

Exploring Parallelograms within a Parallelogram

1. First open online GeoGebra software by typing in your browser the following URL address of GeoGebra www.geogebra.org. You can access the software online or you can work offline by downloading the software onto your device by clicking the download link.
2. Opening GeoGebra and choosing the graphing calculator option will produce a window similar to the figure below.

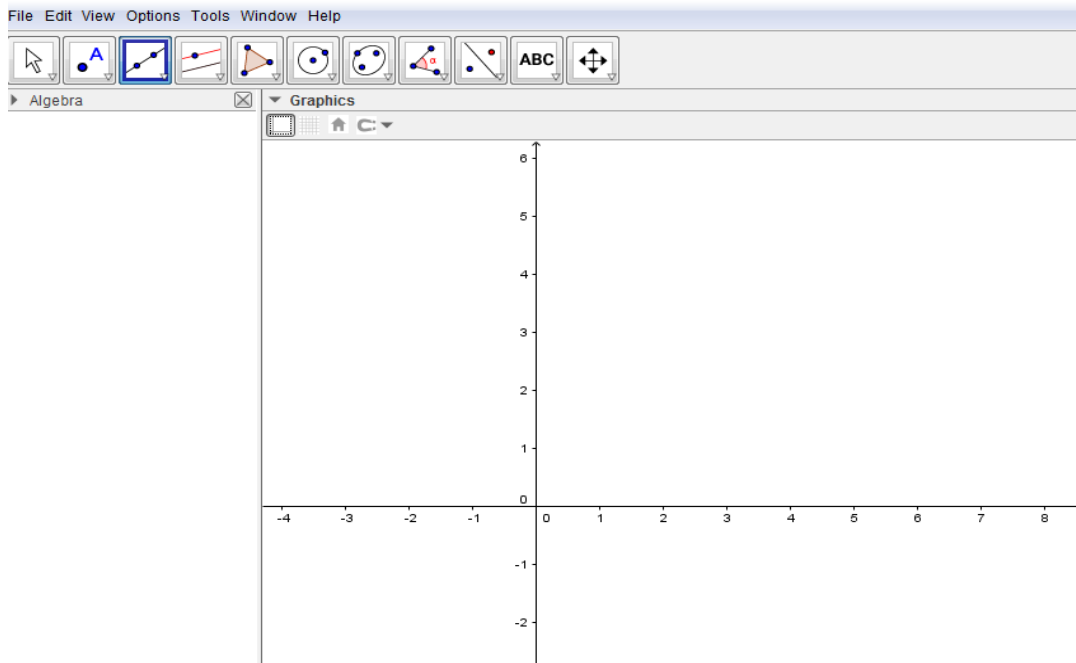


Figure 1. GeoGebra window.

3. To draw a line, in the tool bar select the line tool and draw a line that pass through two points (automatically the software will create points A and B as you click and draw a line that passes through the two points). See figure2 below.

