

# MAT180: Knot Theory

## Final Project

Dr. Melissa Zhang

Due 6/2/23 at 11:59 pm on **Canvas** and **Gradescope**

The final project is an opportunity for you to explore further a topic related to this course that you are particularly interested in. It is also a crash course on the following skills:

- reading research papers or advanced books
- writing expository articles
- typesetting articles properly, especially with regards to
  - the abstract
  - the `figure` environment
  - hyperlinks via `hyperref`
  - the bibliography/references section
- giving “lightning talks” (very short slide presentations)
- extracting value from others’ talks
- briefly describing your math to more general audiences

Everyone will have slightly different interests and backgrounds. I encourage you to choose something that is legitimately interesting to you. You will be graded on the quality of the materials you submit, not the topic you choose. Most importantly, make time to work on it, and have fun!

See below for a rubric detailing exactly how your project will be graded, based on the goals listed above.

## 1 Project Components

### 1.1 Expository Article (100 points)

Your expository article should satisfy the following conditions:

- Be roughly 2 pages in length without the figures.
- Have at least one figure, which may be hand-drawn as usual, with informative captions. (You may include as many figures as you’d like.)
- Include an introductory background section for introducing the topic, basic definitions, setting notation, etc.

- Include at least one nontrivial worked-out example in your own words.
- Include references to works in a bibliography section.
- Have an abstract summarizing the content of your article.

The audience of your article should roughly be a mathematics undergrad who knows a little about knot theory, but not necessarily from our class.

**I will type up next Monday’s lecture notes (Lecture 22) as an expository article so that you have a template for your own expository article.** In particular, I will include a bibliography, figure environments, hyperlinks, etc.

You will be graded using the following rubric:

Points	Criteria
30	mathematical accuracy and depth of content
20	organization, style, and clarity of writing
10	introduction and background content
10	worked example
10	figure(s), captions, and references to figures
10	correct citations, properly formatted bibliography and references to citations
10	informative yet concise abstract

Again, “depth of content” is not a judgement of the topic you chose to study. It’s the difference between where you started in the introduction and far you were able to explain a topic clearly within the quite limited number of pages of text!

## 1.2 Presentations (70 points)

Your presentation should be aimed at your peers in this class. You must prepare a slide presentation (handwritten or typed is fine; your choice) and **submit your presentation slides as a PDF to Canvas**. You can submit a **maximum of 10 slides**, though I highly recommend fewer (like 3), but you can add pauses as long as your PDF contains  $\leq 10$  pages.

Note that I will not be grading you on how well you “perform” your presentation; I hope no one will feel too nervous about these presentations. However, you should practice your presentation to make sure it’s around 3 minutes. The main goal is to share what you learned with the class.

Points	Criteria
30	mathematical clarity and content of slides
5	polished slides (style)
10	presentation timing
25	participation in class presentations

During class presentations, you will be given a sheet of paper to fill out as your peers give their presentations. For each peer, you will write down (1) a keyword you might want to look up later, or a question you want to ask about the topic and (2) an aspect of the presentation you particularly liked.

### 1.3 Math Communication (30 points)

This outreach portion is up to you! Your audience is the general public (e.g. family members who don't study math). You will be graded on effort for this portion (about "30 out of 200 points on a final" kind of effort). Here are some examples of possible types of media related to your topic you could create:

- a 60-second video
- an infographic
- an art piece with a card explaining it (as if in a museum)

Points	Criterion
30	you created something meaningful

## 2 Presentation dates and topics

Presentations will be held in our usual classroom (Giedt 1006) at the follow dates/times:

- Monday, June 5, from 1:10 pm – 2:00 pm (usual class time)
- Wednesday, June 7, from 1:10 pm – 2:00 pm (usual class time)
- Friday, June 9, from 10:30 am – 12:30 am (our scheduled final exam time)

We will have 8 presentations each on the Monday and Wednesday, and the rest of the presentations on Friday. According to Canvas, we have 26 students in our class. Each presentation will be **3 minutes**, with 2 minutes for questions and reflections.

Date	Mathematician	Presentation Topic
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### 3 Potential Topic Ideas

You have seen a lot of math this quarter in this class. Go back in your notes to find which topic was the most exciting to you, or what topic you wished I talked more about. You can also check your textbook for many more areas of knot theory that we haven't touched upon this quarter.

Below are some example topics off the top of my head. You can google these to see if they're interesting to you:

braids, tangles, non-orientable surfaces and cobordisms, positive knots and links, alternating knots, Turaev genus, bounds on unknotting number, Conway notation, Legendrian knots, knot theory and DNA, knotted spheres ("2-knots"), hyperbolic knots, satellite knots / cabling / infection, torus knots, symmetries of knots, ...

On HW08, you will officially choose your topic and read about it. You will be asked to **email me your choice of topic as soon as you pick it. Multiple students may study the same topic.** If there is a ton of overlap, we will coordinate via email what sub-topics each of you should cover in the 3-minute presentation.