Math 280: Calculus III
Carl Toews
Fall, 2016

Basics

Where and when

Section A:
MWF, Thompson 171, 10:00-10:50
T, Thompson 383, 10:00-10:50 (reserve 9:30-10:00 for exams)

Section B:
MWF, Thompson 171, 11:00-11:50
T, Thompson 383, 11:00-10:50 (reserve 11:50-12:20 for exams)

Text
Calculus, 2nd Edition, by Jon Rogawski

Course Webpage
http://math.pugetsound.edu/~ctoews/teaching/fall16/calc3/

Contact Info
Office: Thompson Hall 390H
Phone: (253) 879-3839
Email: ctoews@pugetsound.edu
Hours: M 1:00-2:00, T 3:00-4:00, W 12:00-1:00, and by appointment.

Course Description

Welcome to Math 280, i.e. Calculus III! This course is the last installment in the three-course sequence that started with Math 180 and Math 181. While the focus in Math 180 and Math 181 was on functions of a single variable, the focus in this course will be on functions of two, three, or even more variables. As in the first two calculus courses, our ambition will be not just to acquire a solid technical foundation, but on learning to appreciate Calculus as a logical and aesthetic endeavor in its own right.

Broad learning goals for this course include the following:

• to understand certain core ideas in multivariate calculus
• to become proficient at the computational techniques that derive from these ideas
• to become fluent at communicating mathematics, both on paper and conversationally
• to learn how to independently investigate new and unfamiliar concepts
• to learn how to give and receive feedback on mathematical work gracefully

Course Catalog Description:

This course, a continuation of the calculus sequence that starts with MATH 180 and 181, is an introduction to the study of functions that have several variable inputs and/or outputs. The central ideas involving these functions are explored from the symbolic, the graphic, and the numeric points of view. Visualization and approximation, as well as local linearity continue as key themes in the course. Topics include vectors and the basic analytic geometry of three-space; the differential calculus of scalar-input, vector-output functions; the geometry of curves and surfaces; and the differential and integral calculus of vector-input, scalar-output functions.

Course Structure:

This class will be taught in an “Inquiry-Based Learning” (IBL) style, meaning that instead of allocating our class-time to lectures, we will use most of our time together to actively pose, debate, and answer questions
that get at the heart of the material we are trying to master. IBL emerges from the philosophy that learning works best when the learner discovers ideas rather than simply has them presented in finished form: to really understand a subject, the learner needs to think not just about how to solve problems, but also about how to pose, assess, and communicate them. In describing an IBL classroom, a colleague of mine noted that “Classrooms shouldn’t be places where young people come to watch old people work.” Our classroom won’t be. In this setting, my role as the professor is to help guide you towards productive discovery, and your job as the learner is to be curious, engaged, and communicative.

There are a number of ways to structure an IBL class, but salient features of this class will include the following:

- Hands-on activities instead of lecture
- An emphasis on group work
- Lots of dialogue and discussion
- Student presentations
- A supportive environment in which to take “risks”
- An emphasis on communication, both oral and written
- A need for trust and confidence, both student-student and student-professor

Perhaps unlike other math classes you have had, in this class you will gain your first exposure to new material by reading the text and working a few problems. This bears emphasizing: **every day before class, it is your job to read the relevant section in the text, and do the WeBWork problems that I assign for that day.** I do not expect you to understand every detail in the text, nor to get every WeBWork problem correct, but I expect you to make a good effort and to come to class prepared to engage meaningfully with me and with your peers, discussing the underlying concepts and working related (generally more difficult) problems. In general, our in-class time will start off with me giving a brief (10 minute) highlight of elements from the day’s section that I think are difficult or worth emphasizing, and then passing to group work, where you’ll discuss concepts and work problems. As the problems are completed, I’ll expect students to volunteer to write solutions on the board. By working through problems with your peers, and learning how to present solutions in a cogent manner, you will develop the technical and communicational skills needed to solve both calculus problems and problems from the broader world.

Productive failure is an idea that lies at the root of our approach. 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 with this IBL style class is probably clear, here is a minimalist list of concrete expectations:

- attend class daily
- do all assigned homework
- 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 the spirit of Inquiry Based Learning with enthusiasm, openness, and joy (it is fun), and help make this class a fun and supportive place in which to learn statistics.

