placed the pointer where you want the second point to be release the mouse button. You should now have a line on your screen that looks like the following:



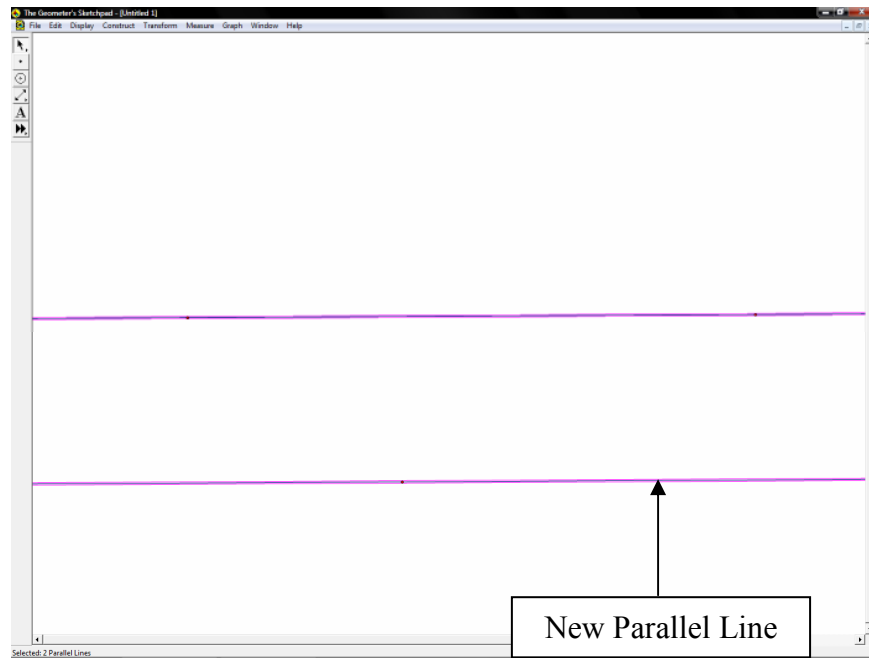
- Next we want to click on the **Point Tool** so that we can create a point above or below the line we have created. Once you have selected the point tool move the pointer onto the sketchpad and click where you wish the point to be located. Once you have created a point click on the selection arrow tool. Your screen should look like the following.



- Now we are going to create a parallel line using the line and point that we have created. First you must click on the **Selection Arrow Tool**. Now move the pointer onto the sketchpad and click in the blank space. This will deselect anything that is selected. Now click on the point you have created, this should highlight the point. Next click on the line you created which will highlight the line. Now the point and line should be highlighted. Next click on the **Construct Menu** and one of the options on the drop down menu will be "**Parallel Line.**" Click on parallel line and a line parallel to your original line will be created through the selected point.



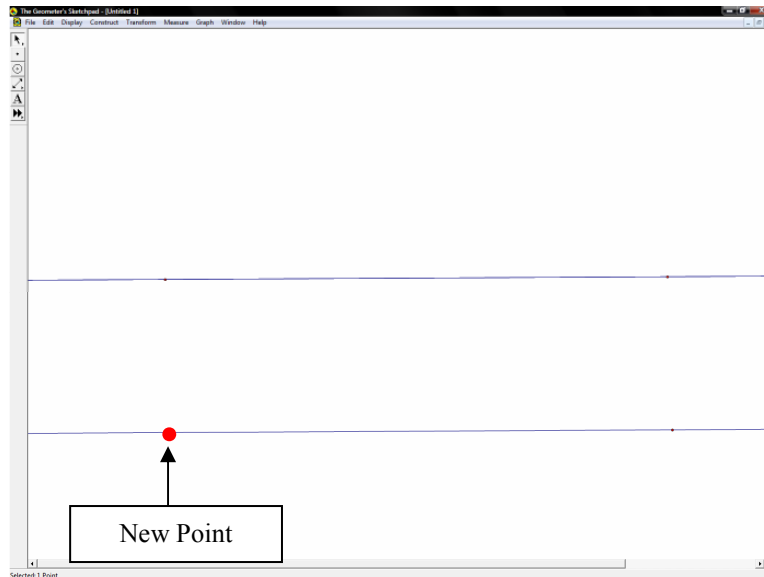
Once you have clicked on the **Parallel Line** option your screen should look like the following.