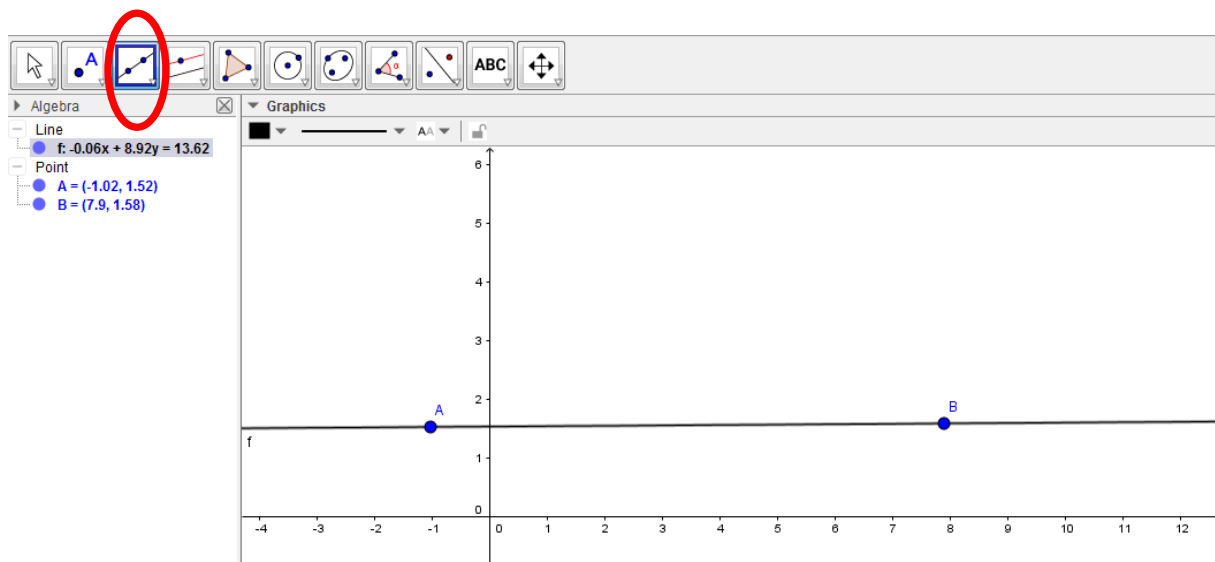


Figure 2. A line AB

4. To draw a line that passes through a point A. Select the line tool, click point A, and click a point above line AB. This creates the line, AC.

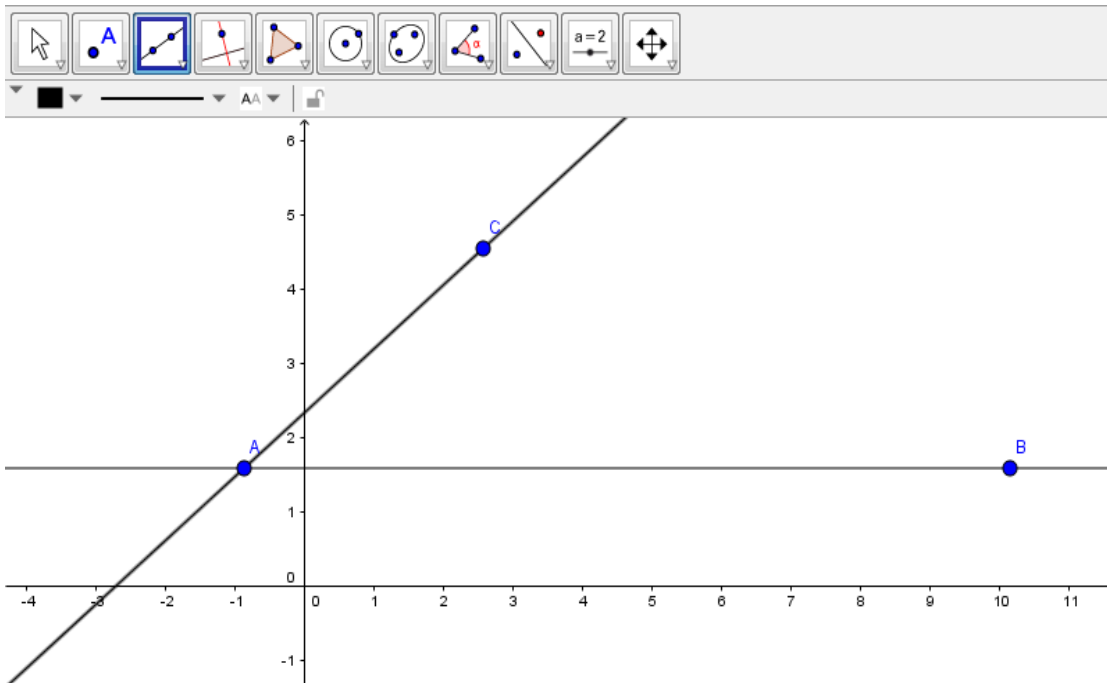


Figure 3. A line AC, that passes through a point A.

5. To draw a line parallel to a line AC, select a parallel line tool on the tool menu, select line AC, and then click a point B. By doing this, you will create a line passing through point B that is parallel to a line AC. See figure 4 below.

