

MAT347Y1Y: Groups, Rings, and Fields
Fall 2026-Winter 2027
University of Toronto

I. Instructor and Teaching Assistants

Course Instructor

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II. Course Overview

Course Description

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.

Prerequisites

MAT257Y1/(85% in MAT247H1/ MAT247H5)

Course Objectives

This course will provide a detailed introduction to modern abstract algebra, which is a basic part of the language of much of modern mathematics. A highlight of this course will be Galois theory, one of the most beautiful gems of mathematics that you will learn as an undergraduate (which Galois developed at the age of 17, four years before dying in a duel). To get there, first we need to develop a lot of background: group theory, ring theory, and field theory. By the end of this course we will see interesting applications of Galois theory, such as why a regular heptagon cannot be constructed by straightedge and compass, and why a general quintic polynomial equation cannot be solved using radicals.

Warning: this course will be tough and very abstract. It is aimed at Mathematics Specialists. Do not take this class unless you are willing to put in a significant intellectual effort! But if you do put in the effort every week, then you will be rewarded by learning beautiful mathematics.

Textbooks/ Course Readings

Dummit and Foote, Abstract algebra, Wiley. 3rd edition.

How this course is organized:

This course will consist of three weekly one-hour lectures and a weekly tutorial. Tutorials will start in the first week of classes.

For homeworks and quizzes I will use Gradescope.

III. Evaluation/ Grading Scheme

Mark Breakdown

Term Tests x 3	45%
Final Assessment	30%
Quizzes	20%
Assignments	5%

Assignments

There will be roughly 10 assignments (late submissions will receive a mark of zero). Assignments carry little credit, but they will be important for learning and in preparing for quizzes and exams! Only a few problems will be collected each time, and they are required to be hand written.

Quizzes

There will be roughly 10 quizzes throughout the year, during tutorials. The lowest 3 quizzes will be dropped.

Term Test

There will be three term tests, during class time.

Test 1 will be on November 5, 1:10-3:00pm

Test 2 will be on January 21, 1:10-3:00pm

Test 3 will be on March 11, 1:10-3:00pm

Final Assessment

The written, in-person final assessment will be held during the final assessment period in April 2027 and will be scheduled by the registrar.

IV. Course Policies

Policy on Missed Term Work

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.

<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 in each course's syllabus.

There will be **no** makeup term tests and quizzes! If you miss a quiz or term test and you do not provide a valid reason (e.g., a doctor's note) within one week, it will be counted as 0. If you provide a valid reason within one week, the marking scheme will be adjusted appropriately.

Re-marking Policy

A student who believes an individual item of work has been incorrectly or unfairly marked may ask the person who marked it for a re-evaluation. With evidence to back their appeal, students should make such requests as soon as reasonably possible after receiving the work back, but no later than 2 weeks after it was returned.

Email Policy

Should you have a question that is not answered on the course site (please check there first!) please note that all communications with the Course Instructor or TA's must be sent from your official utoronto email address, with the course number included in the subject line. If these instructions are not followed, your email may not be responded to. Please write in a professional manner.

V. Institutional Policies and Support

Academic Integrity

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters (<https://governingcouncil.utoronto.ca/secretariat/policies/codebehaviour-academic-matters-july-1-2019>). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to your Course Instructor. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the University of Toronto website on Academic Integrity <http://academicintegrity.utoronto.ca/>).

Recording of Online Course

In case there are any recorded online lectures (which is not currently planned): course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each

situation and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor.

For questions about recording and use of videos in which you appear please contact your instructor.

Accessibility

The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs.

Students with diverse learning styles and needs are welcome in this course. If you have a disability that may require accommodations, please feel free to approach your Course Instructor and/or the Accessibility Services office as soon as possible. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Link to Accessibility Services website: <https://studentlife.utoronto.ca/departments/accessibility-services/>

Equity, Diversity and Inclusion

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Important Academic Dates & Deadlines

The academic dates include enrolment dates, drop deadlines, exam periods, petition deadlines and more.

<https://www.artsci.utoronto.ca/current/dates-deadlines/academic-dates>

Other Academic and Personal Supports

- Writing Centre <https://writing.utoronto.ca/writing-centres/arts-and-science/>
- U of T Libraries <https://onesearch.library.utoronto.ca/>
- Student Code of Conduct: <https://governingcouncil.utoronto.ca/secretariat/policies/code-studentconduct-december-13-2019>
- Feeling Distressed? <https://studentlife.utoronto.ca/task/support-when-you-feel-distressed/>
- Academic Success Centre <https://studentlife.utoronto.ca/departments/academic-success/>
- College/Faculty Registrars <https://future.utoronto.ca/current-students/registrars/>