# Mathematics 250, Foundations of Mathematics
**Spring, 2014**

Mathematics 250 is a survey of basic mathematics with a focus on proving. The course will cover elements of the propositional calculus, the predicate calculus, and techniques of proof (including mathematical induction); sets and the set-theoretical development of basic mathematical objects (relations, functions, operations); and brief introductions to the fields of combinatorics, number theory, group theory, and analysis.

**Goals:**

The overall goal is to prepare the student for higher mathematics courses. To this end, students should grow by learning to analyze and critically evaluate mathematical statements and proofs, developing skill in expressing oneself in writing and orally (especially in relation to presenting sound mathematical argument), and acquiring an interest in learning more by asking questions and seeking answers through personal mathematical inquiry. At the end of the course, the student should meet the following process goals and demonstrate the ability to:

1. Read and apply a definition;
2. Produce an example of a thing defined;
3. Read and understand proofs;
4. Understand what needs to be proved in a statement;
5. Apply various strategies for proving a statement;
6. Create simple proofs;
7. Write a proof cogently.

In addition, the student should meet the following content goals and demonstrate an understanding of:

1. Propositional and predicate calculi;
2. Basic definitions in the fields of set theory, number theory, group theory, and analysis.

**Text Material:**

*Foundations of Analysis* by Landau

*A Transition to Advanced Mathematics* by Smith, Eggen, and St. Andre (SESA)

In addition to these two required texts, excerpts and handouts will be posted on Blackboard.

**Writing Intensive:**

This course satisfies the Sophomore Writing Requirement for eligible students; the basis for this is the writing and revision of solutions to problems, as described below. It is vital to be able to express ideas so that they can be fully and clearly understood by others; often this requires correctly using notational and structural standards (i.e. proper grammar). Students should express solutions in a manner that is clear, concise, logically sound, and aligned with common standards of expression in mathematical proof, including using proper grammar when sentences are used.

**Ways of Inquiry:**

This course is designated a Ways of Inquiry course: this means the student will learn how mathematical knowledge is constructed by constructing it. Much of the student's work in this class will be centered around finding solutions to problems found on the class problem list. This class is structured around the presupposition that this particular aspect is to be an individual endeavor: there should be no collaboration or use of extra resources in discovering or writing up solutions to these particular problems. Circumventing this requirement both destroys the personal inquiry aspect of this class and violates the Honor Code.

**Grading**:

The student's final course grade will be based, in part, on their performance on two tests (10% each) and a cumulative final exam (20%). However, the bulk of each student's grade (50%) will be based on the number of acceptable proofs submitted from the class problem list; further details are given below. In addition, each student will be graded based on class participation (10%), requiring the student to actively participate in asking and answering questions, as well as occasionally presenting content and solutions in class.

Final grades will be based on the following ranges: 90.0-100% A, 80.0-89.9% B, 70.0-79.9% C, 60.0-69.9% D, 0-59.9% F. Plus and minus grades will be assigned based on final grade distributions within each whole letter grade.

**Solutions:**

Students will be expected to submit solutions to problems from the class problem list at the start of each week. These will be graded and returned throughout the week; each solution will either be rejected (X), returned for revision (R), or accepted (✓). A rejected solution is one that presents a deeply fallacious or off-base argument and/or uses very poor style in presentation. A solution returned for revision is one that contains few or no logical errors, but has some issues with incorrect style or inefficiency in presentation; many "good" solutions will still receive this grade. An accepted solution contains no logical errors and is nearly flawless in its presentation.

To help maintain motivation and progress on these solutions, there will be regular deadlines for groups of problems: if a student has not submitted a solution receiving at least a score of R by the problem's deadline, they may not receive credit for that problem. There will likely be between 40 and 50 problems total on the problem list; in previous years, successful students have usually accumulated 30-35 accepted solutions by the end of the course.

At no point should a student consult any resource other than those used in the class or another person other than the professor in the pursuit and capture of these solutions!!

**Homework:**

In addition to the class problem list, extra homework problems will be assigned for the student's benefit and will not be collected; however, students may occasionally be asked to present solutions to these problems in class.

**Tests**:

Students are expected to take tests at the scheduled times. Conflicts, problems and emergencies will be handled on an individual basis. For reasons deemed legitimate by the

professor, arrangements may be made for a student to take a test prior to the testing time. Arrangements must be made several days in advance.

Any student requiring special accommodations must present their letter of accommodation provided by the college; the student must make arrangements for these accommodations several days in advance of the scheduled test date.

**Course Outline:**

This is merely a guideline for course content and is subject to change.

Week of:
*January 13- SESA Ch. 1*
*January 20- Landau Ch. I*
*January 27- SESA Ch. 2*
*February 3- Landau Ch. II*
*February 10-* Test 1
*February 17- SESA Ch. 3*
*February 24- SESA Ch. 4*
*March 3- SESA Ch. 5*
*March 10-* Spring Break (No Class)
*March 17- SESA Ch. 6*
*March 24- Additional Content on Rings*
*March 31-* Test 2
*April 7- Landau Ch. III & IV*
*April 14- Landau Ch. IV & V*
*April 21- Additional Content on Analysis and/or Combinatorics*
*April 28-* Review; Final Exam Friday, May 2 2:00-5:00

**THE HONOR CODE OF OXFORD COLLEGE APPLIES TO ALL ASSIGNMENTS IN THIS COURSE. BY YOUR SUBMISSION OF SUCH WORK, YOU PLEDGE THAT WORK WAS DONE IN ACCORDANCE WITH THE RULES STIPULATED ON THE ASSIGNMENT OR IN THIS SYLLABUS AND THAT YOU ARE UNAWARE OF ANY SUCH VIOLATIONS OF THE HONOR CODE.**