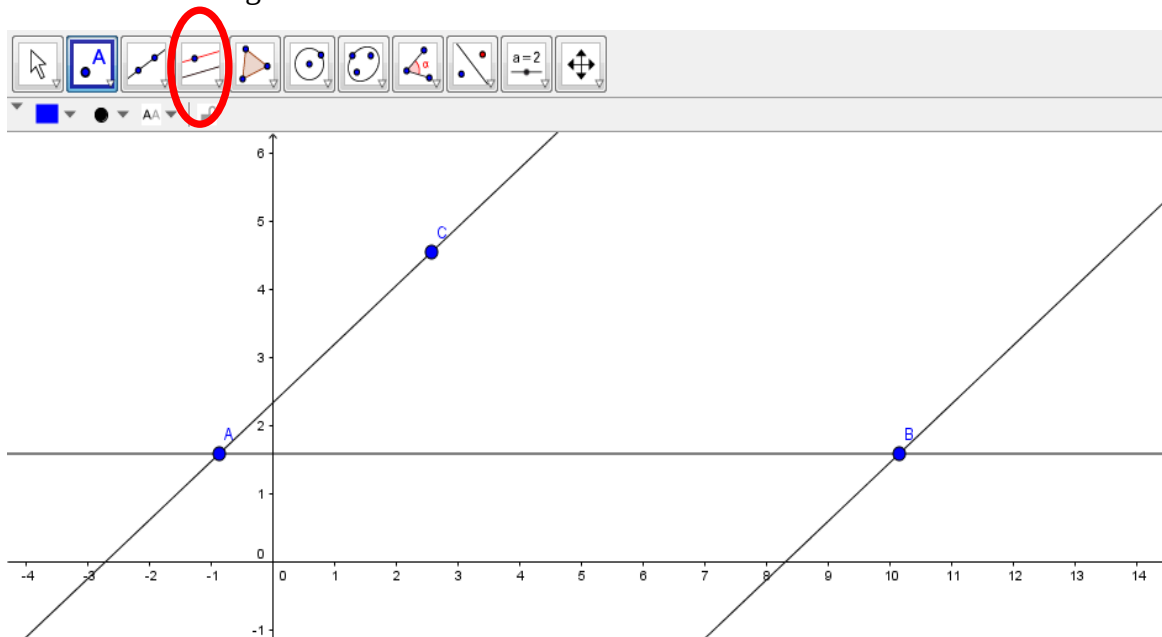


Figure 4. A line passing through B and parallel to a line AC.

6. Similarly, draw a line that passes through a point C and parallel to a line AB. First, select a parallel line as in step 5, select line AB, and select point C. Now, mark the intersection point of these two parallel lines to create point D. See figure 5 below.

