Math 397 Midterm Assignment
Due Wednesday, May 2

By this point in the course we have talked about several topics. Here are the main ones:

- Review of calculus with emphasis on exponential and logarithmic functions
- Areas using the method of exhaustion
- The mathematics behind rainbows
- Some differential equations this week

Your midterm is a writing assignment, to take one of these topics and explain some piece of it. The final product should be in LaTeX, around 3 pages, and it should include each of the following elements:

(i) Some displayed math equations

(ii) Some aligned equations

(iii) At least one picture (not drawn in by hand)

(iv) At least one place where Sage is used in a nontrivial way—i.e., you can't just "use Sage" to do 5 times 5. Ideally, the application should be relevant to calculus in some way.

For resources, you are allowed to use anything: class notes, the readings posted on the course website, books, other things you find online. And you can come talk to me at any time either about ideas or questions. However, what you write must be in your own words and you should put some thought into how you present things.

Some things to keep in mind:

(1) You do not have to cover *all* of your chosen topic. Three pages is not a lot. Choose to cover a piece of the mathematics that is interesting to you.

(2) Three pages is meant as a rough guideline. If you choose to write more, I'm not going to complain. If you write less than three pages it's probably a sign that you haven't delved deeply enough into the topic, but I'm open to persuasion.

(3) Tell a story. Mathematics is not just a collection of facts, there should always be an underlying narrative.

(4) Do not write with me in mind as your intended audience. Imagine that you are writing for someone who has taken MA251–253 or other basic courses (341–342, 281–282 if you like) but not this one.

Grading rubric:

Grades will be on a 25-point scale, organized as follows:

depth and correctness	8
meets guidelines	3
typesetting style	4
storytelling	5
innovation	5

Here's what is meant by each of these:

depth and correctness: Is what you wrote mathematically correct? Does it go into a reasonable amount of depth? If you spend the whole 3 pages explaining why $1+x+x^2+\cdots=\frac{1}{1-x}$, that might be mathematically correct but it's not very deep.

meets guidelines: Does your paper satisfy (i)–(iv) on the previous page?

typesetting style: Does the typesetting look good and conform to preferred mathematical conventions? Have the LaTeX commands that you should know at this point in the course been used where appropriate? Consult the link "Learning LaTeX: The Basics" on the course website for various pieces of advice about mathematical typesetting.

storytelling : Did you convey a narrative rather than just a collection of facts? Could a student with the assumed background follow your steps and understand what you have written?

innovation : If everything you write is something that I did in class, or you saw on a HW assignment, or is in a course reading, that's zero innovation. Did you bring anything new into your paper? It doesn't take much: design a new example that is different from what we did in class, say something mathematical about double rainbows, use Sage to explore some angle that we didn't pursue, etc. There are millions of things you can do to just bring a little bit of new stuff into your paper.

Note that these things are tied together. It is unlikely that someone could get a 5 in storytelling if they also get a 0 in depth and correctness. It is very hard to tell a good story based on complete nonsense.

You don't have to use this, but I have included a sample file "397MidtermTemplate.tex" on the Canvas. The file shows how to set up your title, sections, subsections, Remarks, Theorems, Examples, and so forth. You can use this file as your base and just add your own text. I will also post some more general files with information about using LaTeX on Canvas.