Multivariate Calculus Instructor: Martin Jackson
MATH 280B Office: Thompson 602
Fall 2011 Phone: 879-3567
MF 10:00–10:50 Thompson 383 E-mail: martinj@ups.edu
TT 9:30–10:20 Thompson 383

Course Overview This course is the third in our three-semester calculus sequence. The central theme of this course is extending the basic concepts of calculus to higher dimensions. In the first two semesters of the calculus sequence, the primary objects of interest are functions for which each input is a single real number and each output is also a single real number. Multivariate calculus concerns functions for which each input or output can be an ordered pair or triple (or, generally, n-tuple) of real numbers. In some contexts, we will find it useful to think of the inputs or outputs as *vectors*. Broad goals for this course are

- to understand the relevant concepts of calculus;
- to develop facility with the computational techniques of calculus;
- to explore applications of calculus;
- to gain proficiency in reading and writing mathematical exposition; and
- to sharpen critical thinking and logical reasoning skills.

Class sessions In class, we will discuss new material, handle questions from reading the text, and work through assigned problems on which there are difficulties. When we discuss new material, the focus will be on "the big picture." That is, we will look at new ideas in their simplest form and how these ideas fit together. Often, we will not consider details and variations in depth during a first pass through new material. Your mastery of the details will begin outside of class with a careful reading of the text and work on the assigned problems. We will address the details by responding to questions on the reading and problems that you bring to class. You are expected to participate in class by being present (and alert), by responding to questions I pose, and by asking the questions that you have. I will often ask for ideas on how to proceed on a given problem or in developing a new concept. You should develop the habit of contributing ideas even if you are not confident your idea will work out.

Text The text for this course is *University Calculus*, Joel Hass, Maurice Weir, and George Thomas, (Pearson, 2007). We will cover material from Chapters 9 through 14. Outside of class, you should carefully read the relevant sections of the text. This will generally include working through the reasoning of arguments and filling in steps that are omitted in calculations. You should keep a list of specific questions from the reading and find answers to those questions in class, with me outside of class, with study partners, or with a tutor.

Homework The text is also a source of problems that are essential in building understanding and skill. I will assign homework problems from the textbook on which I expect you to spend considerable time and effort. We'll begin most class sessions by addressing questions from assigned homework and reading. For most text sections, I will designate a homework problem or two to be submitted for grading. For full credit, the work you submit for these homework problems should be complete, clear, correct, and organized.

In doing homework problems, you should seek to go beyond mastering mechanical aspects (such as computational skills) to mastering concepts and ideas. For example, in

doing homework problems, ask yourself "Do I understand the ideas and skills required to get a correct answer?" rather than merely "Did I get the correct answer?"

Projects   Projects are a second type of assignment to be completed outside of class. The purpose of projects is to present challenges, often open-ended, that go beyond the routine of homework problems and to provide practice in technical writing. For each project, you will compose a written report. This should be done in complete sentences with enough detail for a reader to follow your reasoning and reconstruct your work. All graphs should be done on graph paper or with appropriate computer assistance. I encourage you to work on these projects in small groups. If you do work on a project with others, you must do your own write-up of the results.

We'll start with a writing exercise so you can get some practice and feedback on mathematical writing.

Due date policy   Each problem set and project will have a due date. If you wish to turn an assignment in late, you must talk with me before the due date. Under reasonable circumstances, I will grant individual extensions for deadlines. If you submit an assignment after a deadline (or an extension we have agreed upon), I will assess a penalty equal to 10% of the assignment's maximum point value for each working day that the assignment is late.

Exams   In order to assess your learning, we will have four exams. The date for each exam will be given at least one week in advance. The fourth exam will be during the final exam period scheduled for this course: 8–10 am on Wednesday, December 14. Be sure that your travel arrangements do not conflict with this scheduled exam time.

I design exams so that approximately three-fourths of each exam is "straightforward" and the remainder involves more challenging problems. By this, I intend that a well-prepared student can do the "straightforward" problems without hesitation. These problems may be similar to assigned homework problems. The more challenging problems will involve applying, generalizing, or synthesizing relevant ideas. For the challenging problems, I give some credit for identifying ideas that might reasonably be useful and for reasonable approaches even if not complete.

Course grades   To determine your course grade, I will drop your lowest two homework problem scores and then calculate an overall homework percentage. If this homework percentage is greater than the lowest of your exam percentages, your lowest exam percentage will be replaced by the average of that percentage and your homework percentage. (If not, homework will play no direct role in your course grade.) I will then calculate a total course score with projects weighted at 15% and exams weighted at 85%. I assign a preliminary course grade based on an objective standard (93.3-100% for an A, 90.0-93.2% for an A–, 86.7-89.9% for a B+, 83.3-86.6% for a B, etc.). I then look at each student's performance subjectively. Occasionally I will assign a course grade that is higher than the objective standard. For example, if a student has a grade of B according to the objective standard but has shown steady improvement, I might assign a course grade of B+.