**Course Activities**

1. **Daily Homework (WeBWork):**
   This class has both daily and weekly homework. The daily homework will be done via software called WeBWork, an open source mathematics problem library produced by the Mathematical Association of America (MAA.) Each of you will have an account on a server, and you will be able to access the day’s problems by logging in. (I will provide details on how to do this.) You will submit your solutions directly online. The deadline for submission will be 9 AM the day the homework is due.

   WeBWork gives you immediate feedback regarding whether or not your answer is correct, and you are free to try as many times as you like. Each problem is worth one point. At the end of the term, I will assign a score to your WeBWork performance based on my perception of how well you did and/or how hard you tried. You will get full credit for your WeBWork efforts if you get 80% or more of the problems correct. Lesser percentages can still yield good scores if it is clear that you did the work consistently and exercised a reasonable level of determination.

   A few comments: one, be prepared for a learning curve as you figure out how to type math into a computer. (Be patient, and see me if you get stuck.) Two, the purpose of these problems is for you to test your own understanding, and for me to see if the class understands the material. Accordingly, it makes absolutely no sense to cheat, i.e. to copy someone else’s answer without understanding. Three, by grappling with the book before you come to class, you both learn how to read technical material (a difficult but very worthwhile skill) and open up the possibility of grappling with more difficult (and thus more interesting) problems in class. Keep this in mind if these daily exercises ever seem odious.

2. **Weekly Homework:**
   While the purpose of the daily homework is to provide quick feedback on your understanding, the purpose of the weekly homework is to get practice writing up complete solutions in a way that is careful, complete, and stylistically polished. Each Tuesday you will have a set of problems to turn in. These problems will form the basis of the quiz that I assign that Tuesday (see below.) Many, but not all, of the problems will have been worked in class as part of our daily routine, and so you will have seen solutions to these problems. But the solutions that you turn in should not be cribbed verbatim from chalkboard notes; instead, they should be carefully explained and written up in a way that is “self-contained”, i.e. the reader should understand both the problem and your solution based only on what you submit.

   Each weekly homework assignment will be graded by a grader. The grader will assign a point value in the 0-3 range, based on the following criteria:

   **Weekly Homework Grade:**
   3 All problems were attempted. Work is mostly correct and complete. Anotations were added where needed and/or appropriate.
   2 Either not all problems were attempted, or the attempts were noticeably weak, and annotations were lackadisical.
   1 Work is enduringly and egregiously weak, and annotations conspicuously absent.
   0 Worse than any of the above

   Weekly homework may not be turned in late. At the end of the term, I will drop the lowest weekly homework score.

3. **Quizzes:**
   Every Tuesday there will be a quiz that covers the material of the previous week. In general, the quizzes are designed to be relatively straightforward extensions of the homework: if you complete and understand the homework, you should do adequately on the quizzes. Quizzes will be graded on a scale from 0 to 10 points, and I will drop the lowest quiz score at the end of the term. Do note that I do
not allow make-up quizzes: the dropped quizzes is designed to accommodate necessary absences on Tuesdays (e.g. sporting events, death or illness, etc.) If for some reason your semester is especially ridden with death and horrible illnesses and you need to miss a lot of quizzes, talk to me.

4. Exams:
I intend to administer two exams during the course of the semester, spaced at roughly equal intervals. The exams will heavily leverage work you’ve done on the homework and quizzes, i.e. about 80% of the material should be directly analogous. The remaining 20% will consist of conceptual questions or other extensions of the theory.

5. Final Exam:
There will be an in-class, closed book, technology-free final exam during the regularly scheduled final exam period. For Section A, the final is Friday, December 16, 8:00-10:00 a.m., and for Section B, the final is Monday, December 12, 12:00-2:00 p.m.,

6. Attendance and Participation:
You learn mathematics by doing and discussing mathematics, not by having a teacher tell you how to do it. Active participation in this course is imperative.

There are several ways to be actively involved. The simplest is to attend my class sessions. I will take roll, and your presence (or absence) will be noted. Much of the time we spend in class will be devoted to student presentations of homework solutions. If you don’t know the solve something, not a big deal, but if weeks go by and you haven’t opened your mouth, either to present, to comment on someone else’s presentation, or to ask a question, you’re doing something wrong.

Your final participation grade will be a number between 0 and 10, according to the following rough rubric:

**Participation Grade:**

10 Student is always present (may miss up to two class sessions), always actively engaged, an exceptional contributor to the class environment. Student has contributed considerably more than the average number of solution presentations, and the quality of these presentations is very high.

