

MA 225-005: Foundations of Advanced Mathematics Fall 2017

Instructor: Dr. Andrew Cooper, andrew.cooper@math.ncsu.edu

Class Meetings: TH 4.30 – 5.45 pm in 2106 SAS Hall

Office Hours: in 3232 SAS Hall; by appointment

Website: Moodle, accessible at wolfware.ncsu.edu

Text: We will use notes developed by myself and Prof. Jo-Ann Cohen. I also recommend the book Solow, *How to Read and Do Proofs*, 5th edition, for problem-solving advice and strategies.

GEP Fulfillment: None.

University Policies: The course will be administered in accordance with all University Policies, Rules, and Regulation. Students are responsible for reviewing the NC State University PRRs located at oucc.ncsu.edu/course-rights-and-responsibilities.

OVERVIEW

Scope and Objectives. *This course is intended and designed to prepare mathematics majors for proof-intensive courses such as MA 405, MA 407, MA 416, MA 425, and MA 426.* The purpose of this course is to introduce you to the basics of how to read and write mathematical proofs. After this course, a successful student will be able to:

- *Identify* and *apply* appropriate proof techniques appropriate to a variety of mathematical statements.
- *Analyze*, *critique*, and *explain* formal mathematical statements, definitions, and arguments, using the intellectual standards of critical and creative thinking.
- *Formulate* formal mathematical statements, definitions, and arguments from informal descriptions. *Interpret* mathematical statements and definitions in real-world and informal contexts.
- Competently *discuss* mathematical arguments informally.
- *Reflect* on their own mathematical thinking and that of others.

The mathematical objects we will deal with as we learn to read and write mathematics will mostly be the familiar¹ natural, rational, and real numbers.

The official course description is:

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.

Embedded throughout the content of this course, you will become adept at using the intellectual standards for critical and creative thinking in evaluating the work of others, as well as solving problems/addressing questions in mathematics. You will also be introduced to tools to help you reflect on your own thinking (i.e. metacognition).

TH!NK course. This course is a part of the NC State effort to enhance students' critical and creative thinking skills. As a student in this course, you have some special responsibilities in helping us assess the effectiveness of teaching and learning for the critical and creative thinking (TH!NK) initiative.

Each student will receive an email from the Office of Assessment, asking you to take an on-line survey at the end of the semester. This is important in evaluating the success of the program. To receive credit for participation, you must complete the survey online within the requested timeframe.

Some of the assignments that are a part of this class will also be shared with the Office of Assessment. Your work will remain confidential. Your work will never be reported on individually, but may be part of a group report after identifying information is removed

Prerequisites. The formal prerequisite is MA 241. However, we will not use much in the way of calculus, nor will the course require a great amount of computation. Mostly you will need a good deal of persistence, willingness to try new things, and a little bit of creativity. We will also draw on much precalculus mathematics you have previously learned.

CLASSROOM MEETINGS AND PARTICIPATION

Lectures. Most classroom meetings will consist of lecture and individual and small-group activities. Attendance at and active participation in all class meetings should be considered mandatory.

¹As we will quickly see, they may not be so familiar after all.

Preticipation. To inform our class discussions, we will frequently have *preticipation*, that is, guided preclass activities. **Preticipation is an essential part of the course.** Much of what you will learn in this course, you will learn by doing the reading, viewing, and thinking in the preticipation.

ASSIGNMENTS AND GRADES

Evaluation. Your grade will be determined solely on the basis of your graded work as described in this section.

In this course we will use a variant of what is called *specifications grading*. Rather than achieving a certain percentage of available points, you will need to meet various criteria as described in the attached document *Grading and Homework Policy*. If you meet all the criteria for a certain letter grade, you will receive that letter grade. If you fail to complete the ‘C’ specifications you will receive a grade of ‘D’ or ‘F’, depending on how many of the C specifications you have completed.

Missed Assignments. If you will miss an exam, please let me know *in writing* and *as soon as possible*. I will be the sole arbiter of what constitutes a valid reason for missing an assignment, and of determining how missed assignments are to be made up, consistent with the University’s Regulation 02.20.03.

Quizzes. Every week we will have a *definition quiz* (**not a vocabulary quiz!**). You will have a few (less than 3) minutes to recall a definition or the statement of a named theorem. The purpose of quizzes is to encourage you to learn, by heart, the necessary information to follow along with what is happening in class.

Exams. Exams will be closed-book and closed-notes. Some exam questions will require you to write proofs, but true/false, matching, multiple choice, and short-answer interpretive questions will also appear.

Homework Proofs. Ten proofs will be assigned weekly as homework. This is by far the most important component of the course. See the attached document *grading and homework policy* for more details.

Other assignments. Besides proofs, there will be several special homework assignments throughout the semester.

Proof Portfolio. At the end of the course, you will compile a portfolio of your proofs over the course of the semester. More details on the portfolio are given in the document *Portfolios*.

Academic Integrity. The definition of academic integrity is simple and broad: *do not take credit for others’ work*. This applies to all assignments. All assignments—absent an explicit statement to the contrary—should be completed individually.

You may not collaborate on exams in any form. You may not use any aids except those approved through the Disability Services Office and arranged with me in advance. This includes, but is not limited to: textbooks, crib sheets, electronic calculators, electronic communications devices, séances with the ghosts of G. Cantor and/or G. Frege, and tattoos of formulæ.

Infractions against academic integrity will be addressed through the University’s Office of Student Conduct pursuant to University Policy 11.35.01 and Regulation 11.35.02.

OUTSIDE OF CLASS

Office Hours. There is no need to make an appointment during my office hours listed above. In addition, I am also available by appointment (email is best). Office hours are not to be used as a general substitute for class attendance; please come with a specific question or questions so that everyone’s time is used efficiently. You may also consider using the office hours of other sections’ instructors—with their permission, of course.

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

Communicating mathematics via email is inefficient for two reasons: the obvious typesetting difficulties, and the subtle nature of the questions. Therefore I generally do not discuss mathematics via email correspondence. In the long run, it is much more efficient to meet face-to-face. I try to respond to all student emails regarding administrative matters within 24 hours — if I have not responded within that time, please ask again, as your email may have been buried in my inbox.

Other Help. I encourage you to make use of resources from other sources to get a different perspective. I will post some links on the course website.