

# MATH 346/377, Winter 2022

## Number Theory

---

### Basic Info

**Instructor:** Jonathan Love  
**Email:** [jon.love@mcgill.ca](mailto:jon.love@mcgill.ca)  
**Office:** Burnside 1248

**Lectures:** WF 11:35-12:55 in BIRKS 111  
**Course Websites:** myCourses and Crowdmark  
**Office Hours:** T 10-11 AM, WF 2:30-3:30 PM

---

### Material

**Prerequisites:** A background in algebra (groups, rings, fields, and linear algebra) at the level of MATH 235.

**Course textbook:** [\*Number Theory Revealed: A Masterclass\*](#) by Andrew Granville. Required for readings and problem sets. [Ebook available](#) for free through McGill library. For additional resources, see *myCourses* > *Content* > *Course Information*.

**Topics:** Solving congruences, cryptosystems (RSA and Diffie-Hellman), quadratic reciprocity, primes in arithmetic progressions, quadratic forms, lattices, local-global principles, ideal class groups of imaginary quadratic fields, Diophantine approximation.

---

### Instructional Format

#### Lectures vs Textbook:

All of the *content* (definitions, theorems, etc) you need to know for the course will be available in both verbal form and written form.

- **Verbal:** In person in lecture. Lectures will not be recorded.
- **Written:** I will post a list of textbook sections corresponding to each lecture on myCourses. If I cover any material in lecture that you will need to know for homework/exams but is not from the textbook, I will also upload an additional handout covering this material.

If you miss a lecture, you can catch up on the topics you need to know about by checking myCourses.

Despite the overlap in content, we will also spend time in lecture developing *problem-solving skills* and *proof strategies*, and I may sometimes state a result in lecture without proof and refer you to the textbook instead. So for the full learning experience, it is recommended that you attend as many lectures as possible *and* read the textbook and additional handouts.

### **Collaboration:**

You are encouraged to work with others in the class to learn the material; this includes discussion of problem sets. If you do work with others for the homework:

- On your submission, you should list all external references you used, including anyone you discussed the solutions with. See the *Evaluation/Homework* section for more details.
- Even if you learn how to solve a problem from someone else, you should write up the solution on your own. Do not just copy someone else's solution and change a few words and variable names.

### **Discussion board:**

On *myCourses* > *Discussion*, there is a discussion board that you can use to discuss topics related to the class.

- Logistical questions: If you have a question about the structure of the course that is relevant to other students in the class, you can post it on the discussion board and I will answer within 24 hours (except over weekends). If you have a question about a situation that affects you individually, please email me instead.
- Forming study groups: You can find other students to talk to about the material, advertise study sessions, etc.
- Course material: you can ask questions about what you've been learning, answer each others' questions, or share your own personal observations or explorations. Please do not post solutions to homework problems before the deadline. **A small percentage of your final grade will come from posts of this form:** see *Evaluation/Participation* for more information.

Please be respectful of your classmates as you use the discussion board. Abuse and harassment will not be tolerated (see the [Code of Student Conduct and Disciplinary Procedures](#)).

---

## **Evaluation**

### **Default grading scheme:**

#### **MATH 346**

- Homework: 20%
- Midterm: 35%
- Final Exam: 40%
- Participation: 5%

#### **MATH 377**

- Homework: 20%
- Project: 20%
- Midterm: 15%
- Final Exam: 40%
- Participation: 5%

**Alternate grading scheme:** If your score on the final exam is better than your score on the midterm, I will discard your midterm grade and use your final exam score for the balance of your total grade (75% for students in 346, 55% for students in 377).