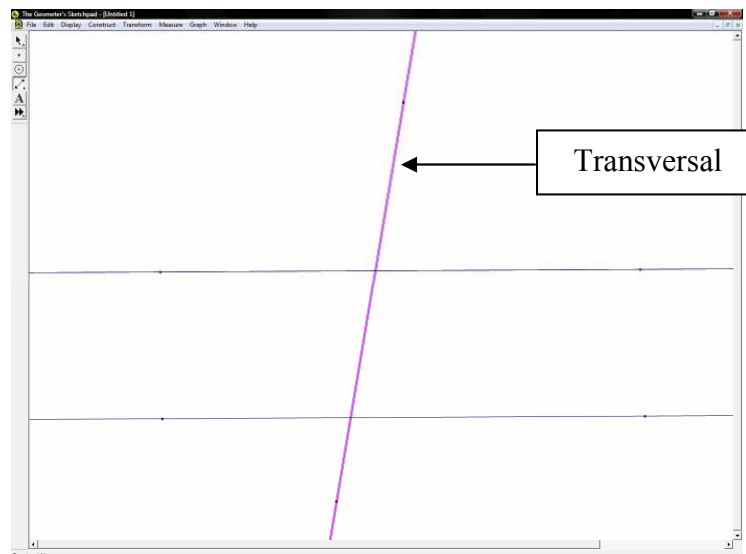
6. Next click on the **Selection Arrow Tool**. Move the pointer so that it is highlighting the point used to create the original line. Click and drag the point so that it is approximately under one of the endpoints of your original line. Your screen should look similar to the one below.



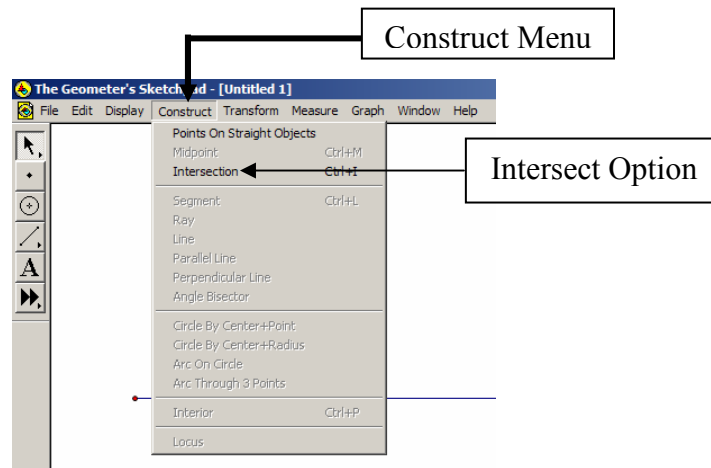
7. Now click on the **Point Tool**. Move the arrow onto the sketchpad and create a point on the line approximately under the point of the original line and left click. This will create a second point on the line.



