MTH300 Introduction to Mathematical Inquiry

This course will teach students how to properly read and analyze a proof. From generating their own proofs to evaluating the proofs of peers, students will have an in-depth opportunity to appreciate the rigour of mathematics. Elements of Analysis will be studied including absolute value and delta-epsilon limit definitions. Some concepts from number theory and geometry will be used to teach the method of proofs. Students will use interpersonal skills to present their own proofs and correct other proofs; learning the difference between the mathematically sound and the logically invalid. This course is designed to encourage the pursuit of true mathematical rigour and inquiry.

Course Information

Course Instructor	Erin Meger
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Office	ENG2XX
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Prerequisite	MTH110 Discrete Math I

Course Agreement

The goal of this course is to offer a meaningful, rigorous, and rewarding experience to every student; you will build that rich experience by devoting your strongest available effort to the class.

You will be challenged and supported.

Please be prepared to take an active, patient, and generous role in your own learning and that of your classmates. (c/o Federico Ardila)

Learning Outcomes

- Use mathematical notation properly and effectively, and integrate definitions with techniques of proving to write proofs in a variety of math topics
- Write well-written proofs, and understand the components of proper math writing including the appropriate logical leap for an undergraduate level student
- Read, understand, and correct your own proofs and others proofs
- Create written documents and slides using LaTeX
- Understand the importance of mathematical literacy in the math community, including respecting the proof writing process and collaborating effectively
- By the end of the course students should understand and be able to write proofs and solve problems about the following topics.
  - Delta-Epsilon definition of a limit
  - Absolute Value
  - Bijections
  - Countability
  - Relations and their properties
  - Set Operations
  - Supremum and Infimum
  - Divisibility and GCD
  - Fermat's Little Theorem
  - Euler's Phi Function
  - Euclids Elements

Method of Instruction

This course is a required course for math majors in the second semester of their first year. It will be offered via one 3-hour lecture to a class capped at 50 students. Classes will be engaging, involving group work activities, small presentations, independent work, and lectures. Each class will contain a quiz to encourage participation and attendance.

In addition, students have a choice in writing either a midterm or two take home assignments. There is significant research showing that students perform better when they have a choice in their assessment methods. The emphasis on this course is on writing proofs. Students have an opportunity to make an informed choice on whether they perform better under pressure or with ample time. This is an important lesson in that the proof-writing process cannot always occur under the time constraints of an exam.

Course Reading and Textbook

The required textbook for this course is *Writing, Reading, and Proving: A Closer Look at Mathematics* written by Ulrich Daepp and Pamela Gorkin. This book will be referenced by its chapter numbers. We will also be using the Bartle book *Introduction to Real Analysis*; this book will be referenced as "Bartle" in the schedule below. The sections by week are listed below along with a number of homework problems assigned from the text.

Mark Breakdown

Traditional Assessments

15% Weekly Quizzes

20% Assignments OR Midterm
- Students Must sign COURSE INTENTIONS FORM by WEEK 2
- Choice of traditional midterm or traditional assignments
- Questions concern all previous mathematics topics
- Marked with heavy emphasis on notation and readability

Group Project

2% Math Goals Reflection
- Find an upper year math course or topic that interests you
- Write a half page reflection detailing why it is interesting to you

6% Group Topic Resource Collection
- In groups find open resources on assigned topic
- Resources could include library textbooks or online videos

10% Group Topic Glossary
- Use feedback from Resource Collection
- Create a document of basic terms from the assigned topic
- Document may include examples and illustrations to explain terms
- Must include proof of assigned theorem written in own words

12% Final Group Presentation
- Groups present assigned topic
- Must include the proof of theorem assigned by instructor in WEEK 7
- Marked as a group.

Final Exam

35% Final Exam
- 150 minutes during University exam period
- Date and location TBD
- Focus on Material, contains small component of course reflection

Weekly Topic Outline

Week	Topics	Textbook
Week 1	Polya's Four Pillars Existential Quantifiers Mathematical Notation Proof Techniques Intro to LaTeX	Chapter 1 Chapter 4 Chapter 4 Tips on Quantification Chapter 5
Week 2	Absolute Value and Interval Notation Relations Sets Writing Proofs	Chapter 5 Chapter 10 Chapter 7,8,9 Chapter 9 Tips on Writing Math
Week 3	Functions Bijections Inverses Reading Math Correcting Proofs	Chapter 14 Chapter 15 Chapter 16,17 Chapter 10 Tips on Reading Math
Week 4	Countability Logical Leaps	Chapter 21-23 Chapter 13 You Solved it now what?
Week 5	MIDTERM Paradoxes	
Week 6	Delta Epsilon	Bartle 4.1
Week 7	Supremum and Infimum	Chapter 11 Bartle 2.3
Week 8	Divisibility and Parity Modular Arithmetic	Chapter 3 Chapter 27
Week 9	Fermat's Little Theorem Eulers Phi Function How to Beamer	Chapter 28 Chapter 29
Week 10	Euclids Elements Presentation Skills	Class Notes
Week 11	Euclidean Geometry	Class Notes
Week 12	Final Presentations	

Course Policies

Participation Policy As per the course agreement stated at the top of this outline, it is important that students come prepared to class. This included being ready to work with others, and having done the appropriate homework for the lesson. Each student should take active involvement in the class in order to gain the most out of each lesson and activity.

Late Policy Assignments will not be accepted after the due date unless arrangments are made with the instructor in advance.

Respect Policy The classroom is designed to be a safe space for learning and especially for making mistakes. It is of the utmost importance that each student understand and respect the learning process for their classmates. Disrespect of any kind will not be tolerated within the classroom.

Email and Office Hours Any student is welcome to send an email to me at anytime regarding any comment or concern in the course, and I will respond to these emails in a timely manner. I am here to guide and support your learning. If you are struggling or confused with the material please send me an email or attend weekly office hours. Remember, all correspondence must be done through your RYERSON email address, referencing the course number, and including you full name.

Changes to Outline The Lecturer reserves the right to modify or change any component of this course outline. Any changes will be posted on D2L prior to taking effect.

Academic Integrity In a course which includes a significant portion of group work, it is imperative that each student has a solid understanding of academic integrity. Any academic integrity violations will be dealt with as per university regulations. For more information you can consult the academic integrity website www.ryerson.ca/academicintegrity and also www.ryerson.ca/senate/policies. It is highly encouraged that you complete the module on the website as well.

University Regulations Please visit the senate website at www.ryerson.ca/senate for more information on policies affecting undergraduate students. The following are a list of policies to consider:

- Course Management Policy 145
- Student Code of Academic Conduct Policy 60
- Student Code of Non-Academic Conduct Policy 61
- Examination Policy 135
- Policy on Grading, Promotion, and Academic Standing Policy 46
- Undergraduate Academic Consideration and Appeals Policy 134
- Accommodation of Student Religious Obligations Observance Policy 150
- Academic Accommodation of Students with Disability Policy 159