

Foundations of Mathematics (3)

Dr. Caldwell, Fall 2022

Instructor: Dr. Chris K. Caldwell (caldwell@utm.edu), office 429 Humanities (drop by!) We will use Canvas in this course.

Prerequisite: Math 251 or departmental approval.

Catalog Description: Proof techniques, sets, propositional calculus, functions, relations, properties of integers. *(In other words: this is our first course in writing proofs, a skill used in most of our upper division classes.)*

Goal: To prepare students for success in upper division proof-based mathematics courses. We will teach how to write proofs and familiarize students with the basic notations, definitions, and styles used in proofs.

Learning Outcomes for Major: This course addresses (as assesses) student learning outcomes iii and iv for the major. (There is additional information about this assessment on line at math.utm.edu such as the UTM Proof Outlines.)

Upon completion of his/her degree from the University of Tennessee at Martin with a major in mathematics, the graduate will be able to:

- i. apply mathematical concepts and principles to perform numerical and symbolic computations;
- ii. use technology appropriately to investigate and solve mathematical and statistical problems;
- iii. write clear and precise proofs;**
- iv. communicate effectively in both written and oral form;**
- v. demonstrate the ability to read and learn mathematics and/or statistics independently.

Teaching Objectives: The student will:

1. Understand abstract definitions by analyzing them carefully and constructing examples
2. Recognize a rigorous proof
3. Identify and correct weaknesses in invalid and incomplete proofs
4. Construct proofs using a variety of proof techniques including: direct proofs, proofs by contraposition and contradiction, proofs by mathematical induction
5. Present proofs both orally and in written form using correct and concise English and mathematical grammar
6. Understand and apply the basic terminology, notation, and concepts associated with each of the following areas:
 - (a) the algebra of sets
 - (b) propositional calculus (including quantifiers)
 - (c) relations (especially equivalence and recurrence relations)
 - (d) the algebra of functions (especially in/sur/bi-jections)
 - (e) properties of the integers (including division algorithm, gcd, prime factorization)

Text(s): Proofs and Fundamentals: A First Course in Abstract Mathematics, Undergraduate Texts in Mathematics, 2nd ed., 2011 Edition by Ethan D. Bloch. ISBN-13: 978-1441971265 ISBN-10: 1441971262.

We will cover most of the first six chapters.

Grading: It is unlikely tests ... will be graded 90% A, 80% B, ...; but numerical grades will be determined using the following weights.

53% tests (about four one period tests)
23% homework (proofs assigned most days)
19% final (comprehensive)
5% participation

Homework: Homework will be turned in at the start of next class meeting. You may turn your homework in early. Late homework is very unlikely to be accepted—so always at least show that you made an effort by writing the problem down!

Trigger Warning: Expect to work in this class (and expect to gain significantly from that work!) This class is hard for many mathematics and statistics majors—especially the switch from doing procedural problems to writing proofs. Undergraduate classes are meant to require two hours of work outside of class for each hour in class, but most do not. This one likely will. I will be respectful of your time and endeavor to use it in a way that is very beneficial to you. Proof writing is central to most of our upper division mathematics classes!

Academic Integrity: Academic dishonesty will not be tolerated and will result in at least an F for the activity or assignment. Your Student Handbook clearly states “suspension from the university is the expected penalty” for “plagiarism, cheating, and academic integrity issues” and this includes submitting the work of another person as your own or permitting another to submit yours as his/her own. For this course especially, make sure that you know what plagiarism is (read the first section of our Citing Sources document).

Disability Services: The University of Tennessee provides reasonable accommodations (academic adjustments and auxiliary aids) to ensure equal access to educational content and university programs for students with disabilities. Students who are eligible for and who request accommodations through the Disability Services office must provide instructors with a letter of accommodation. The Disability Services office is located in the Student Success Center, 203 Clement Hall, (731) 881-7605.