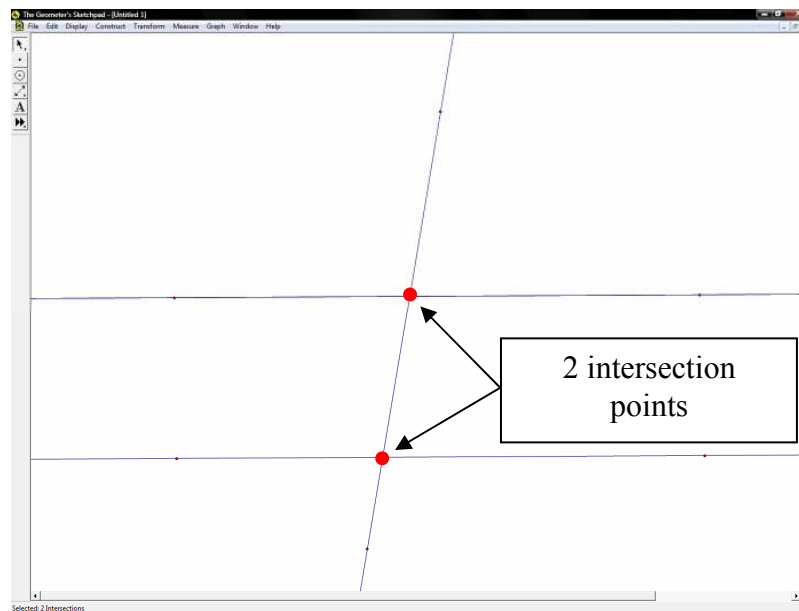
8. Now we are going to create the transversal. Click on the **Straightedge Tool** and choose the line option. Move the pointer to the top middle of the sketchpad and create a line that goes through the 2 parallel lines. Your sketch should now look like the following. Make sure one point is above the lines and the other is below the lines



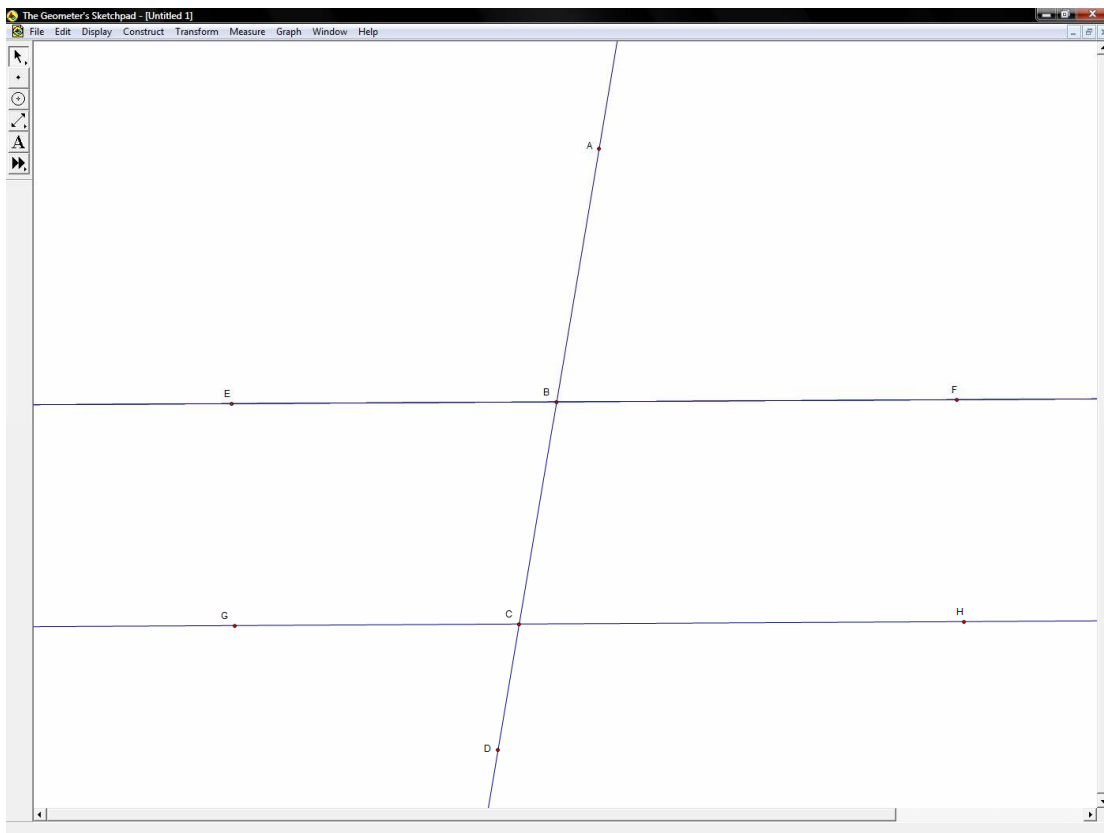
9. Next we are going to create intersection points where the transversal meets each of the parallel lines. To do this first you must select the **Selection Arrow Tool** and click in the white space of the sketchpad to deselect everything. Next move the arrow over one of the parallel lines and click on it so that it is highlighted. Perform the same step so that the transversal is highlighted. Now one of the parallel lines and the transversal should both be highlighted. Next go to the **Construct Menu** and click on the **Intersection** option. You will repeat this step for the other parallel line so there is an intersection point on both of them.



