For this project, you'll create a fractal, using a recursive process, as we've seen with the Koch Snowflake and the Sierpinski Gasket.

Choose a recursive process (several are suggested on the next page). Start out with just one piece of graph paper, and do several of the steps to get a sense of how the process works, and whether this is creating a fractal at all (all the steps I suggest will, but if you make up your own, it may not), and if so, if it's one you want to pursue.

If you create your own new fractal, describe the process using a recursive rule.

After this practice run-through with the recursive process you end up choosing, you'll have a sense of how big to make it. You may want to carefully attach several pieces of graph paper together so that the lines match up. Carefully mark out your beginning figure – since in most cases you're subdividing a figure, you'll want to start fairly large, and have a number of squares which is easy to divide. For instance, if you choose a pattern that involves dividing into thirds, then you'll want to use a number of squares that's a power of 3 (3, 9, 27, 81, 243, etc). If it involves dividing into halves, then choose a number of squares which is a power of 2.

While the creation of the fractal is not creative, what you do with it can be!

(Should your work be selected for the end-of-semester art show, thumb tacks or staples will be used to display it. If you don't want that, please mount it on some sort of matting through which we *can* put thumb tacks.)

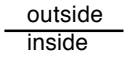
To further pursue this project, figure out the similarity dimension of the fractal (just so you know, not all fractals have fractional dimension). You can also ponder the perimeter and area, if you choose to.

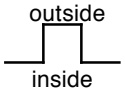
Write a brief description describing the mathematics behind what you've done.

Possible Points: Correctly drawing the first 3 or 4 steps of the recursion process (or however many you need for it to begin to get difficult but at the same time for you to begin to get a feel for what the actual fractal looks like) and of course writing a good clear description of the mathematics behind your work can earn up to 20 points. Adding some creativity to it can earn a few more points. If you also figure out the similarity dimension, the perimeter, and/or the area, you can earn still more – up to 35 points.

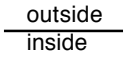
Note: A work of art submitted with out a corresponding mathematical analysis will be returned ungraded.

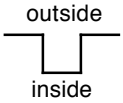
1. The square snowflake:

Start with a  Wherever you see a 

, replace it with a 

2. Vicsek's snowflake:

Start with a  Wherever you see a 

, replace it with a 

3. The Quadratic Koch Island

Start with a  Wherever you see a , replace it with a 

Wherever you see a , replace it with a 

Notice that after one step, if you count the line segments, you could say that you have 6 line segments that are 1/4 the original length and one that is 1/2 the original length, OR you could say that you have 8 line segments, all of which are 1/4 the original lenght ... but that two of them are lined up side by side. After each step treat these longer line segment as if they are two shorter ones side by side.

4. The Dragon Curve

Start with a Wherever you see a , replace it with a 

That is, replace every line segment with the two sides of a right isosceles triangle whose base would be the line segment you're removing.

Use a flipped version of this motif for every other line segment. That is, alternate the "direction" of the point as you work through all the line segments.