

Relationships of Similar Polygons

This activity uses the TI-73 Geoboard APP to investigate the relationships between the lengths of sides, perimeters, and areas of similar polygons. For this investigation, 8 x 8 geoboards will be used.

A. Similar Right Triangles

1. Choose the Geoboard APP on a TI-73 calculator.
2. Choose an 8 x 8 geoboard and press ENTER.
3. Draw a right triangle with legs of 1 unit starting with the first vertex in the bottom left-hand corner of the geoboard. To draw the right triangle, press DRAW, then ADD to start the triangle at the vertex of the right angle. Use the red arrow keys to continue 1 unit to the next vertex, then press ADD to set the first leg of the triangle. Using the arrow keys, make the hypotenuse and then the other leg, ending up back at the first vertex, being sure to press ADD at each vertex. When you are finished making the triangle, press DONE and QUIT using the "soft" keys. The "soft" keys are the five red keys directly below the screen that correspond to the choices on the geoboard screen. (DONE corresponds to the trace key and QUIT corresponds to the graph key.)
4. With the cursor blinking on one of the vertices of the triangle, choose MEAS (the trace button). Choose Perimeter and press ENTER. You should see the perimeter on the screen. Enter the perimeter in the table below in the Perimeter column. Press QUIT (the graph key). Now choose MEAS again, and choose Area. Enter this value in the table in the Area column. Press QUIT to finish.

5. Now create a second right triangle using the same steps as above, but this time create one that has legs of 2 units each. Again, find the perimeter and area of this triangle using the geoboard's functions and enter the values in the table below.
6. Finally, create a third right triangle with legs of 3 units each. Find the perimeter and area and enter the values in the table below.

	Length of Leg	Perimeter	Area
1 st Triangle			
2 nd Triangle			
3 rd Triangle			

7. Do you notice any patterns with respect to the various measurements?

B. Similar Trapezoids

1. To create the first trapezoid, choose OPTN, then choose Erase Board to get a blank screen. Then, starting at the bottom left-hand vertex of the trapezoid, choose DRAW, then ADD as before to set the first vertex. (You are going to make a trapezoid with vertical height of 1 unit, top base of 1 unit, and bottom base of 2 units. The instructions that follow give the specific steps.) Using

the red up arrow key, move the cursor up one unit and press ADD to get the upper left-hand vertex of the trapezoid. Next, move one unit to the right to make the top base of the trapezoid and press ADD to set that vertex. Using both the right and down arrows, add the third vertex so that the bottom length of the trapezoid is 2 units long. Remember to complete the trapezoid by ending up at the vertex where you started and pressing ADD once more. Then press DONE and QUIT.

2. As before, find the perimeter and area of the first trapezoid and place the values in the table below.
3. In a similar fashion, you are going to create a trapezoid with sides that are twice the lengths of the sides of the first trapezoid (vertical height of 2 units, upper base of 2 units, bottom base of 4 units, and diagonal length twice that as the first trapezoid). If you start the first vertex one unit over from the base of your first trapezoid, you should have room to create it next to the first one. Again, find the perimeter and area of this trapezoid and place the values in the table below.
4. Finally, create a third trapezoid with measures 3 times the length of the original trapezoid (vertical height of 3 units, upper base of 3 units, bottom base of 6 units, diagonal length 3 times that of the first trapezoid). And again, find the perimeter and area of this trapezoid and place the values in the table below.

	H	B1	B2	Perimeter	Area
1 st Trapezoid					
2 nd Trapezoid					
3 rd Trapezoid					

5. Do you notice any patterns with respect to the various measurements? Are they consistent with the patterns you noticed with the triangles, or did you find something different this time since the trapezoids have 4 sides?

C. Similar Parallelograms (Rhombi)

1. Clear the geoboard and create a non-rectangular parallelogram with sides of 1 unit each, starting the first vertex in the lower left-hand corner of the geoboard. As before, find the perimeter and area of the parallelogram and enter the values in the table below.
2. In a similar fashion, create a similar parallelogram next to the first one with sides of 2 units each, and find the perimeter and area and enter the values in the table below.
3. Make a third parallelogram with sides of 3 units each and find the perimeter and area and enter the values in the table below.

	Length of Side	Perimeter	Area
1 st Parallelogram			
2 nd Parallelogram			
3 rd Parallelogram			

4. Do you notice any patterns with respect to the various measurements? Are they consistent with the patterns you noticed with the triangles and trapezoids?

D. Squares

1. Clear the geoboard and create a square with sides 1 unit long, a square with sides 2 units long, and a square with sides 3 units long. Find the perimeters and areas of the squares and fill in the values in the table below.

	Length of Side	Perimeter	Area
1 st Square	$S_1 =$	$P_1 =$	$A_1 =$
2 nd Square	$S_2 =$	$P_2 =$	$A_2 =$
3 rd Square	$S_3 =$	$P_3 =$	$A_3 =$

2. The patterns you get here may make the relationships with respect to side length, perimeter and area much clearer than in the other three sets of similar figures. Are these patterns consistent with what you noticed before? If not, go back to the other three sets of polygons and see if the patterns make sense now.

E. Ratios

1. Now that you have looked at the patterns that emerged in your explorations, let's take a look at the patterns in terms of ratios.
2. Using the squares table, find the ratios of the lengths of the sides. $\frac{S_1}{S_2} = \underline{\hspace{2cm}}$ $\frac{S_2}{S_3} = \underline{\hspace{2cm}}$ $\frac{S_1}{S_3} = \underline{\hspace{2cm}}$
3. Using the squares table, find the ratios of the perimeters. $\frac{P_1}{P_2} = \underline{\hspace{2cm}}$ $\frac{P_2}{P_3} = \underline{\hspace{2cm}}$ $\frac{P_1}{P_3} = \underline{\hspace{2cm}}$