Once you have completed this for both lines your sketch should look like the following.

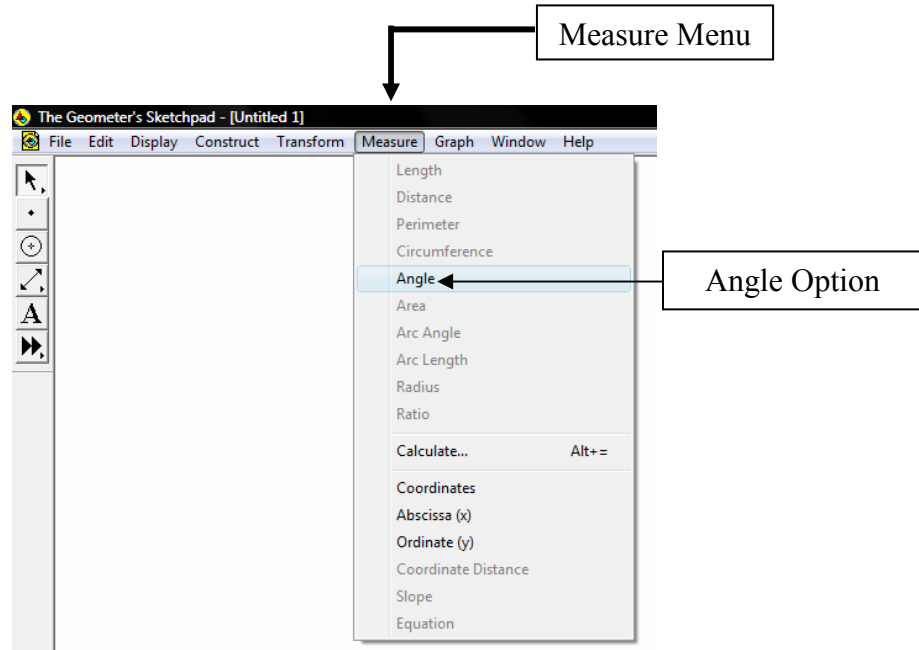


10. Now we are going to click on the **Text Tool** and use it to label each of our 8 points. Once you click on the **Text Tool** the pointer will turn into a little hand when you move it onto the sketch pad. Move the hand over one of the points and the hand will turn black. Once it turns black left click and a letter will appear to label the point. Start with the point at the top of the transversal and then the intersection with the top line. Next do the intersection with the bottom line and then the point at the bottom of the transversal. Once you are done labeling the points on the transversal start with the upper line and label the point on the left and then the point on the right. Do the same for the bottom line. When you have finished it should look like the following.

