

**Math 225 Foundations of Advanced Mathematics**  
**Section 004**  
**Fall 2017**  
**3 Credit Hours**

**Instructor:** Jo-Ann Cohen  
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**Office Hours:** Monday, Wednesday: 10:30-11:30 a.m.  
Tuesday, Thursday: 3:15-4:15 p.m.  
and by appointment

**Course Meeting Time:** Monday, Wednesday, and Friday from 11:45 a.m. to 12:35 p.m.  
in SAS 2102

**Prerequisite:** MA 241

**GEP Category:** This course does not fulfill a General Education Program requirement.

**Materials/book:** The notes are on the course website.  
(There are no additional charges for the notes or for the course.)

**Course Description:** Introduction to mathematical proof with focus on properties of the real number system. Elementary symbolic logic, mathematical induction, algebra of sets, relations, functions, countability. Algebraic and completeness properties of the reals.

**Learning Outcomes:** Students should demonstrate the ability to:

1. read, understand, and make informed judgments about mathematical arguments.
  - Students should be able to recognize the basic methods of proof such as direct proofs, proofs by contradiction, and proofs using the Principle of Mathematical Induction and equivalent principles.
  - Students should be able to analyze and critique mathematical arguments. Students should be able to make a sound case as to the correctness of the argument, should be able to explain any problems that are found, and then should be able to suggest ways to remedy the problems.
2. generate clearly reasoned, convincing proofs.
  - Students should be able to construct proofs using direct arguments, contradiction, and the Principle of Mathematical Induction and equivalent principles.
  - Students should be able to move successfully from discovery of a proof to the writing of a proof. Students must demonstrate that they possess both

- the creativity that guides discovery and the careful deductive reasoning that structures an argument of proof.
- Students should be able to construct a proof in such a way that the reader can follow the steps logically from one to another and is convinced of the validity of the proof.
  - Students should be able to show that they possess a sound understanding of the underlying mathematics as revealed in the construction of proofs.
3. explain mathematics intelligibly to their peers.
  4. understand and use mathematical language and symbols.
    - Students should be able to express mathematical concepts using precise mathematical symbols and prose.
  5. understand the basic definitions and properties of the integers and real numbers, sets (including the size of sets), relations and functions.
    - Students should be able to explore examples, make conjectures, and understand the mathematics driving the results.
    - Students should be able to use these definitions and properties in the construction of proofs.

**Course Structure and Rules of Engagement:** The lectures will be interspersed with small group activities. We will usually assign homework each day and collect all homework at the end of each week.

The course will be structured so that there is a lot of student interaction. In this class we will share ideas and learn from each other. It will be important for each student to “try” on new ideas, to make conjectures even if you are not sure that you are correct. You will also be asked to critique the ideas and arguments of others. While it is OK to disagree with those ideas and arguments, it is not OK to make personal attacks.

**Email:** All email announcements and correspondence will be sent to your official ncsu.edu email address.

**Course Schedule:**

- Chapter 0. Preliminaries: 1-2 days
- Chapter 1. Language, Logic, Sets, and Methods of Proofs: 3-5 weeks
- Chapter 2. The Principle of Mathematical Induction: 2 weeks
- Chapter 3. Functions: 2-3 weeks
- Chapter 4. Equivalence Relations: 2 weeks
- Chapter 5. Properties of the Integers: 1-2 weeks
- Chapter 6. The Size of Sets: 1-2 weeks

Note that the schedule is subject to change.

**Grading:**

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| 1. Weekly Homework Assignments                 | 10% |
| 2. Three Hourly Exams (20% each)               | 60% |
| Tentative Dates:                               |     |
| Friday, September 15th                         |     |
| Wednesday, October 18th                        |     |
| Friday, November 17th                          |     |
| 3. Final Exam                                  | 30% |
| December 11, 2017, 8:00-11:00 a.m. in SAS 2102 |     |

**Standard Grading Scale:**  $97 \leq A+ \leq 100$ ,  $93 \leq A < 97$ ,  $90 \leq A- < 93$ , etc.

**Requirements for Credit-Only (S/U) Grading:** In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <https://policies.ncsu.edu/regulation/reg-02-20-15/>.

It is important that you consult with your advisor to see if the course will count towards your graduation requirements before taking this course as credit-only.

**Incomplete Grades:** Incomplete grades will be handled on an individual basis. Note, however, that if an extended deadline is not authorized by an instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as attempted courses on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <https://policies.ncsu.edu/regulation/reg-02-50-03/>.

**Attendance Policy/Absence Policy/Late Assignments/Make-up Work:** You are expected to attend all classes on time. Late assignments and make-up work will only be allowed for excused absences. For complete attendance and excused absence policies, please see <https://policies.ncsu.edu/regulation/reg-02-20-03/>.

**Academic Integrity/Honesty:** It is my understanding and expectation that your signature on any test or assignment means that you have neither given nor received any unauthorized aid. Students are required to comply with the university policy on academic integrity/honesty found in the Code of Student Conduct (<https://policies.ncsu.edu/policy/pol-11-35-01/>).

**Cell Phone Use:** Cell phones should be turned off during class. But if you have an emergency and need to keep your phone on during class, please let me know before class.

**Electronically-Hosted Course Components:** All reading materials are housed on the course website. Note that I received licenses to include pictures and biographies of the mathematicians and mathematics educators that appear in the notes under the provision that the materials would be located on a secure site. So although you may copy the notes

for your own use, you should not share the pages with the pictures and biographies with anyone else.

The following statement is required by the University:

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

**Accommodations for Disabilities:** Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Services Office at Suite 2221, Student Health Center, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>).

**Non-Discrimination Policy:** NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <https://policies.ncsu.edu/policy/pol-04-25-05/> or <https://oied.ncsu.edu/equity/policies/>. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

**List of Policies:** Students are responsible for reviewing the NC State University PRRs (policies, rules and regulations) that pertain to their course rights and responsibilities:

- Equal Opportunity and Non-Discrimination Policy Statement <https://policies.ncsu.edu/policy/pol-04-25-05/> with additional references at <https://oied.ncsu.edu/equity/policies/>
- Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01/>
- Grades and Grade Point Average <https://policies.ncsu.edu/regulation/reg-02-50-03/>
- Credit-Only Courses <https://policies.ncsu.edu/regulation/reg-02-20-15/>
- Audits <https://policies.ncsu.edu/regulation/reg-02-20-04/>
- Accommodations <https://policies.ncsu.edu/regulation/reg-02-20-01/>
- Attendance Policy <https://policies.ncsu.edu/regulation/reg-02-20-03/>