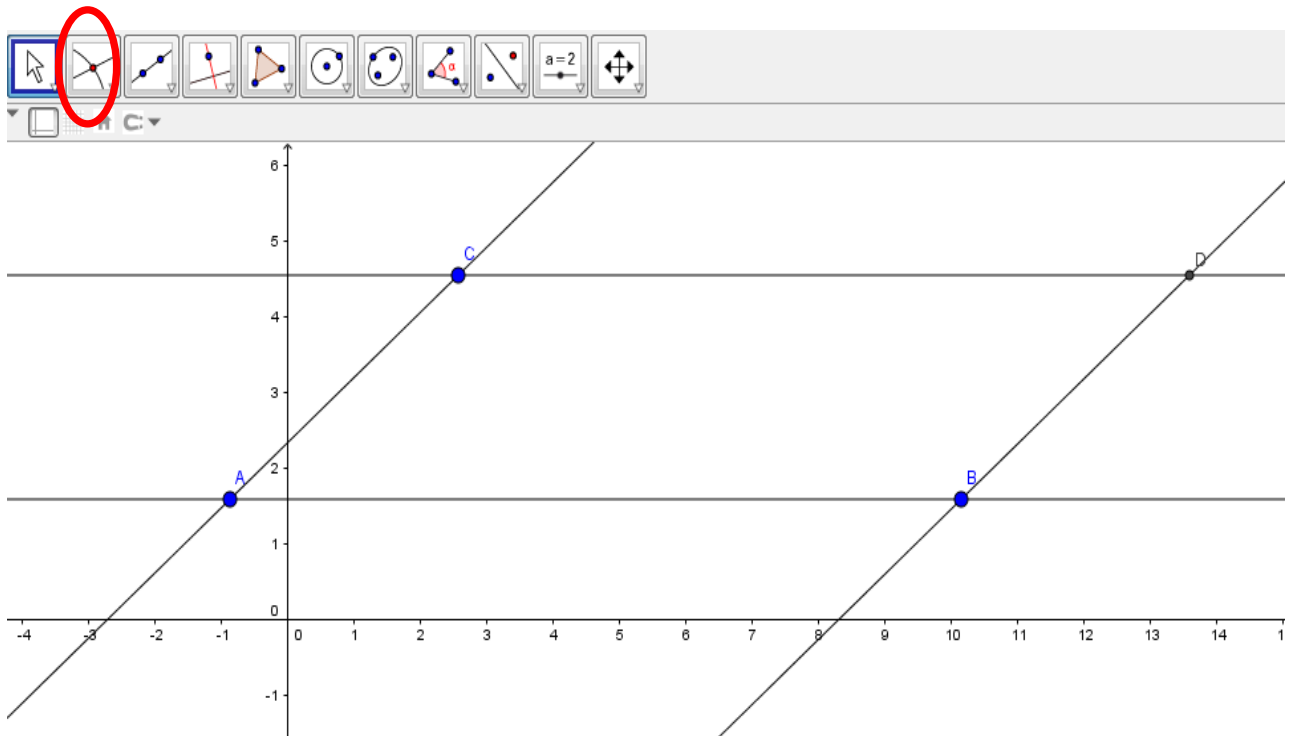


Figure 5. A line through C parallel to line AB, and marking the intersection point D.

7. Draw a diagonal line segment between a point A and D using the line segment tool on the tool menu and then connect point A and D. See figure 6 below.

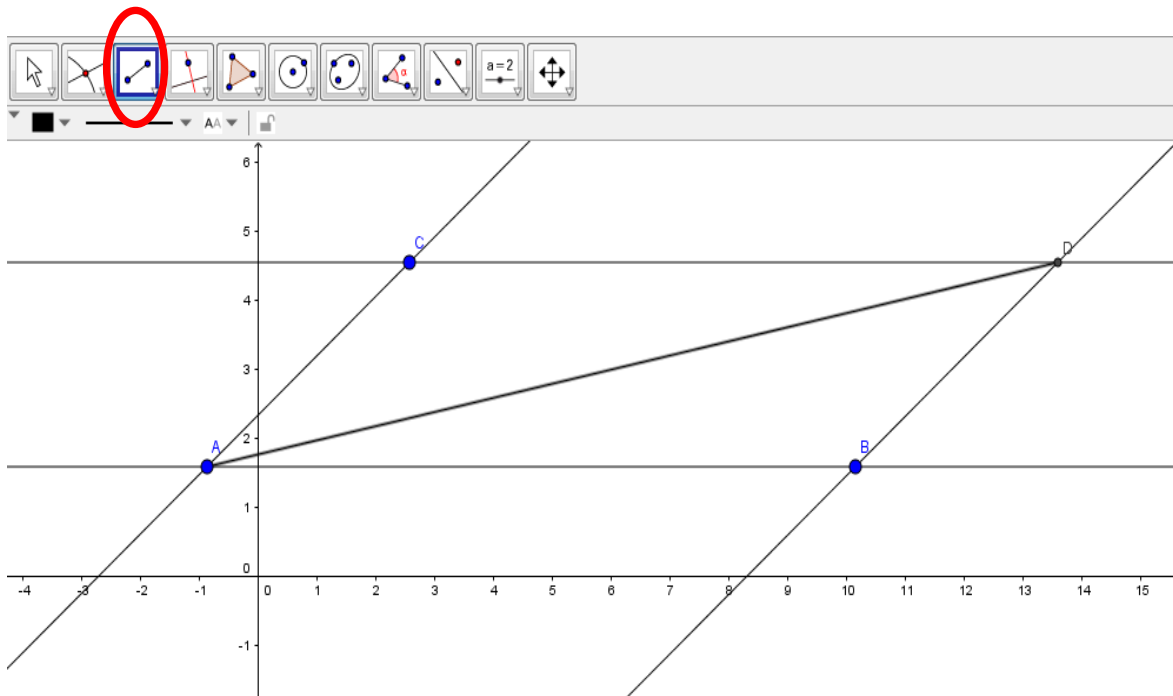


Figure 6. Line segment AD.

8. Now, we will create parallelograms within this larger parallelogram. First create a point E on the line segment AD using the “Point on Object tool. See figure 7 below.

