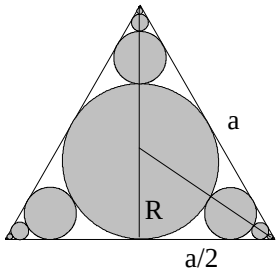
LAB 9 Geometric Series - Hints

There seems to be a few things you need to help you work on these geometry problems. In several cases, we will need to sum geometric series: $\sum_{n=0}^{\infty} ar^n = a + ar + ar^2 + \ldots = \frac{a}{1-r}$. Note that *a* is the first term and *r* is the common ratio.

I. Infinite Snowman

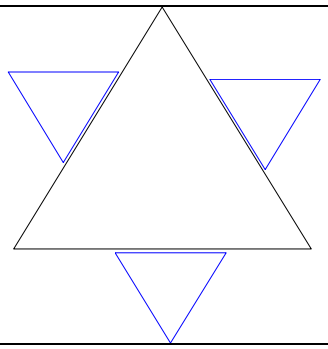
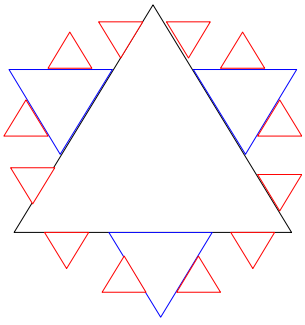
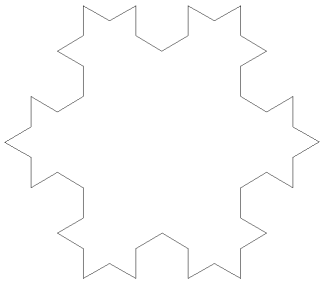
Experimental Area: You know how to get the area of a circle. For this problem we need to sum a lot of these. So, you have $A = p r_1^2 + p r_2^2 + p r_3^2 + \cdots$ Look at each term. Is there a pattern? How does each term relate to the previous term? Do you have a common ratio? You can sum the areas for the three corner sets of circles separately.

General Area: If the big circle has radius *R* and the side is of length **a** (not the same *a* as above), can you write *R* in terms of **a**? How does your total area computation look in terms of *R*? In other words, can you rewrite $A = p r_1^2 + p r_2^2 + p r_3^2 + \cdots$ in terms of *R*? Once you do this and you know how *R* depends on a, then you have *A* in terms of **a**.



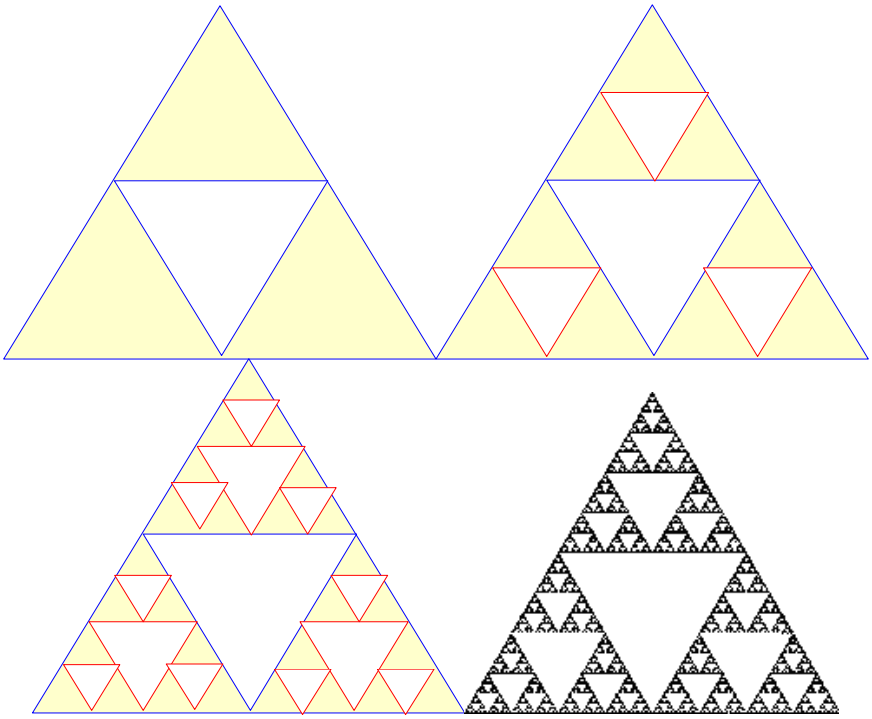
II. Koch Snowflake

In this problem you are taken slowly to the end snowflake with an infinite number of pieces making up the border. We start with the first figure. Draw lines to pick out triangles. How do the areas of triangles change as you add smaller ones? How does the number change? In Koch 2 you add a few more smaller triangles. What is the pattern? If you continue this was forever, what geometric series do you get? Now sum it up. Slowly add up the lengths for the two figures and think about how the length of each side piece changes and how many lengths are needed. Again, find the pattern.

		
$A = \frac{1}{2} b_1 h_1 + \frac{1}{2} b_2 h_2$	$A = \frac{1}{2} b_1 h_1 + \frac{1}{2} b_2 h_2 + \frac{1}{2} b_3 h_3$	

II. Sierpinski Triangle

You can get the total area by adding up the white areas and subtracting from the area of the big triangle. Again, start small. Look at the images provided. Learn the pattern and develop the infinite series that gives the total white area. Again, you only need to measure the the big triangle.



IV. More Circles - Bonus

OK, now that you have gotten this far, you should be able to do the last problem. It is extra credit, so you might want to put it off for a while so you can do your homework.