

MA 240, Theory of Proof, Section 2  
Worcester State University, Fall 2018

**Instructor:** Hy Ginsberg

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office hours:

Tuesdays 1:00 – 2:00, Wednesdays 11:20 – 12:20, Fridays 11:20 – 12:20,  
and by appointment or luck (you are welcome to stop in anytime).

website: <http://www.hyginsberg.com>

**Meetings:** MWF 12:30 – 1:40, S-222.

**Prerequisites:** MA 200 with a grade of at least C- (may be taken concurrently with permission).

**Content:** This course marks a transition from mathematics as a means for solving problems to mathematics as a discipline for the discovery and elucidation of knowledge and understanding. Our main focus will be the extensive study of *proofs*, the mathematician's principal tool in this endeavor, including direct proof, contrapositive, proof by contradiction, and mathematical induction. At the same time we will cover some of the fundamental concepts underlying all of modern mathematics, starting with logic and set theory, and including (at least) functions and equivalence relations. Additional topics will be covered as time permits.

**Important Notes:** *Abstract Algebra* (MA 405) and *Real Analysis* (MA 410) require at least a B- in this class, and many other upper level math courses (MA 260, MA 340, and MA 360) require at least a C. This means that math majors (who must take at least one of MA 405 and MA 410) need at least a B- in this class, and Math for Elementary Education (MEE) majors need at least a C.

With that in mind, please note that it is the math department's policy that *you may repeat this course only once*.

**Text:** *Mathematical Proofs, A Transition to Advanced Mathematics*, by Chartrand, Polimeni, and Zhang, third edition.

**Writing:** We will aspire to *write beautiful mathematics* in this class, and the quality of your writing will be a component of your grade on all assignments and assessments. Your textbook has an excellent chapter on mathematical writing that you should read carefully and refer to often, and you are encouraged to use the Writing Center (S-306) as a resource.

**Homework:** Homework will be assigned frequently. You will be asked to hand in only a specified subset of the assigned exercises (and I will grade only a subset of these), but it is important that you complete the *entire* assignment. In the interest of writing beautiful mathematics, please work out your proofs on scrap paper first, and then rewrite them to hand in. (You are also welcome – but not required – to learn LaTeX, a professional typesetting system designed specifically for mathematical documents. Typesetting your homework has many advantages, including allowing you to make small changes with little effort. A brief LaTeX tutorial is posted on the class website.)

You are welcome to work together on homework assignments; if you do, please write the name(s) of your collaborator(s) in some conspicuous place at the top of your homework. (If you collaborate only on particular problems, you may write the name(s) at the start of those problems.) You may not simply copy; all of your answers must be *in your own words*.

You are also strongly encouraged to take advantage of my office hours (or, if those times are not convenient, to make an appointment with me or just stop in). I am always happy to discuss homework problems.

You may not look up answers to homework problems online, or use the internet in any way to help with your homework. Doing so will be considered cheating and will be dealt with accordingly.

Students will be assigned selected homework exercises to present on the whiteboard. When it is your turn, I expect you to be well prepared and able to discuss your work with the class. You are also expected to participate in the discussion of work presented by your classmates.

**Quizzes:** Quizzes will usually be held weekly on Fridays; exceptions will be announced in class. No makeup quizzes will be given, but your lowest quiz grade will be dropped. Let me know if you have legitimate reasons for missing more than one quiz.

**Midterms:** There will be two midterm exams. They are tentatively scheduled for Friday, October 19th, and Friday, November 30th, but may be rescheduled to better fit the timing of the course, if necessary. You might be able to talk me into a make-up exam if you have a good enough reason; if you care to try, let me know as soon as possible.

**Final:** The comprehensive final exam will be held on Friday, December 14th, from 12:30 PM to 3:30 PM, in our usual classroom (according to the schedule set by the registrar).

**Grading:** 20% for each of the two midterm exams, 15% for your quiz average, 15% for your homework average (divided into 13% and 2%, as described below), and 30% for your final exam.

Two percentage points of your homework average will be awarded based on your presentations of homework problems to the class, as follows:

2 points: Problems presented faithfully; reasonable participation in other students' presentations.

1 point: Problems presented with minimal preparation, or no appreciable participation in other students' presentations.

Any student who does not present homework problems to the class will be awarded a grade of *Incomplete* for the class.

Grades will not be curved or rounded, and final letter grades will be assigned as follows:

	$B^+ \geq 87$	$C^+ \geq 77$	$D^+ \geq 67$
$A \geq 93$	$B \geq 83$	$C \geq 73$	$D \geq 63$
$A^- \geq 90$	$B^- \geq 80$	$C^- \geq 70$	$D^- \geq 60$

**Attendance:** You are expected to attend *every* class. If you must miss a class, *you are still responsible for the material we cover*. In particular, you are expected to read the textbook, get the class notes, and do the homework so that you are caught up with the rest of the class when you return.

Missing 6 or more classes without legitimate *documented* reasons for almost all of them will result in an automatic failing grade in the class.

**Academic Honesty:** You are expected to uphold the university's high standards of academic honesty at all times. Please see the *Student Handbook* on the [Student Services](#) page for details. All incidents of academic dishonesty will be reported to the Academic Judicial Board.

**Tutoring:** Free drop in tutoring is available at the Math Tutoring Center; hours and location to be announced.

**Accommodations:** If you anticipate issues related to the format or requirements of this course, please meet with me as early as possible in the semester to discuss ways to ensure your full participation. If you believe that formal, disability-related accommodations are appropriate, it is very important that you register with Student Accessibility Services (SAS) and notify me of your eligibility for such accommodations. We can then plan how to best coordinate your accommodations. SAS is located in the Administration Building, Room 131 and can be reached by phone ((508)929-8733) or email (sas@worchester.edu).

**Credit hours:** Inherent in the idea of a credit hour is the expectation that for each hour of class time the student will spend a minimum of two hours outside of class on homework, studying, reading the text, and similar activities. This is a four credit course; you should spend at least eight hours per week outside of class working on the class material.

## Approximate Schedule:

Week of	Topics
9/3	Logic
9/10	Quantifiers; Direct proof; Contrapositive
9/17	Biconditional; Divisibility
9/24	Congruence; Set Theory
10/1	Set proofs; Relations; Functions
10/8	Function composition; Inverse functions
10/15	Proof by contradiction; <b>Exam</b>
10/22	Existence proofs; Counterexamples
10/29	Induction; Strong induction
11/5	Equivalence relations; Equivalence classes; Partitions
11/12	Set cardinality
11/19	Countable sets
11/26	Uncountable sets; Cantor's Theorem; <b>Exam</b>
12/3	Proofs in $\mathbb{R}$
12/10	Final review