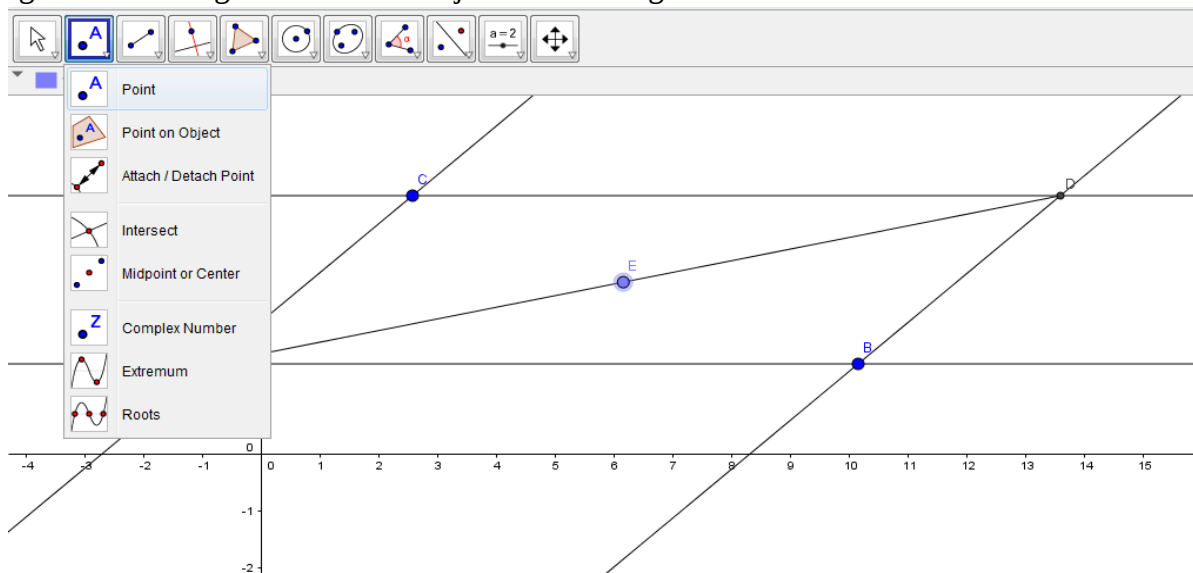


Figure 7. Drawing point E between a point A and a point D.

9. Using E, point construct two lines, one parallel to AB and the other parallel to CD and mark the intersection points between these lines and the sides of the large parallelogram. See figure 8 below.

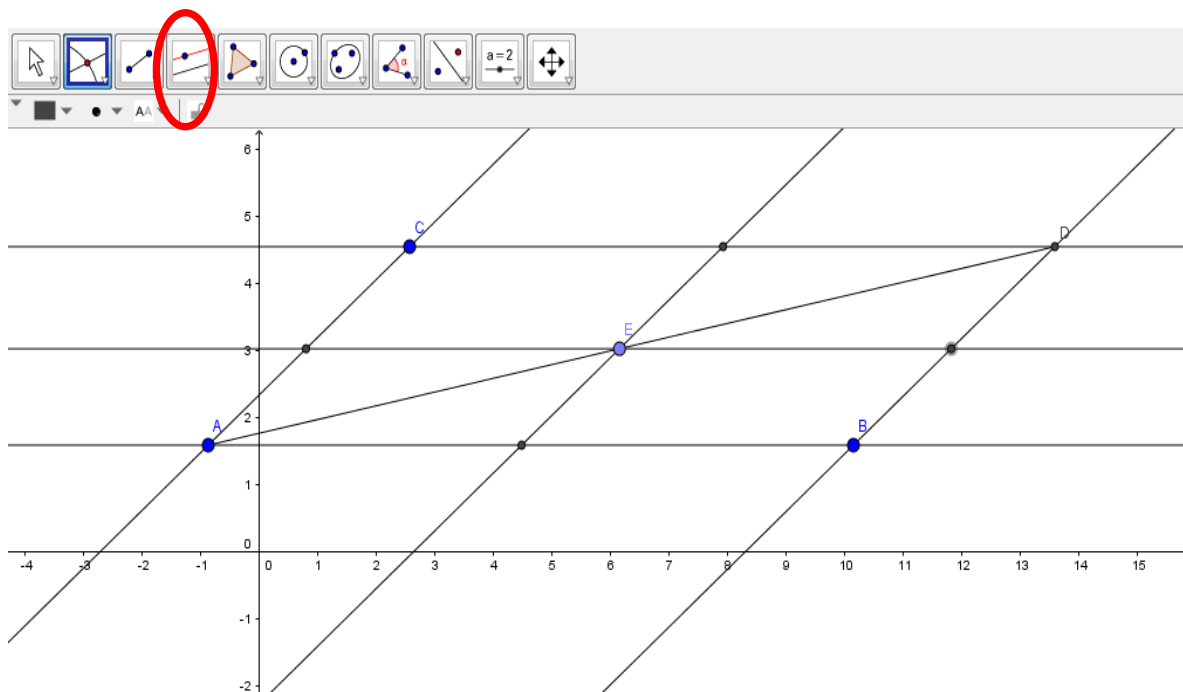


Figure 8. Parallel lines that pass through a point E.

