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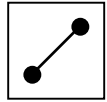
Investigation: Finding Relationships Between Area and Parallel Lines in Triangles

In this investigation you will discover a relationship between parallel lines and the area of a triangle. Specifically, the difference in area as the top vertex of the triangle is dragged along a line parallel to the base. This worksheet will give step-by-step instructions on how to construct a triangle in Geometer's Sketchpad and manipulate the triangle

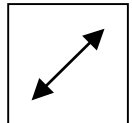
Sketch:

- 1) Choose New Sketch from the file menu.
- 2) Choose the Display option from the toolbar at the top of the screen. Then choose Label Options. While in the label options screen, check the box that says "autoshow labels for new objects."
- 3) Drawing parallel lines! Along the left hand side of the screen, there are six tools to use. From top to bottom they include; the arrow tool, the point tool, the circle tool, the line tool, the label/text tool, and the object information tool.

➤ Choose the Line tool, which is the fourth tool from the top.



➤ Hold the mouse button down and more choices will appear next to the tool. While holding the mouse button down, move to the last tool (the double arrow) and release the mouse.



➤ Move the pointer to the sketch plane. The pointer will look like a crosshair pointer.

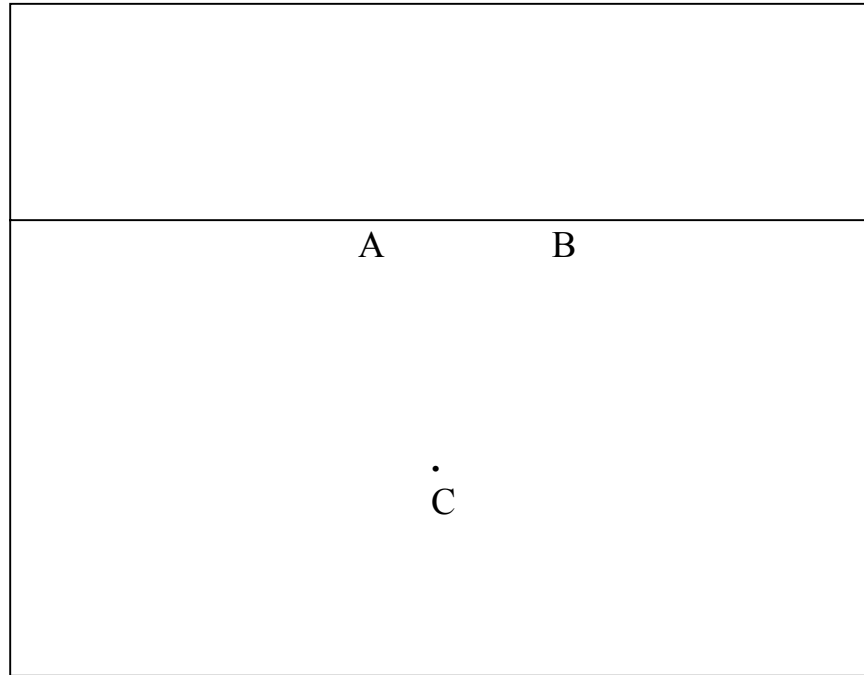
➤ Click in the center of the sketch plane and slightly drag to the side (try to straighten the line out so it looks smooth). A line will form across the entire sketch plane, and it will be highlighted.

➤ The line tool will be in effect until another tool is chosen.

➤ Choose the Point tool, which is the second from the top on the left-hand side.

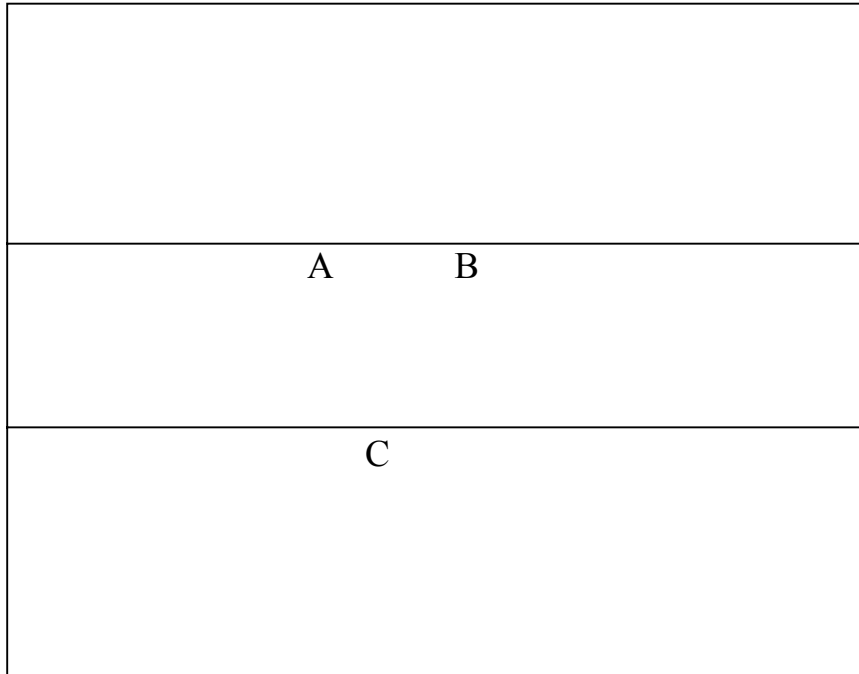


- The pointer will again look like a crosshair. Move the crosshair to the center and then down about two inches and then click the mouse button. A point will appear when you have clicked and it will be highlighted.



