

MAT 331, Spring 2006

Project 2: Complex dynamics

Due April 3th

In this project, you will work with the Julia and Mandelbrot sets of polynomial maps of degree two in one complex variable.

Let $f_c : \mathbb{C} \rightarrow \mathbb{C}$ be defined as $f_c(z) = z^2 + c$ where the constant c can be found with your name in www.math.sunysb.edu/moira/www/sp06/problems/project2data

1. Plot the filled Julia set of f_c and explain the graph.
2. Iterate $z_0 = 0$ for 200 times and show the last 20 points. What can you say about the orbit of this point? What other types of orbits this map has? Explain and show examples.
3. Determine the fixed points of f_c . Which of these fixed points are attractors?
4. Find an attractive periodic orbit.
5. Plot the Mandelbrot set for the map $F(z) = z^2 + c$. (Note that now, c varies). Find a constant c such that the Julia set is totally disconnected. Support your answer with an image of the Julia set. What can you say about the orbit of $z_0 = 0$ in this case?

As always, pay attention to clarity of exposition; and describe what you do at each step from a mathematical viewpoint, not as a commentary on how to use Maple. Pay attention to spelling, grammar, and sentence structure. *Do not* include false starts, mistakes, or irrelevant calculations in your finished product.

The expository part of this project counts AS MUCH as the actual calculations, and should not be ignored.

You should use Maple (or any another appropriate program of your preference) to do the actual computations.

- EXTRA CREDIT You can choose to study, describe and maybe illustrate some aspect of the Julia or Mandelbrot, or fractal associated with Newton's method we did not see in class. You will probably want to refer to books and articles in the library (good possibilities are posted in Blackboard). You might also want to search the World-Wide-Web; there is quite a lot of information on fractals on the web, but be careful: as is always true, some of the information on the web is misguided, misleading, or just downright wrong.

The format of this part is flexible, and you are not required to use Maple. Nevertheless, you should show some "processing" of the information. Just copying paragraphs from books will not give you any credit. In this sense, an illustration of the facts are describing using Maple can help.