10. Finally create the inside parallelograms using the polygon tool. Draw a polygon AGEH, BIEG, IDFE, and EFCH using the polygon tool as shown below. See figure 9.

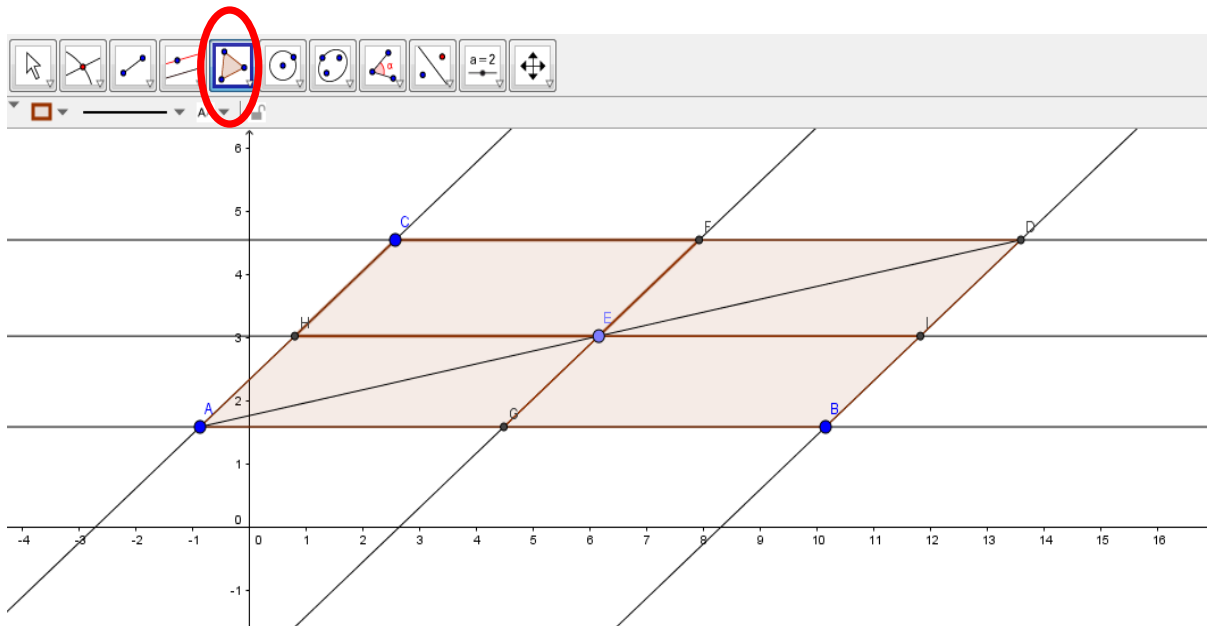


Figure 9. Four different parallelograms within ABDC.

11. Color the inside parallelograms. Right click the inside part of a parallelogram and select object properties. Next, select color and fill each parallelogram with a different color.

