

Math 388 Exercises

Instructions: due Tuesday.

1. Use Mathematica to zoom in on the upper period-3 ball of the Mandelbrot set.
2. Pick a complex number in the period-3 ball (write it down) and use the TI-89 to show that with this c value the iterates of $z^2 + c$ converge to a period-3 cycle. Write down the members of the cycle.
3. Repeat numbers 1 and 2 for the period-5 ball of the Mandelbrot set.
4. From the previous assignment, produce your own fractal. Be creative! Explain as fully as possible how to create your fractal by hand. I will give bonus points to the "best" fractal as judged by the faculty.

Read the Prologue and the chapter "Universality" and answer the following questions.

5. What are some things that Feigenbaum likes to observe? Are these phenomena easy to explain mathematically?
6. What is the basis for renormalization group theory?
7. How did Newton and Goethe differ in their approaches to color?
8. Is chaos theory reductionistic or holistic?
9. Why did slow computing actually help Feigenbaum discover universality?
10. Describe Feigenbaum's number.