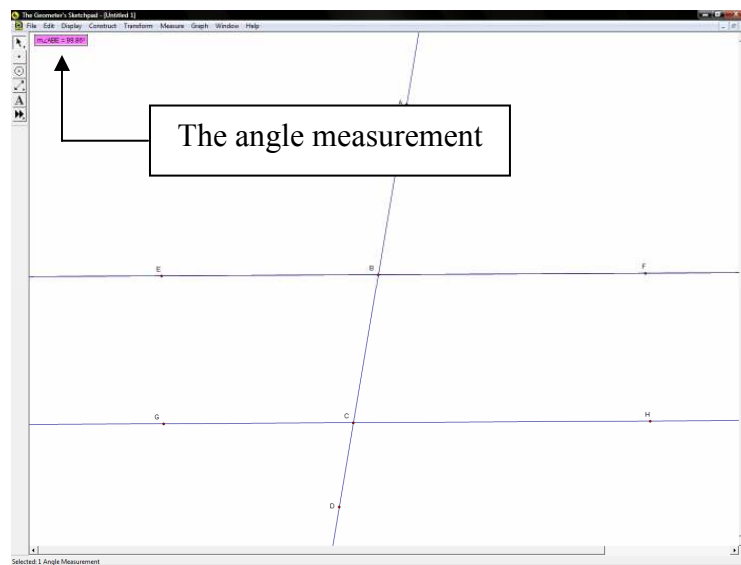


Notice that each point has a letter next to it. If it is hard to see the letter because it is too close to the line perform the following. Select the **Selection Arrow Tool** and move the pointer onto the sketchpad. Move the arrow over the letter you wish to move and the pointer will turn into a hand. Left click and drag to the desired spot. The letter will only move so far.

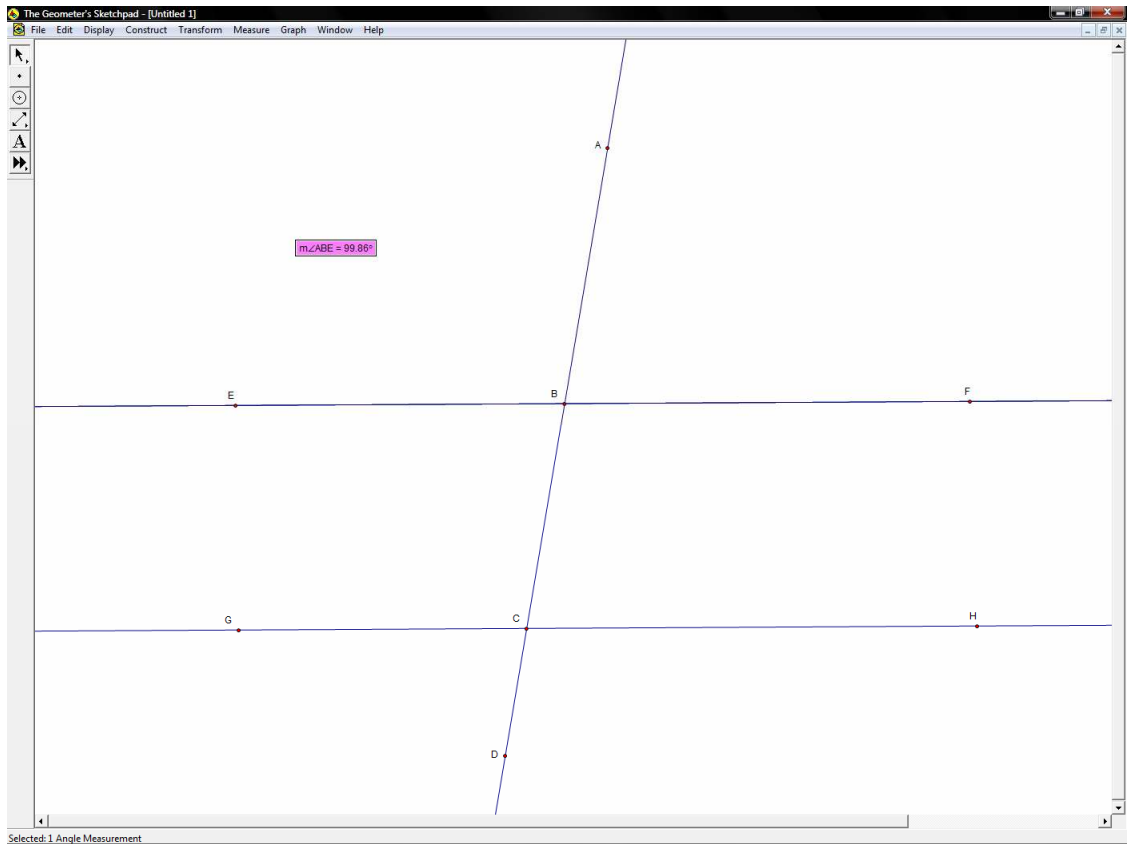
11. Now we will use Geometer's Sketchpad to measure each of the angles. To do this first you must select the **Selection Arrow Tool** and click in the white space on the sketchpad so that everything is deselected. Next we will click on and highlight three points in this order. 1st A then B then point E. You must do it in the order such that the second point selected is the vertex of the angle you wish to measure. Once you have highlighted these 3 points click in the same order as described, click on the **Measure Menu** and in the drop down menu you will see the **Angle** option. Click on the Angle option and a measure will appear on the screen.