9 Student is almost always present (may miss up to three class sessions), pays attention, asks questions, and contributes to the life of the group. Student has an average or slightly above average number of solution presentations, and the quality is high, though not necessarily exceptional.

8 Student is mostly present (may miss up to four class sessions), pays attentions but doesn’t necessarily volunteer comments, works well in a group but is not necessarily a major contributor. Student has an average number of presentations.

... extrapolate on down...

I will ask you to provide me a self-evaluation of your participation half-way through the semester, and again at the end.

**Grading**

Your final grade will be based on your performance in the various class activities. For each activity, you will be assigned a percentage, and your final grade will be a weighted average of these percentages, with the weights allocated as follows:

**Grade Weighting**
Participation 10%
Daily Homework (WeBWork) 10%
Weekly Homework 10%
Quizzes 10%
Exams 40%
Final Exam 20%

The final grading scale is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt; 93.3</td>
</tr>
<tr>
<td>A-</td>
<td>90.0 - 93.3</td>
</tr>
<tr>
<td>B+</td>
<td>86.6 - 89.9</td>
</tr>
<tr>
<td>B</td>
<td>83.3 - 86.6</td>
</tr>
<tr>
<td>B-</td>
<td>80.0 - 83.3</td>
</tr>
<tr>
<td>C+</td>
<td>76.6 - 79.9</td>
</tr>
<tr>
<td>C</td>
<td>70.0 - 73.3</td>
</tr>
<tr>
<td>C-</td>
<td>66.6 - 69.9</td>
</tr>
<tr>
<td>D+</td>
<td>63.3 - 66.6</td>
</tr>
<tr>
<td>D</td>
<td>60.0 - 63.3</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 59.9</td>
</tr>
</tbody>
</table>

**Topic List (Provisional):**

The course essentially consists of Chapters 12-17 in the text. Broadly, the subjects and timeline are as follows:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Vector Geometry</td>
<td>12</td>
</tr>
<tr>
<td>3-4</td>
<td>Calculus of Vector Valued Functions</td>
<td>13</td>
</tr>
<tr>
<td>5-6</td>
<td>Differentiation in Several Variables</td>
<td>14</td>
</tr>
<tr>
<td>7-8</td>
<td>Multiple Integration</td>
<td>15</td>
</tr>
<tr>
<td>9-10</td>
<td>Line and Surface Integrals</td>
<td>16</td>
</tr>
<tr>
<td>11-12</td>
<td>Fundamental Theorems of Vector Analysis</td>
<td>17</td>
</tr>
</tbody>
</table>

This schedule and these topics are flexible, however, and I may occasionally change the order of the material if I feel there is a good reason for doing so. The material definitely gets harder as the course advances, so it is likely we’ll try to push quickly through the early topics so as to have more time for the later ones. A detailed class calendar, as well as class notes, will updated daily on the class webpage.

**Important Dates:**

Tuesday, September 6: Last day to add a course, and last day to exercise P/F option.
Monday, September 12: Last day to drop a course without record
Friday, November 4: Last day to drop a course with an automatic W.

**Policies**

1. **Attendance:**
   
   Built into the philosophy of inquiry-based learning is the idea that we help one another to learn. As a consequence, 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. Your attendance will play a role in determining your participation grade. I reserve the right to drop you from the class if your absences are excessive.

2. **Late Work:**
   
   I do not generally accept late work. I drop the lowest homework and quiz scores as a way of accommodating the fact that once in a while everyone gets sick and needs to be absent. If life is especially brutal to you this term and you need to miss more than one quiz or homework for legitimate reasons, talk to me, and we can discuss equitable solutions.
3. **Planned Absences:**
   If you need to be absent for some family or medical emergency, you should contact me in advance (if possible) or as soon as possible after the emergency. The same goes for student athletes who need to miss class for games.

4. **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.

5. **Missed Exams:**
   If you need to miss an exam, clear it with me in advance. There are not many valid excuses for missing exams (death is one; there may be others.)

6. **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: [http://www.pugetsound.edu/student-life/student-resources/student-handbook/academic-handbook/academic-integrity/](http://www.pugetsound.edu/student-life/student-resources/student-handbook/academic-handbook/academic-integrity/). 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.
Appendix A: Emergency Response

Please review university emergency preparedness and response procedures posted at [www.pugetsound.edu/emergency](http://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.

Appendix B: Accommodations

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