Math 126BA–BD **Calculus With Analytic Geometry III** **Spring 1995**

COURSE DESCRIPTION

Lectures: M,W,F 10:30–11:20
Smith 205

Professor: **John M. Lee**
Office: Padelford C-546
Phone: 543-1735
E-mail: `lee@math.washington.edu`
Office Hours: Mon. & Wed. 11:30–12:30 or by appointment

TA's: **Andreas Wiegmann**
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Office Hours: to be announced

Quiz Sections: 126BA: T,Th 10:30–11:20, Chemistry Library Bldg. 021 (Wiegmann)
126BB: T,Th 10:30–11:20, Physics-Astronomy Bldg. A118 (Moskowitz)
126BC: T,Th 11:30–12:20, Chemistry Library Bldg. 019 (Wiegmann)
126BD: T,Th 11:30–12:20, Anderson Hall 223 (Moskowitz)

Study Center: Communications B14

Mon–Wed:	9:30am–9:30pm
Thurs:	9:30am–5:30pm
Friday:	9:30am–1:30pm
Sunday:	2:00pm–6:00pm

Required texts: [LN] C. R. Curjel, *Lecture Notes "Multivariable Calculus"*, Department of Mathematics, University of Washington, 1994. Available at Professional Copy 'n' Print, 4200 University Way NE (634-2689).

[EMVC] C. R. Curjel, *Exercises in Multivariable and Vector Calculus*, McGraw-Hill, 1990. Available at the University Bookstore.

Equipment: A transparent ruler with metric scale will be required for many homework assignments, tests, and quizzes. You can purchase one in the bookstore. *Be sure to bring your ruler and your textbooks to every lecture and section meeting.*

Prerequisite: Math 124 and 125, or equivalent.

COURSE OVERVIEW

This is an introductory course in multivariable calculus. So far, your study of calculus has concentrated on the study of one function of one variable $y = f(x)$, which can be graphed in the plane. In this course, you will study functions with two or three dependent variables, such as $(x, y, z) = (x(t), y(t), z(t))$ (which describes a curve in space), or two or three independent variables, such as $z = f(x, y)$ (which describes a surface in space). Such functions are much more common in real-world applications of calculus that functions of one variable; they are needed to represent, for example, the path of a baseball as a function of time, or the altitude at a point in Seattle as a function of its map coordinates. You will learn how to interpret such functions geometrically, using vectors; and you will learn how to use calculus to solve such problems as finding the maximum and minimum values of temperature in a sheet of metal, or determining in what direction the altitude is increasing or decreasing fastest at a given point in Seattle. Because most of the action is taking place in 3-dimensional space, you will have to learn new ways to think geometrically and to interpret graphs.

REGISTRATION INFORMATION

As of the first day of the quarter, Math 126B is full. No entry codes will be given; the only way to get in is by registering through STAR when space becomes available. Don't give up hope yet: there are always a number of spaces that open up during the first few weeks. Although there are no guarantees, past experience shows that most people who want to take the course eventually get in.

If you want to change sections, you must do it officially through STAR.

REQUIREMENTS

Homework: All the homework for this course will be taken from the texts [LN] and [EMVC]. *You are responsible for all the text and all the problems in* [LN]. Some problems will be collected and graded: a problem set will be announced each Thursday in section (except during the weeks immediately preceding exams), and will be due *at the beginning* of the quiz section the following Thursday. Late homework will not be accepted.

The problems are the heart of this course. Some homework problems will show up on the quizzes and exams. Don't fall into the trap of thinking you can make it through this course without keeping up with the homework, or without attending quiz sections. Doing problems daily is like exercising your brain, and trying to absorb all the material for this course in the week before the exam is like trying to prepare for the Olympics by working out 18 hours a day for a week.

Many of the homework problems will be rather long. Often you will look at a problem and not know what to do right away. This may be unnerving for some of you who have generally found mathematics easy up to now. Once you get past the first quarter or two of calculus, most new mathematical ideas will require a period of adjustment during which you feel as if you just don't understand what's going on. Don't be discouraged: this experience can be frustrating, but it can also bring much deeper rewards when you do understand. One of the things this course will try to help you learn is how to approach a complicated multi-step problem by breaking it down into its component steps and solving it step by step.

