

Foundations of Higher Mathematics

Time: MWF 9 – 9:50
Room: ACR 206

Instructor: Eric Funasaki
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Office hours:

MWF 10 – 10:50, MW 11 – 11:50, TR 9:30 – 10:45, or by appointment.

Textbook:

Mathematical Proofs: A Transition to Advanced Mathematics, 3rd edition, by Gary Chartrand, Albert D. Polimeni, and Ping Zhang.

Course Description:

A transition course to higher mathematics. Students learn how to organize and structure their mathematical thoughts, how to read and manipulate abstract definitions, and how to prove or refute proofs by effectively evaluating them. Topics such as propositional logic, set theory, and techniques of proving will be the basis for discussions on functions, sequences, relations, limits, cardinality, divisibility, real numbers, and complex numbers.

Prerequisite:

Math 2414 Calculus II

Mathematics Program Learning Objectives:

The student should be able to:

1. Apply knowledge of basic mathematics principles;
2. Identify and provide valid proofs or solutions for theorems or problems; and
3. Recognize and dispute invalid mathematical statements using counterexamples.

Course Objectives:

The student will be able to:

1. Work with sets, subsets, set operations, indexed collection of sets, partitions of sets, and Cartesian products of sets;
2. Work with concepts from mathematical logic; and
3. Write and recognize a direct proof, proof by contrapositive, proof by contradiction, proof by counterexample, and proof using mathematical induction.

EC-6 Core Teacher Competencies:

1. Competency 013 (Mathematics Instruction): The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize, and implement instruction and assess learning.

2. Competency 014 (Number Concepts and Operation): The teacher understands concepts related to numbers, operations and algorithms, and the properties of numbers.
3. Competency 015 (Patterns and Algebra): The teacher understands concepts related to patterns, relations, functions, and algebraic reasoning.
4. Competency 016 (Geometry and Measurement): The teacher understands concepts related to principles of geometry and measurement.
5. Competency 017 (Probability and Statistics): The teacher understands concepts related to probability and statistics and their applications.
6. Competency 018 (Mathematical Processes): The teacher understands mathematical processes and knows how to reason mathematically, solve mathematical problems, and make mathematical connections within and outside of mathematics.

Course Assessment:

Your grade will be based on the following components:

- 6% In-class problems and participation
- 20% Homework assignments and quizzes
- 48% Exams
- 26% Comprehensive Final Exam

The grading scale will be:

90 – 100 A 80 – 89 B 70 – 79 C 60 – 69 D 0 – 59 F

Course Schedule (tentative):

Week 1

- 8/24 M 1.1 Describing a Set, 1.2 Subsets
- 8/26 W 1.2 Subsets, 1.3 Set Operations
- 8/28 F 1.4 Indexed Collections of Sets, 1.5 Partition of Sets

Week 2

- 8/31 M 1.5 Partition of Sets, 1.6 Cartesian Products of Sets
- 9/2 W 2.1 Statements, 2.2 The Negation of a Statement
- 9/4 F 2.2 Negation of a Statement
2.3 The Disjunction and Conjunction of Statements

Week 3

- 9/7 M Labor Day (no class)
- 9/9 W 2.4 The Implication, 2.5 More on Implications
- 9/11 F 2.5 More on Implications, 2.6 The Biconditional

Week 4

- 9/14 M 2.7 Tautologies and Contradictions, 2.8 Logical Equivalence
- 9/16 W 2.8 Logical Equivalence
2.9 Some Fundamental Properties of Logical Equivalence
- 9/18 F 2.10 Quantified Statements, 2.11 Characterizations of Statements

Week 5

- 9/21 M 2.11 Characterizations of Statements
- 9/23 W Review for Exam 1
- 9/25 F Exam 1

Week 6

9/28	M	3.1 Trivial and Vacuous Proofs
9/30	W	3.2 Direct Proofs
10/2	F	3.3 Proof by Contradiction

Week 7

10/5	M	3.4 Proof by Cases
10/7	W	3.5 Proof Evaluations
10/9	F	4.1 Proofs Involving Divisibility of Integers

Week 8

10/12	M	4.2 Proofs Involving Congruence of Integers
10/14	W	4.3 Proofs Involving Real Numbers
10/16	F	4.4 Proofs Involving Sets

Week 9

10/19	M	4.5 Fundamental Properties of Set Operations
10/21	W	4.6 Proofs Involving Cartesian Products of Sets
10/23	F	Review for Exam 2

Week 10

10/26	M	Exam 2
10/28	W	5.1 Counterexamples
10/30	F	5.2 Proof by Contradiction

Week 11

11/2	M	5.3 A Review of Three Proof Techniques
11/4	W	5.4 Existence Proofs
11/6	F	5.5 Disproving Existence Statements

Week 12

11/9	M	6.1 The Principle of Mathematical Induction
11/11	W	6.2 A More General Principle of Mathematical Induction
11/13	F	6.3 Proof by Minimum Counterexample

Week 13

11/16	M	6.4 The Strong Principle of Mathematical Induction
11/18	W	Review for Exam 3
11/20	F	Exam 3

Week 14

11/23	M	7.1 Conjectures in Mathematics, 7.2 Revisiting Quantified Statements
11/25	W	Thanksgiving Break (no class)
11/27	F	Thanksgiving Break (no class)

Week 15

11/30	M	7.2 Revisiting Quantified Statements, 7.3 Testing Statements
12/2	W	Review for Final Exam
12/4	F	Dead Day (no class)

Week 16

12/7	M	Finals week (no class)
12/9	W	Final Exam (8 am – 10 am)
12/11	F	Finals week (no class)

Attendance:

Role will be taken. You are responsible for all material covered in class as well as any assignments and announcements that are made. If you miss an assignment, exam, or quiz you will receive a grade of zero unless I have been notified in advance.

Sul Ross State University policy is to drop a student with a grade of W or F when 9 hours of class are missed. For this course that is when you miss **9** classes.

Cheating:

Cheating will not be tolerated. Anyone caught cheating will receive a grade of zero on that assignment. This includes homework assignments where the student who copied another student's work and the student who allowed their work to be copied will both receive a grade of zero.

Cell Phones and Other Electronic Devices:

Your cell phone must be **off** while you are in class. You may not read or send text messages while class is in session. If there is an unusual situation where you simply must be able to read and send a message without delay, please place your phone in vibrate mode and leave the room before reading and responding. No other electronic devices may be used during class without the permission of the instructor.

ADA Statement:

Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartze in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, TX 79832. Telephone: 432-837-8203. E-mail: mschwartz@sulross.edu.

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