(your picture should look like this so far)

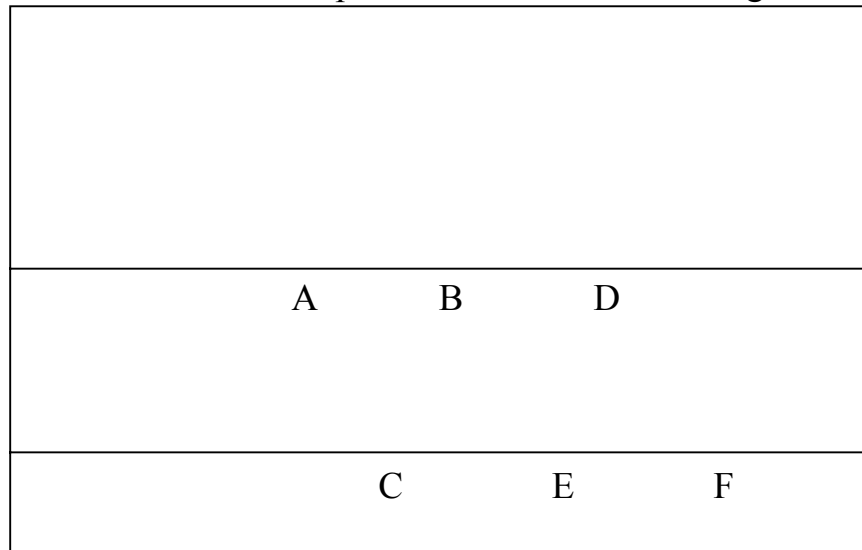
- Choose the Pointer tool, which is the first tool on the left-hand side.
- Move the arrow tool so it points to the line. The arrow will change to a horizontal arrow pointing to the left.
- Click the mouse, when the arrow changes, to highlight the line. Two black dots will appear on the line to show that it is highlighted. (to un-highlight an object just click on a blank spot on your sketchpad or click on the highlighted object again)
- Hold down the shift key on the keyboard and highlight point C in the picture. Point to point C and click the mouse when the arrow changes to a horizontal arrow.
- Once the line and the point underneath the line are highlighted, choose the construct option from the toolbar at the top of the screen. Then choose parallel line. This will create a line through point C parallel to the line containing A and B.



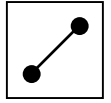
(your picture should look like this so far)

4) Constructing a triangle.

- Choose the Point tool from the left-hand side of the sketchpad.
- Place a point on the upper line about an inch to the right of point B. (use the same procedure mentioned above for constructing a point)
- While the point tool is still selected, place two points on the lower line. Place the first point about an inch to the right of point C and then the second point about an inch to the right of the first.



➤ At this point make sure that the line segment option is selected under the line tool. Click and hold the mouse button down while on the line tool (fourth from the top on the left-hand side). Choose the line segment tool and release the mouse button.



➤ Highlight points D, E, and F by selecting the arrow tool and pointing to either point D, E or F. When the arrow changes to a horizontal arrow, click the mouse. Then hold down the shift key and highlight the other two points.

➤ When all three points are highlighted press Ctrl L on the keyboard to connect the points with line segments to form a triangle.

5) Measuring the area of a triangle.

➤ Make sure the arrow tool is still selected.

➤ Highlight (or click on) the three points of the triangle (D, E, and F).

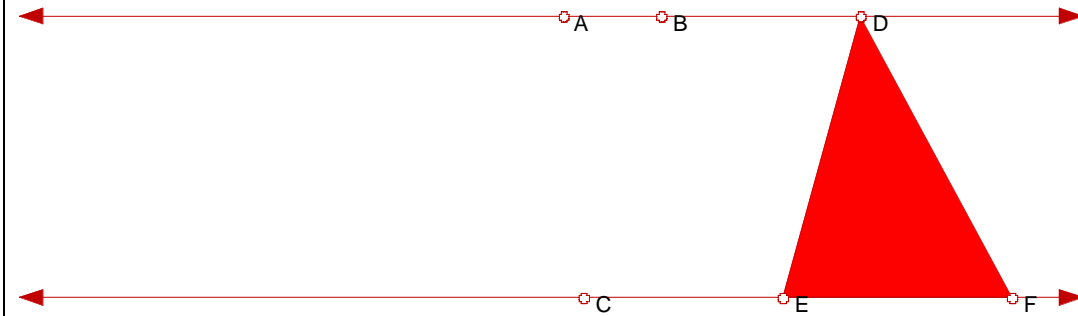
➤ Choose the Construct option on the toolbar at the top of the screen and then choose Polygon Interior. The inside of the triangle will then become shaded.

➤ While the interior of the triangles is still selected, choose the Measure option from the toolbar and then Area. The area of the triangle will be displayed in the upper left-hand corner of your sketchpad.

➤ Select point D by highlighting it, and then drag point D by clicking on point D and holding in the mouse button while you drag it from side to side along the line.

➤ As you drag point D, notice the area figure in the upper left-hand corner.

Area FED = 0.88 inches²



Investigate:

As you drag point D along the parallel line, what do you notice about the area of the triangle? Drag the top vertex of the triangle (point D) all the way over to the left hand side, and record your data. Drag the vertex to three more places and record your data. Try constructing another triangle in the same fashion as discussed above, but this time you choose when to put your lines and points. Drag the vertex and record the area for your new triangle. Do you notice a pattern?

	Area 1	Area 2	Area 3	Area 4
Triangle 1				
Triangle 2				

The area of a triangle is unchanged when the top vertex of the triangle is dragged along a line parallel to the base of the triangle.

Conjecture: Write your conjectures below.

Present Your Findings:

Discuss your results with a partner or a small group. To present your findings, you could print a captioned sketch showing your measurements and your conjectures along with any explanation you might have for why your conjecture is true.

Explore More:

Try using a parallelogram instead of a triangle, measure the area, and see if the same holds true for the parallelogram as did for the triangle.

Written by Keri Jeanes, Kutztown University, 2002