As a discipline, mathematics can be divided into three main subject areas: analysis, algebra, and topology. (Caveat: not everyone would agree with this division.) The purpose of this course is to give you a rigorous grounding in the first of these areas. At the conclusion of this course, you will be well prepared to pursue graduate level studies in this subject.

Because this is an advanced course, one of my goals is to help you start working like a real mathematician. There are three basic skills you need to prosper in this (and many other) fields: one, the capacity to learn information independently from written sources, two, the capacity to express yourself clearly in writing, and three, the capacity to solve hard technical problems. In order to facilitate these goals, this course will have a “flipped” structure: all of the new material you will learn by reading the text outside of class, thus preserving class time for discussing concepts and working problems. The course will be extremely writing intensive, with a dual focus on both proof and expository writing. You will be held to very high standards for written work, but given multiple opportunities for revision. Finally, you will be expected to participate actively in class discussion and present solutions to homework exercises to your classmates. In other words, in this class, you will work exactly a real mathematician does!

Real analysis is a beautiful, rich, and exciting subject. This course will involve a lot of work, both on your end and on mine, but it will be an exciting journey, and one well worth the effort!

**Course Catalog Description:**

This course provides a rigorous study of calculus. The course begins with a study of the real numbers and then moves on to the core topics of limits, continuity, differentiation, integration, and series. In the first semester, the focus is on functions of one variable; in the second semester, the focus is on scalar- and vector-valued functions of several variables. Additional topics may include differential geometry of curves and surfaces or vector calculus.

**Specific Learning Goals:**

After successfully completing this course, you should be able to:

1. Write beautiful proofs.
2. Construct insightful peer reviews of your classmates’ work.
3. Use Latex effectively and comfortably.
4. Communicate mathematics effectively in both written and oral form.
5. Produce well-crafted expository articles on various mathematical themes.

**Required Text:**


The course will cover roughly the first five chapters of the text. Math 322 will cover Chapters 6-9, and Chapter 12.

**Other Requirements:**

- A three ring binder in which to keep your reading notes.

**Course Structure:**

The structure of this course will be unusual. As noted above, the course will be “flipped” in the sense that you will be responsible for reading the text outside of class, and should come to class prepared to discuss concepts, ask questions, and work problems rather than listen to lecture. (I will lecture upon request, but I anticipate that this will be seldom.) There will be no exams, but rather your grade will be based entirely upon the following elements:

- **Chapter notes:** for each chapter, you are expected to take notes on your reading of the text, and to store these notes in a three ring binder, which you will submit to me for inspection. I will provide detailed reading guides for each chapter, and these will help direct these notes.

- **Problem sets:** for each chapter, there will be one or two problem sets. All of the problems are to be written up “professionally”, subject to a revision process that we will discuss in class.

- **Typed problems:** for each problem set, you will be assigned one or two problems to type set. These typeset problems will be used as the basis for a class-generated solution key.

- **Papers:** there will be three expository papers that you need to write over the course of the semester. Each paper is to be typeset in Latex, and will involve peer reviews. Your peer reviewing work will form part of your grade for each paper.

Points will be assigned for these elements according to the following scheme:

<table>
<thead>
<tr>
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<th>points</th>
<th>breakdown</th>
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<tbody>
<tr>
<td>chapter notes</td>
<td>24-30</td>
<td>6 points each</td>
</tr>
<tr>
<td>problems sets (4-5 sets)</td>
<td>36-45</td>
<td>9 points each (includes editing).</td>
</tr>
<tr>
<td>typed problems</td>
<td>36-45</td>
<td>9 points each set (includes editing)</td>
</tr>
<tr>
<td>delta-epsilon paper</td>
<td>10</td>
<td>4 points referee reports, 6 point paper</td>
</tr>
<tr>
<td>Midterm paper</td>
<td>20</td>
<td>8 points referee reports, 12 points paper</td>
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<tr>
<td>Final paper</td>
<td>30</td>
<td>10 points referee reports, 20 points paper</td>
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<td><strong>total</strong></td>
<td>156-170</td>
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**Class Expectations:**

*Productive failure* is an idea that lies at the root of my philosophy to teaching (and life in general.) When you’re trying to learn something, never making a mistake is generally a sign that you’re not pushing yourself hard enough. This class should be a safe and supportive space in which to get things wrong. When talking or presenting, you are challenged to work slightly outside of your comfort zone, to volunteer answers when you have a pretty good idea but aren’t 100% certain, to risk a conjecture that might turn out to be off the mark. And when you are listening to fellow students talk, you are challenged to pay strict attention, to flag small errors of language or comprehension, and to politely and respectfully help guide one another towards a clearer and truer picture of the matter at hand. Failure is part of the design spec for this class, and it can be hard, but you will not be struggling alone.

Although the spirit of what I’m shooting for is probably clear, here is a minimalist list of concrete expectations:

- attend class daily
- do all assigned homework by the deadline
- do all assigned reading, in a timely fashion
- participate actively in class discussions and class group work activities
- volunteer to present solutions on the board
- volunteer answers to questions I pose, and to ask your own questions when you are confused, uncertain, or simply thinking outside the box
- be courteous and supportive of your fellow learners
- help create a classroom that is a supportive, energetic, respectful place to learn.

More broadly, my basic hope and expectation is that you will engage this class with enthusiasm, openness, and joy (it *is* fun), and help make this class a fun and supportive place in which to learn.

**Policies:**

*Attendance:*

Your daily attendance in class is very important, not just for your own benefit, but for that of your peers. I will take role every day and verify attendance. You are allowed to miss up to three days with no penalty. After three missed classes, two things happen: 1) every additional absence will reduce your grade by one level, 2) I reserve the right to drop you from the class.

*Late work:*

In this class, it is extremely important that everything be turned in by the deadline, since there is a complex system of peer reviews and mutual dependencies. I thus will not accept late work. (In the case of extreme emergency, talk to me, and we can probably make an exception.)

*Planned absences:*

If you need to be absent for some planned family or medical reason, you should contact me in advance. If an emergency arises, contact me as soon as possible after the emergency has passed. Student athletes who need to miss class for games should let me know of this as early as possible.

*Classroom policies:*
You are welcome to bring a cup of coffee or a bottle of water to class, but please eat your meals outside of class. Please turn off your phones and keep your laptops closed, unless we happen to be doing a computer exercise. You can take a bathroom break if necessary, but please make this the exception, not the rule—in general, I don’t want people entering and leaving the room during class.

**Academic integrity:**

It is your responsibility to understand the academic integrity policy of the university. You can find this policy in the Academic Handbook, and it is also available online at:


Not citing other people’s work, turning in the same work to satisfy two different classes, citing false information, or plagiarism are all violations of the academic integrity policy. Such violations are taken very seriously, and will be reported if discovered.

**Disabilities:**

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy Perno, Director of Student Accessibility and Accommodation, 105 Howarth Hall, 253-879-3395. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

**Classroom Emergency Response Guidance**

Please review university emergency preparedness and response procedures posted at www.pugetsound.edu/emergency/. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.