Since this is a 5-credit course, and the University's expectation is that each credit represents three hours per week of student effort on the average, the workload for this course is designed under the assumption that you will spend an average total of 15 hours per week on this course. This means that most of you will have to spend *an average of two hours outside of class* on this course, every day, five days a week. On some days, some of you will have to spend considerably more than two hours.

Because of budget limitations, only two problems will be graded on each homework assignment; when you turn in the homework you won't know which two they will be. Each homework set is worth 4 points, and will be graded as follows. The grader will give each of the two selected problems a score of 0, 1, or 2, as follows:

- If you have not done the selected problem, or if you copy exactly what is in the answer sections in the back of [LN] or [EMVC], you get 0 points.
- If you show a few intermediate steps of the computations or reproduce a graphical answer by hand, you get one point.
- If you reproduce the drawing by hand, or produce one of your own, work out all steps of the answer, and explain them in complete sentences in such a way that a fellow student would understand, you get 2 points. (Use short, simple sentences. Bulk alone will not get you points.)

Quizzes: There will be six quizzes given in section, on the dates listed on the last page of this Course Description. Each quiz will consist of one or two short questions, based on material from the lectures, reading, sections, and homework over the past week. No makeup quizzes will be given.

The first quiz (Thursday, March 30) will contain one review question on material from Math 124, requiring you to use the chain rule and interpret graphs. This question will illustrate the type of thinking and analysis you will have to do during this course, and should help you decide whether you are ready for it or not. See the sample question for Quiz #1 below for more information. Scores from the first quiz will be available in Friday's lecture, and will be posted on your TA's office door the same day at 8AM. You may still drop the course without charge through Friday, March 31.

The Proficiency Quiz: Most of the emphasis in this course is on learning to *think* about calculus problems, and to understand the geometric and algebraic concepts that underlie them. But it is important also that you achieve a certain level of proficiency in plain old computations with formulas. The Proficiency Quiz is designed to allow you to demonstrate that you have done so. You have three tries to pass it: Thursday, May 4, Thursday, May 18, and Thursday May 25 (in quiz sections). If you pass it, you do not have to take it again, and nothing happens to your course grade. If you have not passed it by the third try, your final course grade will be lowered by 0.3. The details will be explained after Test 1. You will be given sample tests to practice.

Midterm Tests: There will be two midterm tests; their dates are on the last page of the Course Description. Each midterm will consist of 5 problems, very much like some of the harder problems you'll be doing in your homework and quizzes. No makeups will be given for midterm tests.

Final Exam: The final exam for all sections and all lectures of Math 126 will be given on the Common Finals Day, Saturday, June 3, at 1:30 PM. *Note that this is NOT the final exam time listed in the Time Schedule.* The exam will consist of eight problems, covering material from the entire quarter, with some extra emphasis on the last third of the course. Each problem will be comparable in difficulty to the problems on the midterm tests.

Students who cannot take the final exam for religious reasons should immediately petition to make alternative arrangements. Petition forms are available in the Mathematics Advising Office, Padelford C-36. The petition has to be filed by Friday, April 21. **Other than for religious reasons no exceptions will be made to this examination time.** If you are unable to take the final examination for reasons of health, you must call the Mathematics Advising Office before the final, and you will have to provide a written medical excuse.

SOURCES OF HELP:

In addition to lectures and sections, there are three other sources of help with this course that you should consider utilizing:

1. *Office hours*: Professor Lee and both TA's have regular office hours each week, and we welcome you to come ask us questions. Often getting a few minutes of personal help will be just what you need to get through a difficult point.
2. *Math Study Center:* Located in B14 Communications, one floor below Arts & Sciences Advising, the Math Study Center is a great place for students to work on math, whether or not they need help. It provides a comfortable place and a supportive atmosphere for students to come together and study, in groups or individually, and has a number of tutors on staff. The schedule is printed on the front of this Course Description.
3. *Math 187:* This is an optional computer lab that can be taken in conjunction with Math 126. It gives you an opportunity to get 'hands-on' experience manipulating graphs of the two- and three-dimensional objects we'll be studying in this course, and is highly recommended.

