





About This Class

Important. The course instructor for this class is Professor Joe Repka, who is temporarily unavailable. I, Dror, was asked to replace Joe for the first semester. Thus this page the the **course home page** (<https://q.utoronto.ca/courses/398996/pages/mat-347-groups-rings-fields>) are partial, and cover the second semester in less detail, so as to leave Prof. Repka the freedom to teach the class as he believes it should be taught. Schedules and policies may change once Prof. Repka is back.

@[Dror Bar-Natan](http://www.math.toronto.edu/~drorbn/)  (<http://www.math.toronto.edu/~drorbn/>) @Classes 
[\(http://www.math.toronto.edu/~drorbn/classes/\)](http://www.math.toronto.edu/~drorbn/classes/) @2025-26 
[\(http://www.math.toronto.edu/~drorbn/classes/#2526\)](http://www.math.toronto.edu/~drorbn/classes/#2526)

Primary Instructor. Professor Joe Repka.

Substitute Instructor. [Dror Bar-Natan](http://www.math.toronto.edu/~drorbn/) , drorbn@math.toronto.edu (<mailto:drorbn@math.toronto.edu>) (email for course administration matters only; math on email is slow and prone to misunderstandings, so I generally avoid it). Office: Bahen 6178.

Teaching Assistants. Matt Koster (matthew.koster@mail.utoronto.ca (<mailto:matthew.koster@mail.utoronto.ca>)) and Jacob Taylor (jacobw.taylor@mail.utoronto.ca (<mailto:jacobw.taylor@mail.utoronto.ca>)).

Classes. Wednesdays 10-12 at SS1073 (fall) and BA1190 (spring) and Fridays 11-12 at GB248.

Fall Office Hours. With Dror on Wednesday September 10 at 1-2 and after that on Wednesdays at 2-3 at BA6178 and at <http://drorbn.net/vchat>  (<http://drorbn.net/vchat>).

Tutorials. Fridays 1-2 at WO30 with Jacob and 2-3 at FE213 with Matt, starting September 12.

Text. Abstract Algebra, 3rd Edition by Dummit and Foote. The textbook is not required for the course, but it is highly recommended. Older editions should be similar enough that they can be used.

Fall Semester Blackboard Shots. See <https://drorbn.net/bbs/show.php?prefix=25-347>  (<https://drorbn.net/bbs/show.php?prefix=25-347>).

Course Description, taken from the Faculty of Arts and Science Calendar:

Hours: 72L/24T

Groups, subgroups, quotient groups, Sylow theorems, Jordan-Hölder theorem, finitely generated abelian groups, solvable groups. Rings, ideals, Chinese remainder theorem; Euclidean domains and principal ideal domains: unique factorization. Noetherian rings, Hilbert basis theorem. Finitely

generated modules. Field extensions, algebraic closure, straight-edge and compass constructions. Galois theory, including insolvability of the quintic.

Prerequisite: MAT257Y1/(85% in MAT247H1/ MAT247H5)

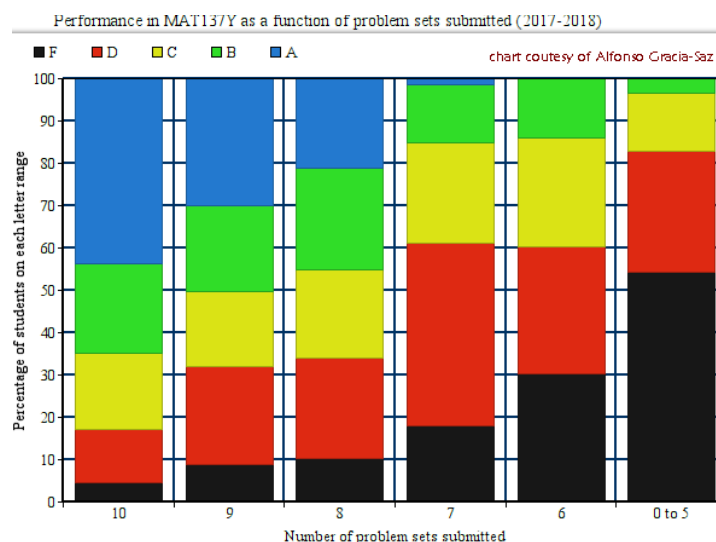
Breadth Requirements: The Physical and Mathematical Universes (5)

Warning and Recommendation. This will be a tough and very abstract class, designed for math specialists. We will make every effort to make it understandable, but certain parts of the material require a very high level of mathematical sophistication. Don't take this class unless you are ready to put in the tremendous intellectual effort that will be involved! Every bit of this class absolutely makes sense. But you'll have to think hard at all times, and be ready to repeatedly adjust your perspective, to see that this is so. Don't let go! If you'll fall behind you'll find it nearly impossible to catch up. This actually does not mean "do your homework in time" (highly recommended anyway). It means **"do your deep thinking in time"**.

Marking Scheme. There will be two term test (one in the fall and one in the spring, 20% of the total grade each) and a final exam (50%), as well as about 18 homework assignments of which only your top 14 will count (10%).

The Fall Term Test will take place on Tuesday November 4th at 7-9pm at EX310.