Once you have clicked on **Angle** your screen should look like the following.

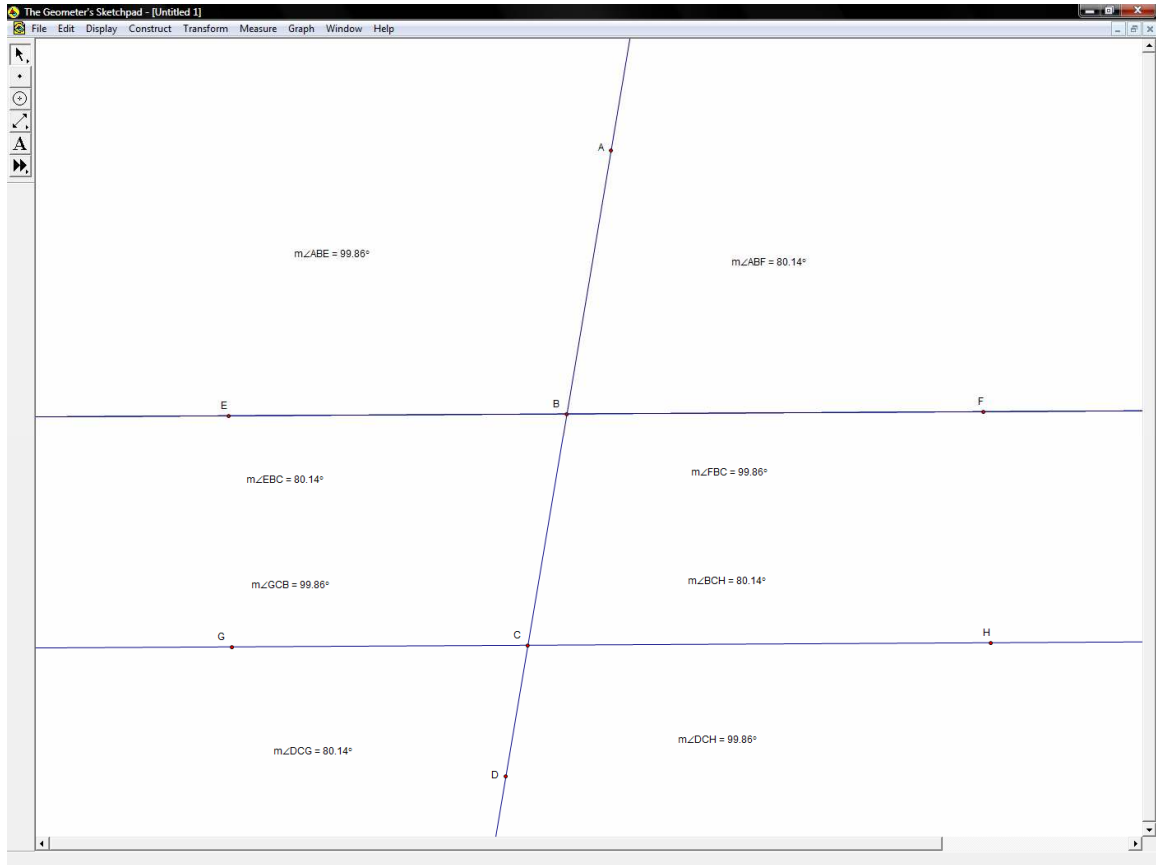


Now we will move the angle measurement so that it is near the corresponding angle. To move the angle measure box select the **Selection Arrow Tool** and click in the white space so that everything is deselected. Now click on the box that contains the measurement and drag it to where you want to place it. Your screen should now look like the following.



Now click in the white space so that everything is deselected and repeat for the remaining 7 angles moving each measure to its corresponding angle.

12. Once you have measured all of the angles record the angle names and measures on the attached worksheet. Here is an example of what your sketch should look like once you have measured all of your angles and moved the angle measurements to the angle being measured.



13. Next you will need to click on the **Select Arrow Tool** and click in the white space so that everything is deselected. Move the arrow over one of the points above or below the parallel lines located on the transversal and click and drag it from side to side so that all of the angles change. Move the transversal 4 times and record the measures on the worksheet.
14. Complete the worksheet to be handed in once you have discovered at least 4 of the angle properties of parallel lines and a transversal.

Name: _____
Date: _____

Parallel and Transversal Investigation Worksheet

Directions: Answer the following questions that coincide with the investigation you have performed using Geometer's Sketchpad.

1. Fill in the blank spaces in the chart with the appropriate information from your investigation.

Angle Names	$\angle ABE$	$\angle FBC$	$\angle GCB$	$\angle DCH$	$\angle ABF$	$\angle EBC$	$\angle BCH$	$\angle DCG$
1st Measures								
2nd Measures								
3 rd Measures								
4 th Measures								
5 th Measures								

2. What similarities between the measurements of the different angles are apparent?
3. Describe how the angles that have the same measurement are positioned to one another.