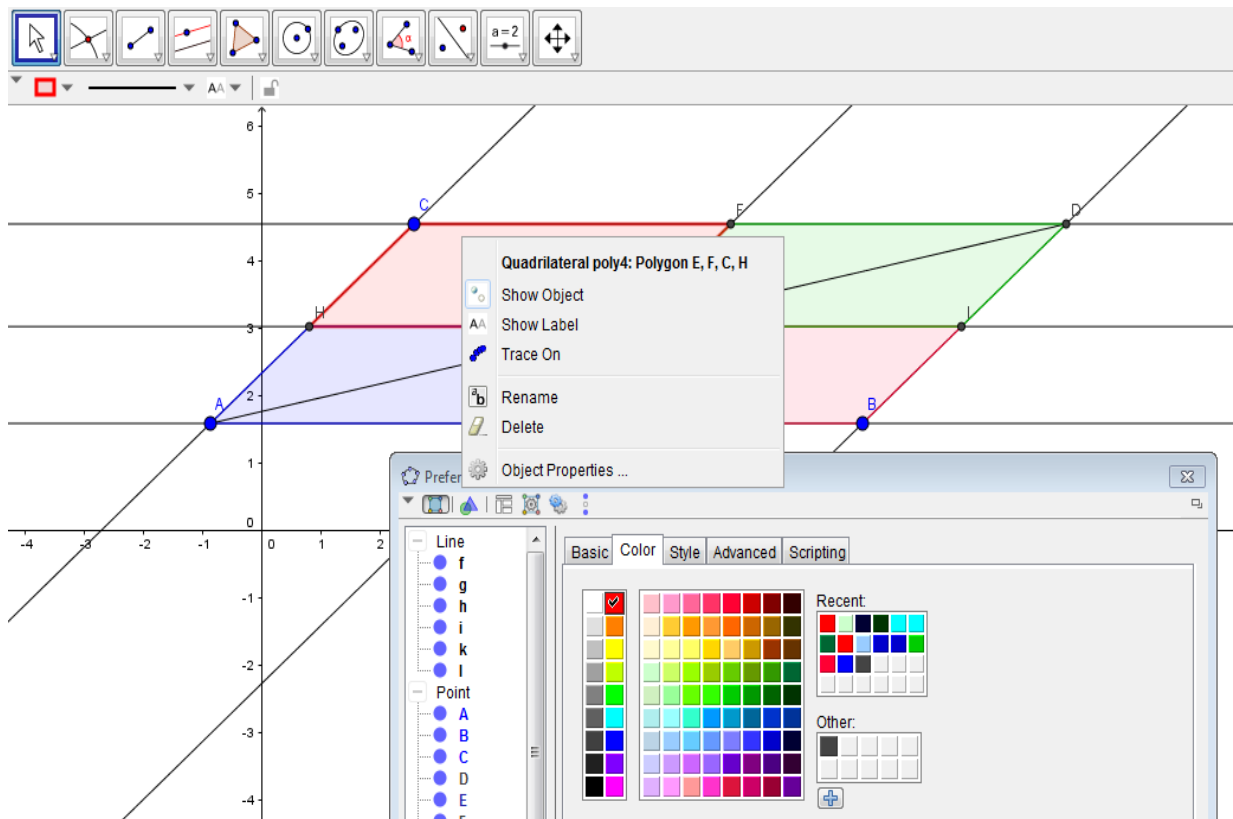


Figure 10. Color the inside parallelograms using the fill tool.

12. Hide unnecessary line segments, axes, or objects by right-clicking them and deselecting the “Show Object” option or by deselecting the radio button for each item in the algebra pane (see figure 11).

