Math 451
Exploration Paper 1
Due Start of Class, Lesson 8

Download ComplexTool from the Math 451 website.

As you explore each of the following functions, do the following:
A. Describe the behavior of the function. Clearly explain where the domain and range are, and what the range looks like under the action of the function.
B. Explain how your observations about the graphs could be determined by analyzing the equation for the function.

Function 1: $f(z) = z^2$. Do at least two separate things with this function: Make a rectangular grid and see what happens as you move it into each quadrant of the plane; and make a portion of a polar grid (for example, a semicircle or a quarter of a circle) and move it around. Pay particular attention to what happens when it "sits over" the origin and covers parts of all four quadrants at once.

Function 2: $f(z) = e^z = \exp(z)$. Viewing a rectangular grid, explain the the following: What images of horizontal and vertical lines are under this function, and what happens as you move it far from the origin to all four corners of the plane.

Function 3: Create your own nonlinear function, and do some of the same explorations as above.

This is a **writing** assignment. Please show all mathematics used, but the bulk of your paper should describe your understanding, both of the process and of the results. Your paper should be written at a level that is understandable by any student of complex variables. In particular, it should be accessible to any student who understands the concepts discussed, but who may not have thought about this particular assignment. Make sure that your paper flows well and is not simply a series of equations.

All equations MUST be typed using Microsoft Equation Editor (Insert; Object; Microsoft Equation 3.0). You may use whatever format you wish to best present your work. You may include pictures, tables, or whatever you wish so long as it is relevant. At a minimum you must include your name and a **TYPED** documentation statement. There is no minimum or maximum length – your paper should be long enough to describe what you've done and learned, and no longer.