4. What rules can you write in regards to the relationships of these angles?
5. What was your favorite part of this investigation?

Name: _____
Date: _____

Parallel and Transversal Investigation Worksheet

Directions: Answer the following questions that coincide with the investigation you have performed using Geometer's Sketchpad.

1. Fill in the blank spaces in the chart with the appropriate information from your investigation.

Angle Names	$\angle ABC$	$\angle ABD$	$\angle CBF$	$\angle DBF$	$\angle GFB$	$\angle EFB$	$\angle GFH$	$\angle EFH$
1st Measures	94.98	85.02	85.02	94.98	94.98	85.02	85.02	94.98
2nd Measures	69.07	110.93	110.93	69.07	69.07	110.93	110.93	69.07
3 rd Measures	123.47	56.53	56.53	123.47	123.47	56.53	56.53	123.47
4 th Measures	88.39	91.61	91.61	88.39	88.39	91.61	91.61	88.39
5 th Measures	20.35	159.65	159.65	20.35	20.35	159.65	159.65	20.35

2. What similarities between the measurements of the different angles are apparent?
 - One might notice that there are only 2 measures for all 8 angles.
 - In the chart after the first measurement it always goes the next 2 are equal and then the following 2 are equal and so on.
 - The sum of the 2 different angles adds up to 180 degrees
3. Describe how the angles that have the same measurement are positioned to one another.
 - alternate interior
 - alternate exterior
 - vertical angles
 - corresponding angles
4. What rules can you write in regards to the relationships of these angles?
 - Alternate interior angles formed by parallel lines and a transversal are congruent
 - Alternate exterior angles formed by parallel lines and a transversal are congruent
 - Vertical angles formed by parallel lines and a transversal are congruent
 - Corresponding angles formed by parallel lines and a transversal are congruent
 - Interior angles formed by parallel lines and a transversal are supplementary
5. What was your favorite part of this investigation?
 - Using Geometer's sketchpad to look at the properties of parallel lines and a transversal was lots of fun and educational.