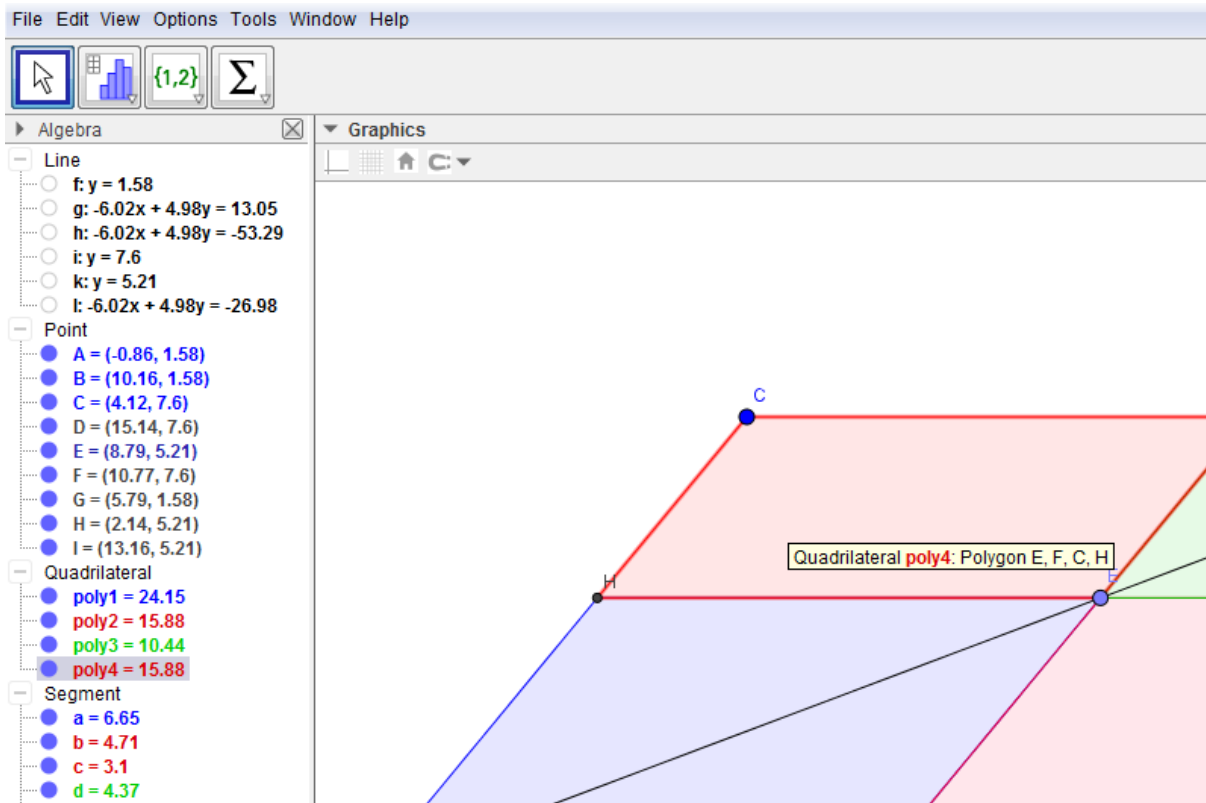


Figure 11. Clean up the window by deselecting items in algebra pane.

13. Finally, open a spreadsheet window (under the view menu), click in the cells of the spreadsheet to type in “Area of top left parallelogram” etc. Then, dynamically link the areas of the parallelograms to the spreadsheet by clicking on a cell and typing =poly4 to display the area of polygon 4. See the algebra pane to determine the names for each of the smaller parallelograms (e.g. poly1, poly2, etc.).

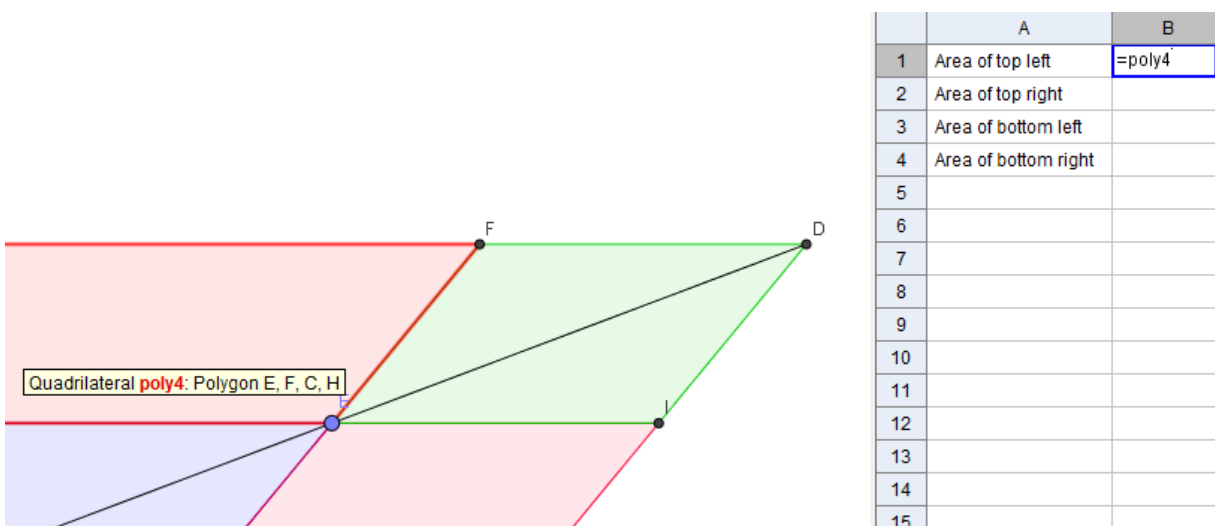


Figure 12. Dynamically link areas of parallelograms to spreadsheet.