

# Syllabus

## Math 236 - Introduction to Mathematical Structures

### Winter 2020

**Professor:** Rafe Jones

**Office Hours:** Monday 1:50-2:50; Tuesday 1:00-2:00; Wednesday 10:00-11:30, Friday 11:00-12:00; or just stop by and see if I'm around (it helps to make appointment, though it's not strictly necessary). I have a schedule posted on my office door that gives a general idea of my whereabouts.

**Office:** CMC 226

**Phone:** x4450

**Email:** rfjones@carleton.edu

**Course meeting time:**

MW 12:30-1:40, F 1:10-2:10 in CMC 209

**Course Web Site:** <http://www.people.carleton.edu/~rfjones/Math236w20/index.html>. If you don't want to type this into your browser, there is a link to this site from the course Moodle page. You can also just google "rafe jones" then click on the top result to get to my homepage (an advantage of having an unusual first name). Scroll down just a bit and you'll see a section titled "Courses" containing a link to the Math 236 website.

**Text:** *Doing Mathematics*, second edition, by Steven Galovich.

**Course Content and Goals:** This is a course in how to think mathematically. We will discuss a variety of mathematical topics, such as propositional logic, set theory, relations, and counting techniques, but the essential goal of the course is for you to become an able user of the rigorous mathematical mode of thinking, and to enlarge your toolbox of mathematical problem-solving techniques. Another major goal of the course is for you to become an adept writer of mathematical arguments. Useful in its own right, this skill is highly transferable to many non-mathematical endeavors – clear writing about technical subjects is a staple of nearly every job.

**Grading system:** Below is how your course grade will be determined. Following this there are detailed discussions of each component.

**Homework:** 20%

**In-class midterm exam:** 25%

**Take-home exam 1:** 27.5%

**Take-home exam 2:** 27.5%

**In-Class Exam:** Our first exam will be an in-class exam, on Wednesday, February 5. You will not be allowed to use any outside resources (written, electronic, or otherwise) for this exam. In particular, calculators, cellphones, computers, tablets, notes, and books will not be allowed on this exam.

**Take-home Exams:** There will be two take-home exams. The first will be handed out on Wednesday, February 19, and due at the beginning of class on Monday, February 24.

The second will be handed out on Friday, March 6, and due at the beginning of class on Wednesday, March 11. For these exams you will be allowed to use your book, your own class notes, and your own graded homework. You will be allowed to ask me questions, but not to communicate with anyone else about the exam. You will also not be allowed to use the internet, or any other electronic resources.

**Final Exam:** There won't be a final exam for this course.

**Group Homework:** Two of the course homework assignments will be group assignments – you will work with a classmate and hand in a single paper. These assignments must be prepared in LaTeX (see below for more on LaTeX). For all non-group homework assignments, you will hand in your own write-up, though you are welcome to discuss the problems with classmates (see below in the homework section).

**Homework:** Assignments will be due every other class meeting. The best (and quite possibly the only) way to learn and truly understand mathematics is by doing problems. So the homework is the most critical component of your learning in this course, and as such it counts for a considerable portion of your grade (20%). Homework will be assigned and collected every other class period, with a few exceptions (see the course schedule on the webpage). I expect that each assignment will take you multiple hours to complete. One of the best strategies for doing well on the homework, and gaining solid knowledge from it, is to start it as soon as it's assigned. Studies have shown that learning occurs best when you allow ideas – even ones you don't fully understand at first – time to sink in. So starting on problems, working until you get stuck, and then coming back to them the next night is a good recipe for understanding.

Because of our limited time in class, it won't be possible to do examples of every kind of problem that will appear on the homework. So you should expect some problems that don't look immediately familiar; however, the underlying techniques you'll need to do the problems will have been covered in class.

The homework assignments are posted on the homework page of the course web site, and are due at the beginning of the class period indicated. Please staple your homework and write your name on the first page. If you want your homework graded, hand it in on time. If you hand in an assignment late due to some legitimate reason, then I will quickly check to make sure it is complete, and then mark it down as such in the grade book. It won't count as part of your homework average (but it also won't count as a zero).

Learning often happens best when we are forced to explain our work or thinking to someone else. Sometimes just verbalizing your mathematical thoughts can deepen your understanding. So I encourage group work on the homework (groups of two or three tend to be most effective). However, you must still each write the problems up on your own, and in your own words.

