

# Honors Discovery Seminar: Final Project Presentation

## 1 Outline

The final project in this seminar will be student presentations. You may work in groups of 1 - 3 people. (If you really want to be a group of four, come talk to me to make sure we can accommodate the timing.) Your presentation will consist of:

- A short 10-15 minute presentation or activity in class (time length including questions and dependent on size of group). I have provided several topic ideas at the end of this document.
- A (minimum of) two pages written about your topic of choice, with references, to be shared with the class.

Should it be necessary for your own unique circumstances, we can accommodate Zoom presentations as well. If you are interested in running a longer activity, please come talk to me.

This is a chance for you to expose the class to your own mathematical interests and topics beyond what we have covered so far.

## 2 Purpose

The purpose of this project is to:

1. Practice research skills
2. Develop technical presentation skills
3. Develop technical writing skills
4. Learn in-detail a new topic
5. Be exposed to several topics through classmate presentations

## 3 Timeline

By the end of next week, Friday, April 14, you will need to submit the following information (via a Moodle survey):

1. Group members (groups should be 1-3 people; send me an email if you'd like to be in a larger group and we can discuss)
2. Topic choice (we won't repeat topics, so if more than one group picks the same topic, I will contact you)
3. Any dates in the range April 26, May 3, May 10 that your group is *unable* to present

There will be time in-class on Wednesday, April 12, to discuss with your classmates and make groups, if you wish.

Presentations will take place during April 26, May 3, and May 10 classes. Your write-up is due May 17, although you are welcome to turn it in early (I recommend having it done before you present!).

## 4 Grading

Your grade will consist of two parts.

## 4.1 In-class presentation: 20 points

Your presentation in class will vary depending on what topic you choose. You may choose to discuss a field of mathematics, a historical or current mathematician, a specific problem, or even lead an activity. One method of presentation could be similar to the videos you had to watch from March 1, writing problems and pictures on the board. One method could be using a powerpoint. One could be leading a group activity. Below is a general grading rubric.

1. *Background: 5 points.* Did you clearly present the topic/problem/historical figure/activity to the class? Did you include relevant definitions, historical background, and context?
2. *Mathematical content: 10 points.* Was the math in your presentation correct? Were the definitions correct? Was it delivered at the level of the rest of the class (not too technical)? If you've chosen a historical figure, were their mathematical contributions clearly stated? Was your interest in the topic clear and compelling? If relevant, were there applications of the topic? Did you answer questions to the best of your ability?
3. *Delivery: 5 points.* Did you present your project in a clear, easy-to-follow manner? Was your board-work/powerpoint slides/etc readable? Was your voice loud enough to be heard?

## 4.2 Write-up: 10 points

To supplement your presentation, you will submit a two-page (or more) write-up of your topic, including a summary, relevant definitions, historical context, and references. This will be distributed to the class for anyone wishing to know more about your topic. This will be completed in your presentation group. Below is a general grading rubric.

1. *Organization: 4 points.* Was your write-up clearly organized? Was there an introduction to your topic, necessary background material, and a summary of what was presented? Did you include additional information for interested classmates?
2. *Technical content: 4 points.* Was the mathematics correct? Was it delivered at a level your classmates could follow?
3. *Professionalism and references: 2 points.* Was your write-up done in a professional manner, with correct spelling and punctuation? Did you include references? *Note: I do not care what referencing style/convention you use. Just make sure whatever material you used is clearly referenced.*

## 5 Academic Integrity

This work should be done in groups and you are allowed to use internet resources, however, use of AI tools like ChatGPT to create your presentation and write-up is strictly forbidden. Using such tools constitutes a breach of academic integrity standards and will result in a failing grade.

## 6 Suggested Topics

Here is a list of topics/projects that may be interesting. You can choose something from the list or choose any mathematical topic you've encountered in your own lives. If you have a question on your topic/in general, I will have office hours MWF 12 - 1 in LGRT 1242 for the rest of the semester, and am also available to meet by appointment.

### 6.1 Mathematical research areas

Here are some research areas you could introduce. You can also elaborate on any area we've already covered (number theory, topology, graph theory,...)

1. Real analysis
2. Complex analysis
3. Mathematical logic
4. Non-euclidean geometry
5. Game theory

## 6.2 Specific mathematical concepts

Here are several ideas of specific mathematical concepts you could introduce.

1. What is a complex number?
2. What is the Gamma function?
3. What is the cardinality of an infinite set?
4. What is the continuum hypothesis?
5. What is the Farey sequence?
6. What is an irrational number?

## 6.3 Unsolved problems

Here are several unsolved problems you could present on.

1. The twin prime conjecture
2. The Goldbach conjecture
3. The Hadamard maximal determinant problem
4. The sum-of-three-cubes problem

## 6.4 Problems solved in the last 100 years

Here are several problems you could present on that were solved relatively recently.

1. Fermat's Last Theorem
2. Sum-of-three-cubes problem for numbers less than 100
3. Classification of tessellating convex pentagons
4. Existence of aperiodic monotile

## 6.5 Historical figures

Here are several interesting historical mathematicians.

1. Muhammad al-Khwarizmi
2. Isaac Newton
3. Sophie Germaine
4. Evariste Galois
5. Srinivasa Ramanujan
6. Maryam Mirzakhani

## 6.6 Mathematical tools

Some things many working mathematicians use every day.

1.  $\text{\LaTeX}$
2. CoCalc (formerly known as SageMath)