Math 290: Introduction to Advanced Mathematics
George Mason University, Fall 2017, Section 002

Instructor:
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Office Hours:
MW 4:15-6pm & by appointment
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Class:
MW 3-4:15
Robinson A 412

Textbook:
A Transition to Advanced Mathematics
Smith–Eggen–St.Andre, 8th Ed.

Course content. The goal of this course is to help students transition from calculus-level math to proof-based advanced mathematics. The mentality of advanced mathematics is quite different from what you see in entry-level classes. Instead of learning how to *use* mathematical tricks (e.g., the quadratic formula), we will be interested in *why* they work, *what else* we can come up with (do cubic polynomials have solutions?), and how to create new tools for non-mathematicians.

We will start by pretending to know absolutely nothing.

We won't know: Stokes' Theorem, what a derivative is, how to find the x-intercept of a function, what a function even is, what plus means, whether zero is a natural number, whether every statement is true or false.

We will then work to rebuild (very carefully and precisely):

- Logic: true/false statements and proofs,
- Sets: collections of things and ways of breaking them up or combining them,
- Induction: a common trick for proofs that "work their way up",
- Numbers: axioms and basic properties of the natural numbers,
- Relations: ways of sorting things and thinking of them as equivalent,
- Functions: what they are and how to make new ones,
- Cardinality: infinity, and how to count past infinity.

We will finish by proving that some infinities are bigger than others: there are more real numbers than rationals, although no one knows how many there are.

Workflow and designations.

This is an Inquiry-Based Learning Course. There will be no lecturing, apart from occasional recaps of material. Instead, students will work in groups on problems that guide them through the material. They will then choose good ways of phrasing their solutions and present their work to others. On the flip side, students will also be asked to help guide and evaluate each others' work during class.

This is a Writing-Intensive Course. The course involves weekly writing assignments that will be submitted online in PDF form. All submissions must use complete sentences (including full punctution) and full explanation of ideas; and must be in PDF form and typeset in LaTeX(see, for example, `http://sharelatex.com`).

This is an OSCAR/SaS Course with a Scholarly Inquiry (RI) designation. The course will therefore involve some discussion of current research in mathematics, including writing assignments focused on famous proofs, open problems, and mathematicians.

Blackboard. All writing portfolio and homework assignments will be due on Blackboard (accessible via `https://mymasonportal.gmu.edu`) at **5pm every Friday**. Submissions must be in PDF format, typeset in LaTeX. Late assignments will not be accepted, but early ones may be submitted at any time.

The same deadline applies to the instructor: new assignments will be posted by 5pm every Friday, a week before they are due.

Grades and comments on assignments (other than the midterms) will be accessible only Blackboard. In particular, quizzes will not be returned except by request.

Writing portfolio. Short (1-2 pages) writing assignments will include both topics covered in class and independent explorations. At the end of the course (on **December 6**), students will submit their full writing portfolio, consisting of all weekly writing assignments, and incorporating corrections in response to instructor comments. These will be graded again (the instructor will pick out a sampling of the assignments to grade).

Homework. Homework assignments are problem sets that will be drawn primarily from the textbook. They should be written up in full sentences and are held to the same standards as the writing portfolio (but are not re-submitted at the end of the semester).

Quizzes There are many things in the class that must simply be memorized. To enforce this, there will be a quick quiz at the beginning of every Wednesday meeting: 3 multiple-choice questions focusing *mostly* on recent terminology, limited to 5 minutes.

Exams There will be two in-class mid-term exams and a final. The second midterm is not cumulative (although the class does build on itself, so don't reviewing earlier content is helpful). The final is fully cumulative, with a bit more emphasis on material covered after the second midterm. The exam dates are:

- First Midterm: Monday, September 25,
- Second Midterm: Monday, November 6,
- Final Exam: **Monday, December 18 from 1:30pm until 4:15pm**.

Grade breakdown. For the final grade, assignments will be weighed as follows:

- Writing portfolio (weekly submissions): 10%,
- Writing portfolio (final submission): 10%,
- Homework: 10%,
- Quizzes: 10%,
- Two Midterms: 15% each,
- Final Exam: 30%.

Letter grades will be based on the usual breakdown (90-93.3 for A-, 93.4-96.6 for A, 96.7-100 for A+, etc). There will probably not be a curve.

Legalities and resources. Hopefully, everyone in the class will have a good time and learn a lot. The policies below exist to encourage these two goals.

Participation and attendance. Coming to class (both physically and mentally) is extremely important in this course for both the student and their team. Furthermore, students are expected to be courteous and attentive throughout the class. Students who do not actively participate will be marked absent. Disruptive students will be asked to leave.

Serial Absenteeism Clause. A student is allowed at most three unexcused absences from class. The instructor will decide what is an acceptable absence on a case-by-case basis, and all absences due to illness require a note from a health professional. For every unexcused absence beyond the third, **the student's final grade will be reduced by one letter grade**. For example, a student with four unexcused absences and a final grade of A will receive a B, and a student with a final grade of A and five unexcused absences will receive a C.

Groupwork vs. cheating. Groupwork is critical to the format of the class, and students are encouraged to work in groups on all homework. That said, all submitted work must be the student's own.

Any copying (especially verbatim) is unacceptable, and will result in a zero for the entire assignment. A second instance of cheating on homework will result in automatic failure of the course. Late homework will not be accepted, except in grave emergencies, and will count zero.

Conducive environment. A pleasant and accommodating environment for all students is critical for learning. In particular, the instructor is happy to provide individualized support during both reguarly scheduled and additional office hours; while the university provides support services for a variety of ongoing conditions and emergencies.

Any violations to the above standard are taken very seriously by the university. In particular, any cases of discrimination, harassment, or violence involving students are investigated by the Compliance Diversity and Ethics Office, and can lead to expulsion from the university and/or criminal charges.

Resources. The following groups exist to support student learning, with both academic and non-academic issues, so don't hesitate to contact them:

- Student Services Center: `https://www.gmu.edu/resources/students/`
- General Advising: `http://advising.gmu.edu/`
- Math Major: `http://math.gmu.edu/undergrad-student-resources.php`
- Disability Services: `http://ds.gmu.edu/`
- Counseling and Psychological Services: `https://caps.gmu.edu/`
- Compliance Diversity and Ethics Office: `https://diversity.gmu.edu`

Students are also welcome discuss their interests or bring up issues with the instructor during office hours. Such conversations are not necessarily confidential.