Fall Homework. Assignments will be posted on the course web page (usually on Thursdays) approximately on the weeks shown in the class timeline. They will be due a 8 days later and they will be (at least partially) marked by the TAs. All students (including those who join the course late) will receive a mark of 0 on each assignment not handed in; though in computing the homework grade, your worst few assignments will not count. I encourage you to discuss the assignments with other students or even browse the web, so long as you do at least some of the thinking on your own and you write up your own solutions. Academic integrity rules will not be enforced on homework, so cheating will be easy and may increase your homework grade a bit. But it will hurt your appreciation of yourself, your knowledge, and your exam grades a lot more.



Policy on Missed Assignments. As flexibility for missed or late course assignments have been built into the marking scheme, late and missed assignments will not be accepted for any reason.

Students who are absent from class for prolonged periods and who require consideration for missed academic work should contact the instructor and verify their absence(s) through either the Absence Declaration

tool, Verification of Illness or Injury (VOI) form, College Registrar Letter, or Letter of Academic Accommodation from Accessibility Services, as appropriate to their situation. See

<https://www.artsci.utoronto.ca/current/academics/student-absences>.

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(<https://www.artsci.utoronto.ca/current/academics/student-absences>) The absence declaration can be used once per term. Outside of the one time absence declaration use, students must adhere to the alternate processes for absences listed above, as well as the missed work policy as set out here.

If you miss a term test or the final assessment, then you must inform the course Instructor within 72 hours

of the test. No exceptions. If your request is approved, you may receive an accommodation. The accommodation to be used will be decided by your instructor. Some examples of accommodations may

include: an oral exam, written make-up test, or a re-weighting of your assessments.

Fall Solution Sets. No "official" solution sets for homework assignments and for the term test will be provided. However, I encourage students who got 90% or more on any given assignment (or test) to scan and send me their marked assignments, and I will post their solutions on the class web site as a service to everybody else. Notes:

- Please hide student ID numbers in all such scans! You may or may not wish to also suppress your name.
- Scans must be of good quality: they must be of high resolution and contrast, and the paper must look "flat". Use a flatbed scanner or one of those phone apps that simulate a flatbed scanner. Do not use a cellphone camera directly.
- I prefer to receive PDF files, but I'll also take .jpg images if a solution is only 1-3 pages long.
- You may fix and improve your solution set before sending it to me, yet please keep a clear distinction between what was written before submission and what was written after; for example, use a pen of a different colour for the later edits.
- I will remove all solution sets from the class web site sometime in June 2026 or when instructed by Professor Repka.

Academic Integrity. Avoid these troubles! Carefully read the Office of Student Academic Integrity's [Information for Students \(https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-](https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-)

[integrity#:~:text=Academic%20Integrity%20in%20the%20Faculty,%2C%20respect%2C%20responsibility%20and%20courage.\)](#).

Cheating will be possible in MAT347. You are smart and clever and if you truly want it and if you don't mind the harm it will do to your knowledge and to your appreciation of yourself, surely you'll find ways. We're smart and clever too, and experienced, and our avatars have accounts on several relevant web sites. We will aggressively pursue any cases of suspected cheating while fully respecting all university rules. We will do it out of love and respect, not hate and disgust. We are not disgusted by cheaters. Yet respect for the fair majority will force us to act, and as needed, act we will.

Telling - again with love in mind and respect for the fair, we encourage you to tell us if you know anything. Anonymous is fine and in all cases privacy will be respected. Though keep in mind that we cannot act on words but only on evidence. We care about means even more than we care about names.

Accessibility Needs. The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact [Accessibility Services \(https://www.studentlife.utoronto.ca/as\)](https://www.studentlife.utoronto.ca/as) as soon as possible.

How to Succeed in this Class

- **Keep up!** Don't fall behind on reading, listening, and doing assignments! MAT347 moves at a very high pace. New material is covered once and just once. There will be no going over the same thing again and again - if you fall behind, you stay behind.
- Unless you are an Einstein, there is no way to do well in this class merely by attending lectures - you must think about the material much more than just 3 hours a week if you want it to sink in. And if you are planning on not attending lectures, well, think again. Most people find it very hard to pace their own studies without a human contact; if you'll try, you are likely to discover the hard way that you belong to the majority.
- Take your own class notes, in your own handwriting, and strive to make them as complete as possible. Writing "burns" things into your brain and forces you to keep from daydreaming. And nothing beats reading your own notes when you review the material later on.
- Math is about understanding, not about memorizing. To understand is to internalize; it is to come to the point where whatever the professor does on the blackboard or whatever is printed in the books becomes yours; it is to come to the point where you appreciate why everything is done the way it is done, what does it mean, what are the reasons and motivations and what is it all good for. Don't settle for less!
- This said, you are expected know all definitions and all proofs, and memorizing helps. Memorizing is sometimes the first step towards understanding. If you remember something, you can think about it on the subway ride back home instead of reading advertisements.
- Keep asking yourself questions; many of them will be answered in class, but not all. Remember the old Chinese proverb:

"Teachers open the door, but you must enter by yourself"

"师傅领进门,修行靠个人!"