

# Math 194: Senior Seminar

Instructor: Jesse Leo Kass

Spring 2024

## Description

This class is the capstone to your college mathematics education! You probably have heard of some fascinating mathematics topics: the number  $\pi$  is transcendental! the number  $e$  is irrational! You can't comb the hair on a coconut (i.e. every vector field on the sphere has a zero)! What's up with the Riemann hypothesis? What are the  $p$ -adic numbers and how does one do calculus with them?

You certainly have seen the answers to all (maybe any?) of these questions, but you know have the tools to research and understand the answers yourself. (Well, you probably won't be able to solve the Riemann hypothesis, but with work, you can understand the statement and why it is so important.) The goal of this class is to demonstrate this!

## Description from the Course Catalogue

Designed to expose the student to topics not normally covered in the standard courses. The format varies from year to year. In recent years each student has written a paper and presented a lecture on it to the class.

## Prerequisites

Satisfaction of the Entry Level Writing and Composition requirements; MATH 103A or MATH 105A or MATH 110 or MATH 111A or MATH 111T or MATH 117. Enrollment priority is given to seniors; juniors may request permission from the undergraduate vice chair.

## Instructor's e-mail

jelkass@ucsc.edu.

## Instructor's Office Hours and Location

Monday, Wednesday 3:00 - 4:00 pm in McHenry 4174 or by appointment.

## Resources

There are no required textbooks, but an important component of this class will be learning how to find resources to help you research a mathematical topic. I will be posting relevant material to the course website as the quarter progresses.

## Meeting times

Class meets Monday, Wednesday, Friday 4:00–5:05 pm in McHenry 4130

## Policy on electronic devices in the classroom

Please turn the ringer on your cell phone off.

## Course requirements and grading

Grades will be entirely based on homework, a final exam, and a final paper.

Students who chose a Pass/Fail option will receive a Fail if their numerical grade is 69 or lower and otherwise will receive a Pass.

Course grades will be computed as follows: Homework: 25% Presentations: 25% Final paper: 50%.

## Homework

I will assign homework on a weekly basis. The homework will largely be designed to help you produce your final essay.

Homework is due at the beginning of class. Homework submitted during class but after the start of class will be marked LATE and the grader may invoke a penalty. Once class has ended, no homework will be accepted. If you can't make it to class on a day that a homework is due, the correct procedure is to submit the homework before class in my mailbox on the 4th floor of McHenry (by the main office).

To address various situations where you are unable to submit a homework, I will drop the lowest homework grade you received when computing final grades. For example, if you received a zero on the first homework and full credit on all subsequent homework, then you will receive the full 50% on the homework component of your course grade.

## Presentations

You will first give a few practice talks to help you develop your public speaking skills. Then, during the last half of the quarter, each student will give a 30 minute talk on their chosen topic. I will give more details later in the quarter.

## Final paper

The class focus on the class is to write a research-style mathematical paper. This is both a way to explore a mathematics topics on your own and a chance to develop your technical writing skills. We will discuss the requirements a LOT more as the quarter progresses, but the basic requirements are that the final paper must:

1. be written in the typesetting software system  $\text{\LaTeX}$
2. be at least ten pages long;
3. use at least three scholarly references.

## Tentative schedule

The schedule is *tentative*.

**April 1** Introduction to the course

**April 3** Practice on public speaking

**April 5** Practice on public speaking

**April 8** How to find resources on mathematics topics? How to find about interesting mathematics results?

**April 10** How to find resources on mathematics topics? Have to dig deeper?

**April 12** How to find resources on mathematics topics? How to look up references?

**April 15** Introduction to  $\text{\LaTeX}$

**April 17** Practice with  $\text{\LaTeX}$ typesetting

**April 19** Discussion of good mathematical writing

**April 22** Discussing of good writing in general

**April 24** Check up on topic selections

**April 26** Peer editing

**April 29** Practice on mathematics presentations

**May 1** Practice on mathematics presentations

**May 3** Last discussion of topics

**May 6** Topic selections due today. We will discuss what everyone selected.

**May 8** Student presentations

**May 10** Student presentations

**May 13** Student presentations

**May 15** Student presentations

**May 17** Student presentations

**May 20** Student presentations

**May 22** Student presentations

**May 24** Student presentations

**May 29** Student presentations

**May 31** Student presentations

**June 3** Student presentations

**June 5** Flexible day.

**June 7** Final draft of paper due.

## Collaboration Policy

With each week's homework, you must turn in a one-paragraph description of all the resources you used on that homework. You must mention any person you talked to about the problems, any book you looked at, any online resource (Wikipedia, Chegg,...) that you used. A sample paragraph is

On this week's homework, I worked on the problem set collaboratively with Gauss and Grothendieck. We found an Alex Jones video (<http://youtube.blah.com>) that gave a really clear explanation of excellent rings. We compared our solutions against a solution key that we found on the /commutativealgebra/ board of 4chan (<http://blah.blah.edu>). We also got really stuck on Problem 5, and so we DM-ed the Twitter account "catturd2." Turns out, he doesn't know any math or history, so I went to Chegg.com and paid an online tutor ("Zariski") \$50 to solve the problem for me.

This paragraph is required even if you work entirely on your own and only reference the course textbook. You could just write something like: "This week I did not work with any other students and relied entirely on course notes, and the Katz textbook."

It is acceptable to use any and all resources that you would like (including Alex Jones videos and Chegg), but failure to include this paragraph may result in a reduced grade and may raise honor code concerns.

## **Academic integrity**

Cheating will not be tolerated. Honor code violations will be addressed according to university guidelines.

## **Accessibility**

If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by email, preferably within the first two weeks of the quarter. You can contact the DRC by phone at 831-459-2089 or by email at [drc@ucsc.edu](mailto:drc@ucsc.edu).