# MATH 318/334 TERM PROJECT, SPRING 2019

## 1. Goals

The purpose of this project is to introduce you to the experience and mechanics of doing independent mathematical work. The project gives you the opportunity to explore a topic of your choice in algebra and/or analysis, whichever you are enrolled in. (If you are taking both 318 and 334, you will be writing *two* papers, one for each class.) If you are a math major, the experience will provide a preview of some important elements of the senior thesis process and better prepare you to hit the ground running as a senior (or as a summer research assistant).

## 2. Structure

The Math 318/334 project has a "co-instructor" (David Lippel) to offer additional structure and support. The faculty will split their duties as follows:

- The principal course instructors (Liz and Josh) will provide lists of suggested topics (though you should feel free to suggest alternatives) and will be the primary resource for helping you narrow down your topic(s) to a workable set of goals for your paper(s).
- The co-instructor (David) will provide one-on-one consultation throughout the semester and also will organize group meetings early in the semester to discuss library and internet resources, avoiding plagiarism in math papers, the general principles of mathematical exposition, and the details of mathematical typesetting with LaTeX. Note that attendance at some of these meetings is mandatory; the timing of such meetings will be set to accommodate everyone's schedule.
- Both the primary instructors and the co-instructor will read drafts of your paper(s), but the primary instructor alone will assign the grade and decide how much it counts towards your course grade.

## 3. Expectations

Note: The following expectations for your term paper are slightly modified versions of the Math Department's standards for the senior thesis.

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*Date*: January 11, 2019.

3.1. **Length.** The target length for the paper is 6–8 pages, not including references[1]. Small deviations from this target are permissible, but only in consultation with the instructors. A paper whose length is significantly outside the target range may be graded down or judged to be unacceptable.

3.2. **Ownership.** The paper should display your ownership of the process and the material. You achieve ownership through independent efforts to survey the relevant literature, to grapple with both the context and the details of the mathematics, and to synthesize material from several sources. Evidence of such ownership could take the form of devising new illustrative examples of a theorem, or new applications of an algorithm; organizing material in a novel way; or constructing proofs that differ significantly from the proofs in your sources.

3.3. **Writing.** The paper should be clearly and carefully written and adhere to professional mathematical standards for written mathematics. In particular, you must engage with precise definitions of terms, make careful statements of theorems, and write correct and motivated proofs based on definitions. For a paper analyzing an algorithm, you must present a problem to be solved and precisely specify and rigorously verify an algorithm to solve it, possibly analyzing the algorithm's speed and/or space requirements.

3.4. **Citations.** The paper must follow proper citation conventions as specified in the handout that you will receive.

## 4. Deadlines

| | **Algebra (334)** | **Analysis (318)** |
|---|---|---|
| Progress Report | Week of February 11, 2019 | Week of February 18, 2019 |
| Detailed Proposal | Fri., March 1, 2019 | Wed., March 6, 2019 |
| First Draft | Fri., March 29, 2019 | Wed., April 3, 2019 |
| Final Paper | Fri., April 26, 2019 | Wed. May 1, 2019 |

Below are details about each stage of the project.

**Progress Report:** You will report on your progress in finding a topic and sources for that topic. We expect that by this point, you will have narrowed your ideas to one or two topics and will have found at least two plausible sources for each one. Prepare a short *oral* narrative of your progress; you'll deliver it in a one-on-one meeting with David.

[1]Note: the paper must be typeset with LaTeX— we will help you with this! You will be provided with a sample file, and the page count will be based on the layout settings in the sample file. In particular, you should use 11 pt font and use LaTeX-default margins, which will yield about 60-70 characters per line. Careful: if you use the `geometry` package, it automatically changes the margins!

**Detailed Proposal:** You will submit a detailed written proposal, briefly describing your topic, giving a tentative outline which includes the theorems/examples/etc. that you want to work through in your paper. In addition, the proposal should include an annotated bibliography, i.e. a list of sources you intend to consult, a brief descriptions of the content of each source, and a brief evaluation of how you think each source will be useful.

**First Draft:** This should be a *complete* draft of your final paper, containing all of the content that you intend to discuss in the paper. There can be gaps, e.g. missing or incomplete proofs, but you should be as specific as possible in documenting what is missing.

Note: all written work for this project must be typeset with LaTeX. David will provide help with LaTeX as needed.

## 5. Grading Rubric

Here is how your project will be graded:

**Topic Selection Process and First Draft (10 pts).** Graded items: participation in the library meeting; progress report; topic proposal (with annotated bibliography); first draft (on time, of appropriate quality, with appropriate scope).

**Final paper (20 pts).** Grade components:

- Scope (5 points): the paper engages an appropriately difficult topic at the right level of detail.
- Correctness (5 points): the mathematics is correct and clearly communicated to the target audience.
- Ownership (5 pts): the exposition displays evidence of the author's ownership of the material. (See Section 3 above.)
- Writing (4 points): the paper adheres to standards for written mathematics, including typesetting with LaTeX, correct use of notation, careful statements of theorem and definitions, appropriate cross-referencing, etc.
- Citations (1 point): the paper follows proper citation conventions. (See Section 3 above.)