**Homework and LaTeX:** LaTeX is the typesetting program mathematicians everywhere use to write their mathematical papers, books, notes, and manuscripts. It's become nearly universal, and for good reason: it's easy to get started with, and it produces *beautiful* output. In fact, this very syllabus – which I'm sure you've noticed is the apex of aesthetic achievement

– is written in LaTeX. And so is this formula:

$$\sum_{n=1}^{\infty} \left( \int_1^n x^n e^x dx \right).$$

One of the goals of this course is for you to become proficient in LaTeX. I will provide you with resources and templates to get you started, and after that you'll be required to hand in both group assignments and at least two other homework assignments typeset with LaTeX.

**The Right Mindset:** Studies have shown that IQ is not what is most important in determining success in a math classroom; it's grit. What's grit? It's "perseverance and passion for long-term goals". Grit gives you the ability to sustain your motivation even when things get difficult. How do you build your grit? Here are five suggestions from leading researchers in the field: 1. Understand that effort can get you further than ability. 2. Think creatively so you don't see problems, you see opportunities for growth and learning. 3. Set tiny goals that are leading to your bigger purpose; a sense of purpose helps. 4. Take time each day to reflect on what you've accomplished. 5. Surround yourself with other gritty people.

**Participation:** One thing you'll quickly notice in class is that there are a lot of opportunities to participate, especially in the form of answering questions I pose to the class. Class participation (which presupposes class attendance) is important to me, and while I don't keep formal count of who's answered a lot of questions, I do maintain a general sense. And I should note that *when it comes to participation, I make no distinction between right and wrong answers*. Class participation doesn't count as a fixed percentage of your course grade, but it could make a difference in your final grade if you're on one of the grading borderlines.

**Classroom Atmosphere:** All people in this class deserve to feel safe, respected, and valued. That means that all members of our classroom community are responsible to each other to make sure that all voices get heard, all comments are considered respectfully, and everyone has a chance at success. Determination, cooperation, and hard work are highly valued in this class; helping your neighbor understand the material is more important than trying to be the first to answer. We flourish as a community when every individual participates and learns.

**Getting information and help:** If you have questions about any organizational aspect of the course, the first place you should go is the course web page. It is a veritable treasure trove of course-related information, and will be updated frequently. Among the things you'll find there are this syllabus, homework assignments, class schedule, exam-related announcements, review tips, links to practice exams, and links to several LaTeX resources (see below for more information on LaTeX).

If you can't find the information you need quickly on the webpage, or have a mathematical question, don't hesitate to contact me. I will read emails until about 7 pm each night, and will respond to any messages you send me within 24 hours, provided that I am not traveling. For face-to-face discussions, stop by any time during my office hours, listed above. Feel free

also to stop by outside of office hours, and if my door is open, you can come on in. However, I may not be available (there is a schedule posted on my office door). To make sure I'll be around, send me an email to make an appointment; give me 24 hours notice if at all possible.

For additional help pretty much any time, you are encouraged to go to the Math Skills Center. It's an almost ridiculously welcoming place that provides drop-in peer tutoring, and it also functions as a place to study, to do homework, and to meet for one-on-one tutoring. Its hours are Monday-Friday: 8:30am-11pm, Saturday: 2-5pm, and Sunday: 2-5pm and 7-11pm.

Finally, I may periodically need to contact the whole class via email, for instance to let you know that there are new materials on the website. I'll use your official Carleton email accounts (the ones that end in carleton.edu), so be sure that you check this account regularly.

## How to do well in this class:

- *Attend class, participate, and ask questions.* Class will significantly augment the material in the book (particularly in worked examples), and there will be lots of chances for you to participate. The more engaged you are in class, the better prepared you will be to understand the ideas and work problems.
- *Do all the homework, and do it well.* The best way to learn math is by doing math. The homework is your chance to do math, and you will gain the most understanding by doing it well. This means that after you finish each problem, you should be able to explain the idea to your classmates, your friends, or your mom.
- *Work with your classmates.* The knowledge and abilities of your classmates are great assets. Learn to explain mathematics to your classmates. Math can be fun and rewarding when there are people around you who enjoy figuring out problems as much as you do. Take advantage of this opportunity and organize study groups.
- *Get extra help when you need it.* When you need help or are feeling stuck, come talk to me! You can also send me an email, ask your classmates, or go to the Math Skills Center.