**In-Class Activity for Fractal Lesson 2**

Today we will be exploring how to find the perimeter and area of fractals. Images have provided for you in order to make your work easier. We will also look at 'deconstructing' fractals, that is we will be looking at starting with a stage 2 image and determining the initiator and generator that gave rise to it, rather than beginning with the initiator and generator and finding stage 2. This 'deconstruction' is actually more useful in the real world because we are typically looking at shapes and trying to find a rules to model them. Additionally we will consider non-linear fractals, what they are and how they are created. **INSERT THESE PAGES IN YOUR EXTENDED SYLLABUS BETWEEN PAGES 34 AND 35, AND TURN THEM IN WITH YOUR NEXT HOMEWORK PACKET.**
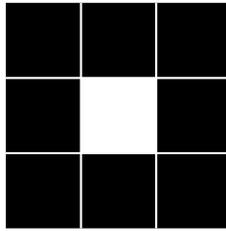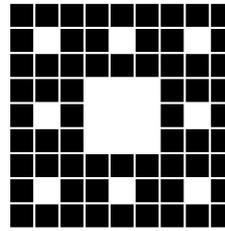
CANTOR SET
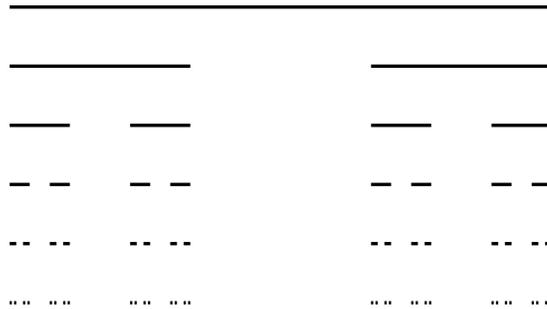
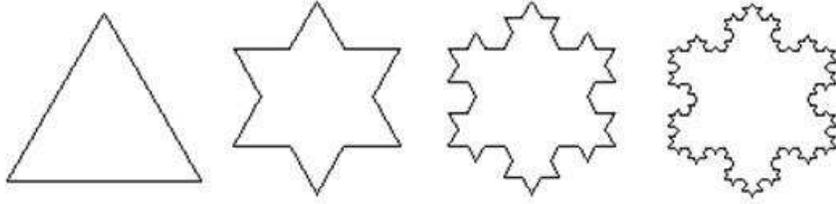**LENGTH:**

SIERPINSKI CARPET
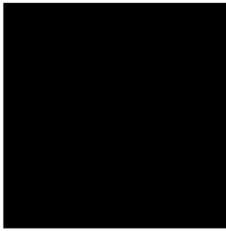
stage 0
initiator

stage 1
generator

stage 2

AREA:

PERIMETER:
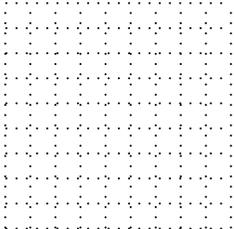
KOCH SNOWFLAKE CURVE

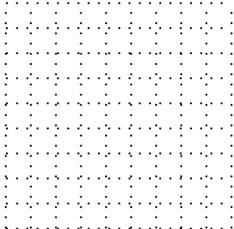**AREA:**
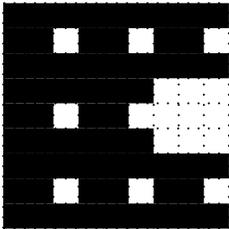
PERIMETER:

SIERPINSKI GASKET

AREA:

PERIMETER:

DECONSTRUCTION

stage 0

initiator

stage 1

generator

stage 2

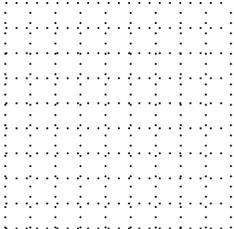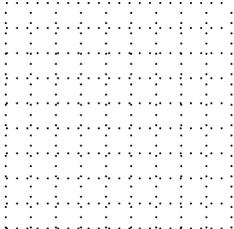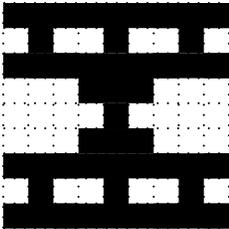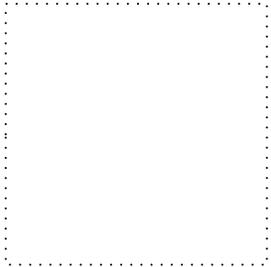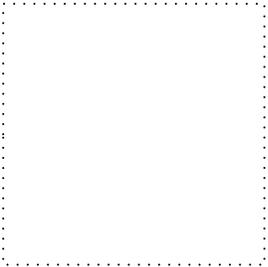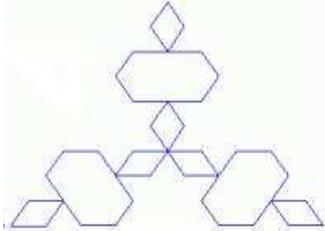

stage 0

initiator

stage 1

generator

stage 2

stage 0

initiator

stage 1

generator

NON-LINEAR FRACTALS

All fractals share the same properties in terms of being the result of an infinite process of iteration, displaying detail on all levels, exhibiting self-similarity, etc. But as you can see from the images below, non-linear fractals can look quite different from the linear fractals we have been studying. These images give you an idea, but you might want to search online in order to find images like these in color. The images you see below are all taken from the fractal known as the Mandelbrot Set.

Before exploring the above images further I'll give some explanation of the process of their creation using a number-line and real numbers, so be sure to get that in your notes. For this particular image we use an iteration of an equation rather than an iteration of a shape, and we use the complex plane rather than a Cartesian coordinate system, which means we use complex numbers and not just real numbers. This may sound pretty complicated, but the process is quite simple, actually. This set, which is so complicated as to have been called more complex than the universe itself (because this mathematical shape has infinite resolution), comes from the following short equation:

$$z = z^2 + c$$

The letters z and c stand for complex numbers. We also set z to zero to begin with, and we choose a point c in the plane to iterate. This gives us a new z, which we plug in, and we continue to use our original c until we know the 'behavior' of the point. We'll do some examples together to see how this works, and we'll look at some images together to illustrate this as well.

The complex plane looks like a Cartesian coordinate system, but instead of each point representing an ordered pair, each point is a single complex number, where the horizontal axis corresponds to the real part of the number and the vertical axis corresponds to the imaginary part of the complex number.

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