### **Homework:**

- Weekly problem sets. An electronic copy is to be submitted to Crowdmark on **Wednesdays by 11:59 PM**.
- Homework can either be typeset or handwritten. If handwritten, please ensure that the scans/photos of your work are not blurry before submitting. Your grade will be based only on the parts of your submission that are legible.
- **Cite your sources!**
  - If you state a result without proof in your solution, you must **provide a reference** for this result. Acceptable references include “in lecture we proved...” or “by Lemma 1.1.1 from the textbook...” or “by Exercise 1.1.1 (proved in last week’s problem set)...” or “by Fermat’s Little Theorem...”
  - If you use any resource other than lecture, the main course textbook, or office hours while working on the problem sets (e.g. a different textbook, a Youtube explainer video, a classmate you discussed the problems with, etc.), you must **list these sources** on your submission.
- Late submissions will not be accepted.
- Your lowest two homework grades will be dropped.
- Each problem set will have some questions labeled “(377 only).” For MATH 346 students, only the questions without this label will be graded. For MATH 377 students, all questions will be graded.

### **Participation (5%):**

1 point for each post (up to a maximum of 5) on the myCourses discussion board that meets the following criteria:

- posted on **Friday, April 14 or earlier**
- engages with the course content (asking a question about something from lecture or the textbook, answering someone else’s question, sharing an observation, etc.)
- contains at least 50 words+equations, not including quotations.

**Midterm:** In person during class time (11:35 – 12:55) on **Friday, February 17**. More details TBD.

**Final:** In person, to be scheduled by the university during the examination period (April 14 to April 28).

**Project (377 only):** A paper on a topic related to (but going beyond) the course material. The final draft should be 10-15 pages, and will contain both a historical overview of the topic and some independent work (an original proof, numerical experiments and data, computer code, etc).

- Topic selection should be done by **Friday, February 24**.
- The final draft will be due on the last day of class, **Wednesday, April 12**.

More information about topic selection and assessment will be available on myCourses.

---

## Disclaimers, Reminders, and Resources

**Academic Integrity:** McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the [Code of Student Conduct and Disciplinary Procedures](#) (see [Academic Integrity](#) for more information).

**Submitting work in either of the Official Languages:** In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

**Syllabus and Grade Calculation:** In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

**Life difficulties:** It's normal to experience circumstances that interfere with your ability to succeed in your courses. In such a case, contact me as soon as you can and I will do what I can to accommodate your situation. If you are not comfortable contacting me directly, you can work via an intermediary at the [Office of the Dean of Students](#).

**Shortlist of Resources:** The Department of Mathematics and Statistics and the University at large have many resources to help you succeed in this course and throughout your degree. A more extensive list of resources can be found in the MyCourses Webpage for this Course (under "Content"), as well as the Department's [EOSW webpage](#). A shortlist of the most commonly used resources is available here:

- [The Student Wellness Hub](#) is a centralized website for physical and mental health resources.
- [The Math Help Desk](#) is staffed by knowledgeable math students who can help answer your questions related to your courses. They have tutors on M-F from noon-5 PM in Burnside 911.
- [SUMS](#) is the Society of Undergraduate Mathematics Students. Join their Facebook group to get on their listserv, connect with other students in the department, and participate in some of their activities/social events.
- [Advising](#) is an important resource to guide you throughout the duration of your degree, and advisors can help with answering questions related to your degree program. Check out the Department's Advising Website to find out how to get in touch with a Departmental Advisor, should you need to do so.
- [The Office for Mediation and Reporting](#) is a McGill centralized office used to file a formal report of discrimination, harassment, or sexual violence; learn about policies and processes; or be connected to additional supports.
- [The Office for Sexual Violence, Response, Support and Education](#) provides support for all members of the McGill community who have been impacted by sexual violence (whether it be sexual harassment or assault, gender-based or

intimate partner violence, or cyberviolence) and works to foster a culture of consent on campus and beyond.

- [The Office of the Dean of Students \(Case Management\)](#) is a collaborative process between a student, a Case Manager, and other concerned parties with the intention of improving the student's academic and personal outcomes. Case managers are trained in confidentiality, disclosures of sexual violence, and mental health first aid.