

# MATH 1300, Mathematical Explorations, Fall 2017

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This 3-credit course is for students who wish to experience mathematical thinking.

The overarching themes are: What is mathematics? What is mathematical rigor? How do we make mathematical discoveries? How do we understand things mathematically?

We will explore these via a selection of mathematical topics from across a spectrum of subjects such as origami, symmetry, knots, the infinite, two-player games, graphs/networks, probability, mathematical paradoxes, and connections between mathematics and art, dance, music, and magic.

We will emphasize ideas and imagination over techniques and calculations. The course is not designed for students who are considering majoring in mathematics or other mathematics-heavy disciplines. There are no prerequisites.

Students will work collaboratively in small groups in class, will record their class experiences in a journal, and will design a poster. There will be no exams.

All books and resources used will be freely available. The [Art of Mathematics group's materials](#) will be a major source.

## Learning aims

- To provoke self-critical thought processes, discovery, creativity, and productive struggle.
- To cultivate reasoning and problem-solving skills.
- To learn to present an argument clearly in a discussion or in writing.
- To challenge assumptions about mathematics.
- To engender confidence and a sense of accomplishment and achievement in doing mathematics.

## Journals and assignments

Every Tuesday and Thursday night after class, and whenever the urge strikes you, write neat, clear descriptions of that day's in-class investigations and your further thoughts about them. These should be readable, coherent stories, not just fragments of sentences. Two or three paragraphs per class is enough. You may also include any sketches, photographs, diagrams, collages, doodles etc. that might help you remember and convey your ideas more clearly.

The portfolio is a relatively free-form activity. Think of it as an artists portfolio, a writers journal, a scientists lab notebook, a diary, or a mathematical scrapbook. Write summaries of the mathematics we learned. Write about any frustrations or confusions you have, any ideas or questions that spring to mind, anything you find yourself wondering about. Include reflections on your thinking: What were your 'ah-ha' moments? What is most confusing? What were the struggles? How is your understanding developing? Make connections to things outside of class

such as newspaper articles, blog posts, your other classes, movies, literature, art, architecture, design etc.. You could write the entries immediately after class, or wait a few hours to let the ideas sink in. Get creative!

While I recommend you keep rough work out of your journals, they do not have to be formal. They can be typed or hand-written. Please write in full sentences. Be clear. If you include a computation, explain its steps.

Imagine Cornell students not taking this class as your readers. Give your own statements of the problems being addressed. Explain the concepts and ideas at hand. Would your reader be able to follow what you are saying? Would they enjoy your account?

You will be also be asked to do short writing assignments at occasional points during the semester. These too can be inserted into your journals.

Your professor and teaching assistant will collect your journals from time-to-time and will give you feedback. Please use the journal binders you are supplied with. (They are small and light, making it practical for us to collect them in at various points of the semester.)

### **Collaborating**

You may collaborate with other students inside and outside class. However, all you write should be written yourself in your own voice. Copying someone else's homework and presenting it as your own will be treated as a violation of [Cornell's Academic Integrity Code](#), as will copying solutions that you might find on the internet or elsewhere.

In keeping with the good practice of acknowledging all contributors to a piece of work, name collaborators who contribute significant ideas. (Your grade will not be affected.)

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site.

### **Our 'Inquiry Based Learning' classroom**

- Neither your Professor nor your Teaching Assistant will lecture. They are coaches and facilitators.
- We work together supportively to advance our thinking. So called "mistakes" are great. We make conjectures, test them, and improve them.
- If a student asks how to solve a problem or if a solution is correct, the instructors will try to ask questions or provoke students' thinking, rather than answer.
- Students will share their thinking and process (including being stuck) on a regular basis, often at the board.
- The instructors will give emotional support as needed, for instance encouragement to try a problem or share a thought or question.

- We will work on problems that ideally are easy to state, can be solved in stages, and have high ceilings (that is, have the potential to develop into ‘deep’ or ‘sophisticated’ investigations).
- Students will sit in groups of five or six around tables, in places determined by name-tags, which will be rearranged each class.
- The classroom should be loud because everybody is working and collaborating in groups at their tables, or sharing the results of their collaborations in class discussions.

### Assessment

- 30% Class participation
  - B-level work
    - \* Attend class.
    - \* Do not use cell phones, laptops, and other electronics in class.
    - \* Participate positively and meaningfully to group work at your tables and to whole-class discussions.
    - \* Give your best effort in solving the mathematical problems.
    - \* Ask and answer questions. Listen actively when someone else is speaking.
    - \* Be supportive, encouraging, and respectful of other students.
  - A-level work
    - \* Be engaged and attentive.
    - \* Be reflective: appreciate what you don’t understand, take appropriate steps to move forward.
    - \* Help your classmates advance their understanding.
    - \* Take chances, try things, display a spirit of curiosity and adventure in class.
    - \* Contribute thoughtfully, constructively, insightfully, and creatively to group work at your tables and to whole-class discussions.
- 50% Journals and assignments
  - B-level work
    - \* The journal is well-organized and easy to follow.
    - \* The writing is clearly legible.
    - \* All our class investigations and all the assignments are included.
    - \* Complete sentences are used. There are minimal spelling, grammar, and punctuation errors.
    - \* Appropriate background setting out the questions being answered or the subject being investigated is included.
    - \* A Cornell student not in our class would be able to read the journal and understand it.
    - \* Mathematical terms are used correctly.

- \* The report appropriately cites sources used, including any books or web sites and any people consulted.
  - \* Sufficient details of any calculations are provided so that the calculations could be easily followed and reproduced.
  - \* Effort is invested.
- A-level work
- \* ...is creative.
  - \* The language and tone of the report is polished and well-crafted.
  - \* The writing is honest and authentic; your own voice comes through.
  - \* The journal goes beyond simply answering questions. Rather, topics are thoroughly and thoughtfully explored.
  - \* The writing is well-structured. Illustrations, examples, calculation etc. are used to make points clearly.
  - \* The journal raises its own mathematical questions (and answers some of them).
  - \* Mathematical arguments are complete and correct.
  - \* The writing is engaging. It includes motivation for topics and smooth transitions between ideas.
- 20% Posters. As a final creative project, you will make a poster about a notable mathematician of your choice from the 20th or 21st century. This will be due shortly before Thanksgiving break. We will hold a poster fair after we return. More details of this activity will be published later in the semester.
  - 0% Midterms, quizzes, or final exams—there will be none.

If you have a medical excuse or other serious circumstances, causing you to fall behind in your work, allowances will be made; contact your instructor at the earliest opportunity.

TRR, August 2017