GRADES:

Your grade will be based on the following scores:

6 homework assignments	(4 points each)	24 points
6 quizzes	(4 points each)	24 points
2 midterm tests	(100 points each)	200 points
1 final exam		200 points
TOTAL:		448 points maximum

Let T be the sum of your homework scores, quiz scores, midterm test scores, and final exam score. Your course grade $G(T)$ is given by the following formula, with rounding off to the next *lower* decimal:

$$G(T) = \begin{cases} 4.0 & \text{if } T \geq 403; \\ (0.0149)T - 2.0 & \text{if } 202 \leq T \leq 402; \\ 0 & \text{if } T \leq 201. \end{cases}$$

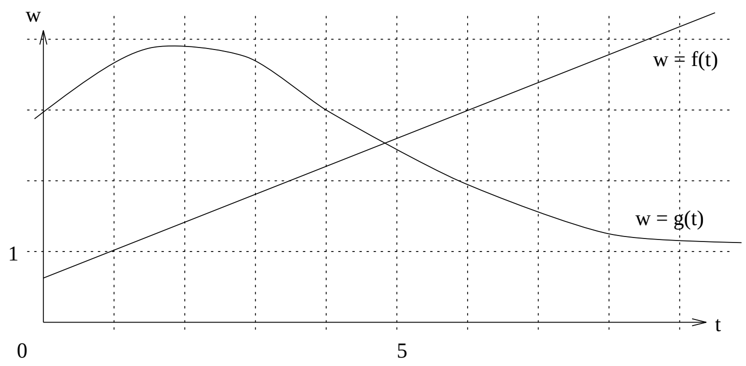
SAMPLE QUESTIONS FOR QUIZ #1

The first quiz, on Thursday, March 30, will contain one question on new material and one review question on material from Math 124. Here are sample questions to help you prepare for the review question.

The two functions $w = f(t)$ and $w = g(t)$ are given by their graphs below. We define a new function $H(x)$ by $H(x) = f(g(x))$. Use ruler and pencil to answer the following questions. For such questions there is always a range of correct answers. Draw and measure as well as you can, *and show your work.*

On all quizzes, straight lines must be drawn with a ruler. No credit is given if drawn by hand.

1. Find $H(2)$.
2. Find $H'(3)$.
3. Find x so that $H(x) = 1.5$.
4. Find x so that $H'(x) = 0.2$.



Solutions:

1. $H(2) = f(g(2)) = f(3.9) = 2.2$;
2. $H'(3) = f'(g(3))g'(3) = 0.4 \cdot -\frac{5}{12} = -0.17$;
3. $H(x) = f(g(x)) = 1.5$ means $g(x) = 2.2$, $x = 5.6$;
4. $H'(x) = f'(g(x))g'(x) = 0.2$ means $0.4 \cdot g'(x) = 0.2$, $x = 1.1$.

ELECTRONIC COMMUNICATION

If you need to get in touch with Professor Lee or your TA for any reason, you're encouraged to contact us by electronic mail; our e-mail addresses are on the first page of the course description. In addition, there is a World-Wide Web site for Math 126, which will contain copies of this course description, homework assignments, all handouts given in lecture and sections, quizzes, tests, solution sets, and general announcements about the course. To view the Web site, start up a Web browser such as Netscape or Mosaic, and open the following URL:

`http://www.math.washington.edu/~lee/Courses/126`

Alternatively, from the University of Washington Home Page, you can click on the following links in sequence:

- **UW Links**
- **Mathematics**
- **Current Class Information**
- **Professor Lee's math126 class.**

If you need help using a Web browser, ask any consultant at one of the Computing and Communications computer labs.

SCHEDULE OF QUIZZES, TESTS, AND EXAMS

Quiz 1	Thursday, March 30	in section
Quiz 2	Tuesday, April 11	in section
Midterm Test 1	Wednesday, April 19	10:30–11:20 in Smith 205
Quiz 3	Tuesday, April 25	in section
Quiz 4	Tuesday, May 2	in section
Midterm Test 2	Monday, May 8	10:30–11:20 in Smith 205
Quiz 5	Tuesday, May 16	in section
Quiz 6	Tuesday, May 23	in section
Final Exam	Saturday, June 3	1:30–4:20 (room to be announced)