

Math 201 Homework #2

Instructions: you must work by yourself. The easiest way to turn this in is electronically as a Mathematica file. Just email it to me. You can turn in hard copy if you prefer or if your file ends up being too large to email. It is due Friday, October 2, at 1:10. Late papers lose 15% the first day or partial day late, plus 10% for each additional day late. I will be glad to discuss the assignment with you until, but not including, Thursday night. Start early, ask questions, and do well!

We will spend some time in class talking about fractals and how to generate them in Mathematica. The sample file is posted on Y (Public): \Mathmatica as 201ChaosGame.

Even though I am not asking you for an organized paper with paragraphs, it is important to convey your results clearly with complete sentences and explanations. Your grade will be affected by how well you communicate. In particular, having to bounce back and forth between different files is distracting – *place all of your results in one place!* If you are using Mathematica as a wordprocessor, just leave the commands and output in the appropriate place in the file. If you are not using Mathematica as a wordprocessor, neatly write out your results and attach the Mathematica print-out.

First, for the Chaos Game, answer the following questions.

The transformation $\begin{bmatrix} 1/2 & 0 \\ 0 & 1/2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$ moves points (x, y) halfway to what point?

The transformation $\begin{bmatrix} 1/2 & 0 \\ 0 & 1/2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 1/2 \\ 0 \end{bmatrix}$ moves points (x, y) halfway to what point?

The Chaos Game in class produced a Sierpinski triangle based on an equilateral triangle. To produce a Sierpinski triangle based on a right triangle, answer the following question and then modify the Mathematica code to produce a triangle with vertices $(0, 0)$, $(1, 0)$ and $(0, 1)$.

What transformation moves points (x, y) halfway to the point $(0, 1)$?

Next, for the Collage Theorem, start with a geometric object other than the square shown in class. Describe the convergence of the iterates to the Sierpinski triangle.

The Mathematica file shows a fern that is created using the Chaos Game with four rules. Indicate what those might be by identifying four copies of the fern within the fern that union together to form the entire fern.

Finally, take the code for the Koch snowflake and modify it by changing starting vertices, rotation matrix and/or other aspects of the code to create your own fractal. Be as creative as you can. I will have various faculty judge your fractals, with winning fractal receiving bonus points and lasting fame.