

Mathematics 2200H – Mathematical Reasoning

TRENT UNIVERSITY, Fall 2022

[Last modified 2022-08-25.]

Instructor

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hours: Tuesday, Wednesday, & Thursday 11:00-11:50,
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Department of Mathematics

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Prerequisite: MATH 1120H or MATH 1350H.

Text: None, though there will be occasional handouts to supplement the lectures.

Two books that may be useful as resources: *A Gentle Introduction to the Art of Mathematics*, Version 3.1, by Joseph Fields, lives up to its title and covers a number of the topics in this course from a different angle. It is freely distributable under the terms of the *GNU Free Documentation License*, version 1.3, and may be downloaded from <https://giam.southernct.edu/GIAM/>, or locally from Blackboard and the MATH 2200H archive page. An interesting non-free book that makes an extra effort to explain everything in detail is *Proofs*, by Jay Cummings, which you can find out more about and read a largish sample at <https://longformmath.com/proofs-home>.

Meetings

Lectures: Tuesdays 14:00-14:50 in ENW 103, Wednesdays 13:00-13:50 in ENW 106, and Thursdays 12:00-12:50 in ENW 108. The lectures will be recorded and posted to Blackboard.

Seminars: Wednesdays 14:00-14:50 in ENW 103 (F01) and 15:00-15:50 in DNA ENW 110 (F02). The seminars will not be recorded.

Marking Scheme

There will be at least eleven weekly assignments and a take-home final examination. Please consult the schedule below for due dates. The work will weigh as follows:

Best 10 assignments (6.5% each)	65%
Take-home final examination	35%

At least 25% of the course marks will be obtained by the final date (Tuesday, 8 November) to withdraw from Fall courses. Please note that assignments will be accepted after the due date entirely at the instructor's discretion. Students who miss more than one assignment for reasons beyond their control should contact the instructor as soon as possible.

This scheme may be modified for students in exceptional circumstances, such as a lengthy absence due to illness. Any such modification will require the agreement of both the student and the instructor.

Learning Outcomes

This course is an introduction to the basics of handling abstractions and doing mathematical proofs while acquiring familiarity with a number of basic concepts, drawn from logic, set theory, number theory, and combinatorics, which are used in many mathematical fields. Successful students finishing the course should be able to solve problems using the methods developed in the course, read and write mathematics effectively using appropriate notation, and formulate and communicate logically correct proofs.

Schedule

Please note that where the material covered is concerned this schedule is a polite fiction: no lesson plan survives contact with actual students unchanged! We will adjust the pace and possibly the order of some material as necessary.

Week 0. (8-9 September) Polya's problem-solving tips. Classes begin Thursday, 8 September.

Week 1. (12-16 September) Problem-solving. Some basic set theory, functions, relations. Assignment #1 due on Friday, 16 September.

Week 2. (19-23 September) Connectives. Propositional logic and deductions. Assignment #2 due on Friday, 23 September.

Week 3. (26-30 September) Quantifiers. First-order logic and deductions. Assignment #3 due on Friday, 30 September.

Week 4. (3-7 October) Axioms for set theory. Construction of the natural numbers. Assignment #4 due on Friday, 7 October.

Week 5. (10-14 October) Mathematical induction, division and Euclidean algorithms. Assignment #5 due on Friday, 14 October. *University closed on Monday, 11 October, for Thanksgiving Day.*

Week 6. (17-21 October) Divisibility, prime numbers, and modular arithmetic. Assignment #6 due on Friday, 21 October.

Fall Reading Week. (24-28 October) Enjoy!

Week 7. (31 October – 4 November) Equivalence relations. Construction of the rational numbers. Assignment #7 due on Friday, 4 November.

Week 8. (7-11 November.) Linear orders and well-orders. Extending the natural numbers to the ordinals. Assignment #8 due on Friday, 11 November. *The last date to withdraw from Fall courses is Tuesday, 8 November.*

Week 9. (14-18 November) Construction of the real numbers via schnitts (Dedekind cuts). Assignment #9 due on Friday, 18 November.

Week 10. (21-25 November) Cardinality of sets. Assignment #10 due on Friday, 25 November.

Week 11. (28 November – 2 December) Schröder-Bernstein Theorem. Assignment #11 due and take-home final examination distributed on Friday, 2 December.

Week 12. (5–7 December) Catch-up and clean-up. *Wednesday, 7 December, is the last day of classes.*

Fall Examination Period. (9–22 December) Possible Assignment #12 due on Friday, 9 December. Take-home final examination due on Friday, 16 December.

Academic Integrity

Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from a 0 grade on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's Academic Integrity Policy. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more – www.trentu.ca/academicintegrity

For clarity, the following guidelines will apply in MATH 2200H:

You are permitted and encouraged to work with others and ask anyone willing (especially the instructor!) for explanations, hints, and suggestions for the assignments, and to consult whatever sources you wish. However, **all work submitted for credit must be written up entirely by yourself, giving due credit to all the sources of help and information that you actually used.** There will be greater restrictions on the take-home final examination, which will be spelled out on the exam.

Access to Instruction

It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Student Accessibility Services Office (SAS), Blackburn Hall Suite 132, 705 748-1281, sas@trentu.ca. For Trent University in Oshawa Student Accessibility Services Office contact 905 435-5102, ext. 5024. Complete text can be found under Access to Instruction in the Academic Calendar.

Archive Page

MATH 2200H has an archive page with links to assignments, exams, and various handouts from previous iterations of the course at: <http://euclid.trentu.ca/math/sb/2200H/> Material from the current iteration of the course will be archived on this page as well from time to time.