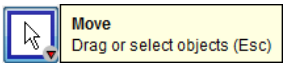
GGB Lab2: Constructing a Perpendicular Bisector

(revised for Geogebra from Exploring Geometry with The Geometer's Sketchpad Key Curriculum Press, 2012, pp 27-28)

OBJECTIVE: In this activity you will construct a perpendicular bisector using Geogebra's freehand tools – the equivalents to Euclid's compass and straightedge.

SKECTH and INVESTIGATE: Open a new GGB file and save it as "Lab2 Construct a Perpendicular Bisector" Answer the questions in your composition book as you complete the lab and questions are asked.

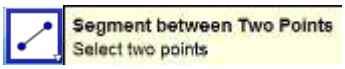
1 ***NOTE:*** Get in the habit of pressing ESC (the escape button on your keyboard) to get back to the move tool 

especially after using other drop-down menu commands.

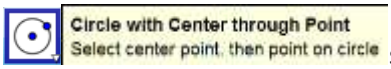
2 ***NOTE:*** When you make a mistake, it is easy to undo. Press Ctrl-Z or Command-Z either once or repeatedly to return to a previous state of your sketch.

3 ***NOTE:*** Because we are using freehand tools we do not want to use the axes or the grid. If the Axes and Grid are showing, turn them off. Right click in the white space of the graphics screen and select Axes and Grid within the menu to turn OFF Axes and Grid.

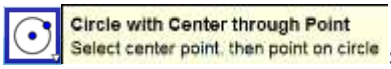
Now you will begin the work to make the Perpendicular Bisector dynamic sketch. Follow these instructions which will always first **state what you need to do** and then second **state how you are to do it**. So if you read you will be successful.

4 Construct segment AB. Use 

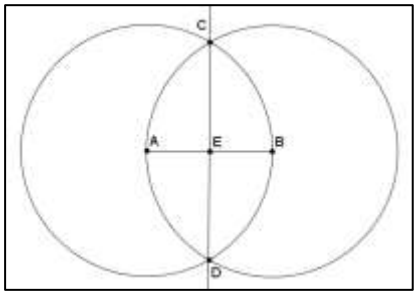
left click in graphics window to place point A, move and left click again to place point B. Press ESC.

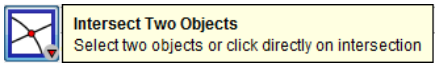
5 Construct circle AB, using point A as the center and point B as the endpoint of the radius. Use 

select point A then point B.

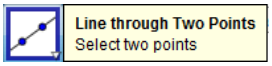
6 Construct circle BA, using point B as the center and point A as the endpoint of the radius. Use 

select point B then point A. Press ESC.



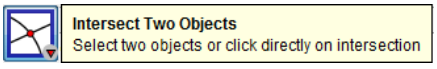
7 Construct point C and point D, the intersection of the two circles as shown in the diagram. Use 

. When you move the cursor over the intersection both circles should be bolder, click to place point C. Repeat to place point D at the other intersection. Drag point A or point B to be sure that C and D remain at the intersection of the circles. Press ESC

8 Construct line CD. Use 

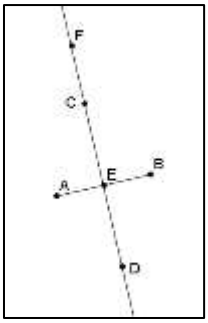
select point C, then point D. Drag point A or point B to make sure the construction stays together. If the construction "falls apart" then you must recreate it. Press ESC.

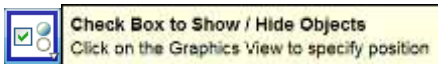
QUESTION 1: Line CD is the perpendicular bisector of segment AB. Without measuring, what can you say about the distances AC and BC and the distances AD and BD? What evidence allows you to make this conclusion?

9 Construct point E the intersection of segment AB and line CD. Use 

and select the segment AB then select line CD. Press ESC.

QUESTION 2: What is special about point E? Move points A and B to confirm your answer. What name is given to point E that describes its relationship to endpoints A and B?

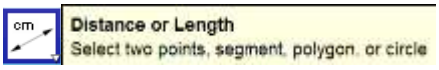


10 Insert a Check Box to show/hide the two circles. Use 

click in the graphics window and the Check Box dialogue box will open. In the Caption window type "Show Two Circles". Now select each of the circles in the graphics window. Select Apply. And the "Show Two Circles" Check Box will appear in the graphics window. Press ESC. Uncheck the box to hide the two circles

11 Construct point F on line CD. Use 

and place F on line CD. Press ESC. Drag point F. Notice that is will always stay on line CD.

12 Measure distances FA and FB. Use 

and select point F then point A. Repeat and select point F then point B. Press ESC. Move text box measurements so they are not overlapping and you are able to read them both.

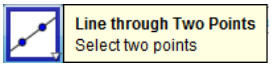
QUESTION 3: Drag point F up and down the line CD. Write a conjecture about any point on the perpendicular bisector line CD to the segment AB. State your conjecture as an IF-THEN <u>conditional</u> statement.
Now write the <u>converse</u> of the IF-THEN statement.

EXPLORE MORE:

13 In the same sketch, investigate the **<u>converse</u>** as follows: Construct point G <u>not</u> on the perpendicular bisector line CD. Measure distance GA and GB. Move point G until those distances are equal.

QUESTION 4: Where is point G when distances GA and GB are equal? Explain how this demonstrates the converse you wrote.

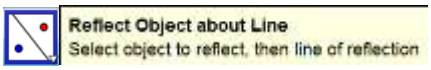
14 In this sketch, move the objects you have constructed off to the side to make space for the final construction.

15 Construct Line HI. Use 

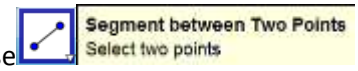
left click in graphics window to place point H, move and left click again to place point I.

16 Construct a point J <u>not</u> on line HI. Use 

to place point J off line HI.

17 Reflect point J in the line HI. Use 

and select point J as the object to be reflected, then select line HI as the line of reflection. Point J' will appear on the opposite side of the line HI.

18 Construct segment JJ'. Use 

select point J, then select point J'. Drag point J and notice how J' behaves.

QUESTION 5: How is the segment JJ' related to the line of reflection HI?