Computing technology   You will often find it useful to have a calculator (or equivalent technology) with the following capabilities: function graphing, numerical equation solving, numerical differentiation, and numerical integration. Many brands have suitable models. I am most familiar with Texas Instrument calculators. Among Texas Instrument calculators, the TI-83, TI-84, TI-86, and TI-89 models have appropriate features. Note that

for some exams, I may forbid the use of symbolic computing features on calculators such as the TI-89.

Many graphing calculators are limited to two-dimensional plots. We will often want to look at three-dimensional plots and for these we will turn to other computing technology. Throughout the course, we will look at some options available for making three-dimensional plots.

Course web site A web site for this course is located at

math.pugetsound.edu/~martinj/courses/fall2011/m280/m280.html

(or go to math.pugetsound.edu/~martinj and follow the obvious links.) On the course web site, I will maintain a list of assignments and due dates along with a list of daily topics and relevant sections of the text. I will also post announcements and comments about questions or issues that come up in class. You should check the web site for new announcements several times each week. Class handouts distributed in class will be available to download as PDF files in case you lose your copy or miss class. Other handouts will be available only on the course web site.

Office hours and appointments I am generally available in my office for help several hours each day. I am often in my office during the day in hours at which I do not have a scheduled class, meeting, or other activity. You can see my weekly schedule at

math.pugetsound.edu/~martinj/schedule.html

Feel free to come look for me. To be (almost) guaranteed that I will be in, come during one of the hours labeled as an "office hour." You can also call, send e-mail, or stop me after class to schedule an appointment for a specific time.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am	Math 280A TH 383		Research		Math 280A TH 383
8:30 am		Math 280A TH 383		Math 280A TH 383	
9:00 am	Office Hour				Office Hour
9:30 am		Math 280B TH 383		Math 280B TH 383	
10:00 am	Math 280B TH 383				Math 280B TH 383
10:30 am					
11:00 am	Math 302A TH 374	Math 302A TH 374		Math 302A TH 374	Math 302A TH 374
11:30 am					
Noon	Exercise and Lunch	Lunch	Exercise and Lunch	Lunch	Exercise and Lunch
12:30 pm		Office Hour		Office Hour	
1:00 pm					
1:30 pm					
2:00 pm	Research				
2:30 pm					
3:00 pm					
3:30 pm					
4:00 pm	Departmental meeting or seminar			Math & Science Seminar	
4:30 pm					
5:00 pm					

Tentative course schedule

MONDAY		TUESDAY		THURSDAY		FRIDAY	
Aug 29	**1**	Aug 30	**2**	Sep 1	**3**	Sep 2	**4**
Sep 5 Labor Day		Sep 6 *Last day to add*	**5**	Sep 8	**6**	Sep 9	**7**
Sep 12 *Last day to drop w/o record*	**8**	Sep 13	**9**	Sep 15 Exam #1 (9:30-10:50)	**10**	Sep 16	**11**
Sep 19	**12**	Sep 20	**13**	Sep 22	**14**	Sep 23	**15**
Sep 26	**16**	Sep 27	**17**	Sep 29	**18**	Sep 30 Writing exercise due	**19**
Oct 3	**20**	Oct 4	**21**	Oct 6	**22**	Oct 7	**23**
Oct 10 *Last day to drop w/ automatic W*	**24**	Oct 11	**25**	Oct 13 Exam #2 (9:30-10:50)	**26**	Oct 14	**27**
Oct 17 Fall Break		Oct 18 Fall Break		Oct 20	**28**	Oct 21	**29**
Oct 24	**30**	Oct 25	**31**	Oct 27	**32**	Oct 28 Project #1 due	**33**
Oct 31	**34**	Nov 1	**35**	Nov 3	**36**	Nov 4	**37**
Nov 7	**38**	Nov 8	**39**	Nov 10 Exam #3 (9:30-10:50)	**40**	Nov 11	**41**
Nov 14	**42**	Nov 15	**43**	Nov 17	**44**	Nov 18	**45**
Nov 21	**46**	Nov 22	**47**	Nov 24 Thanksgiving Break		Nov 25 Thanksgiving Break	
Nov 28	**48**	Nov 29 Project #2 due	**49**	Dec 1	**50**	Dec 2	**51**
Dec 5	**52**	Dec 6	**53**	Dec 8 Reading Period		Dec 9 Reading Period	

Exam #4: Wednesday December 14, 8-10 am

Note that University policy mandates a grade of WF if you drop a course after Monday, October 10 unless "there have been exceptional circumstances beyond the student's control and the student's work has been of passing quality." For full details, see the Academic Handbook (available on-line).