Math 50: Final Project

The final project will combine all of the calculus skills we've learned so far. In small groups of four, you will be given an interesting rate equation that comes from physics, engineering, or geometry, and analyze its behavior with the techniques of calculus.

There are four primary tasks:

1. Sketch solutions to the rate equation with (discrete) approximation.

2. Calculate and graph polynomial approximations of solutions.

3. (with guidance) Identify interesting properties or identities of the solutions to the rate equation based on the previous steps.

4. Use calculus to carefully check some or all of the above properties.

This will parallel our study of the exponential functions, where we started with a rate equation suggested by population growth and finances:

$$f'(t) = r f(t)$$
$$f(0) = C$$

We began by sketching solutions for various choices of r and C to get a sense of what such functions looked like. Using calculus, we were able to carefully check identities like $e^{rx} = (e^x)^r$, and produce polynomial approximations to get a more precise handle on the function's behavior and the values it takes.

Your small groups will work through these tasks collaboratively to produce a clear write-up, including figures, and then briefly present your work to the class together (10-15 minutes). Of course you are encouraged to seek help from the TA and instructor!!

You'll be graded both individually and as a group. What I most want to see is **collaboration** and **effort**. These are challenging problems, but thinking about them and practicing your conceptual understanding is more important than a "right answer".

[I may make some modifications to this document after the midterm based on overall class performance so that everyone has an opportunity to demonstrate more growth and mastery]