Math 126 **Calculus With Analytic Geometry III** **Fall 1995**

COURSE DESCRIPTION

ADMINISTRATIVE INFORMATION

Lectures: Math 126A: MWF 9:30–10:20, Bagley 154
Math 126B: MWF 10:30–11:20, Anderson 223

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

TA's: **Angela Pasquale**
E-mail: `pasquale@math.washington.edu`
Office Hours: Mon 2:00–3:00 (Study Ctr), Wed 3:00–4:00 (Study Ctr)

Jian Huang
E-mail: `jhuang@math.washington.edu`
Office Hours: Tue 1:30–3:30 (Padelford C-8-K)

Walt Pohl
E-mail: `pohl@math.washington.edu`
Office Hours: Wed 9:30–10:30 (Study Ctr), Tue 12:30–1:30 (Study Ctr)

Anna Burago
E-mail: `burago@math.washington.edu`
Office Hours: Mon 1:00–2:00 (Study Ctr), Wed 1:00–2:00 (Padelford C-8-K)

Sections:
126AA: T,Th 9:30–10:20, Chemistry Library Bldg. 019 (Pasquale)
126AB: T,Th 9:30–10:20, Johnson 437 (Huang)
126AC: T,Th 10:30–11:20, Architecture 021 (Pasquale)
126AD: T,Th 10:30–11:20, Savery 127 (Huang)
126BA: T,Th 10:30–11:20, Johnson 119 (Pohl)
126BB: T,Th 10:30–11:20, Thomson 235 (Burago)
126BC: T,Th 11:30–12:20, Savery 127 (Pohl)
126BD: T,Th 11:30–12:20, Smith 318 (Burago)

Study Center: Communications B14
Monday–Thursday: 9:30am–9:30pm
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 homework assignments, quizzes, and exams. You can purchase one in the bookstore. *Be sure to bring your ruler and* [LN] *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).

REGISTRATION INFORMATION

All the sections of Math 126 are full. If you are not currently enrolled, the only way to get in is by registering through STAR when space becomes available because someone has dropped the course; no entry codes will be given. Although there are no guarantees, it is likely that most people who want to take the course will eventually get into one of the sections attached to the 10:30 lecture. The 9:30 lectures, however, are likely to remain full because the lecture hall is smaller.

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

REQUIREMENTS

Homework: The homework will consist of problems from [LN] and [EMVC], with a few supplementary problems provided by the lecturer. These problems are the heart and soul of this course. You will notice that the problems in [LN] are of two types: some are integrated in the text, to provide examples and practice problems to do during lecture, section, or your reading; others are grouped at the end of each chapter. Your written homework will consist of all the end-of-chapter problems in the lecture notes. Each Tuesday during section, the problems on the material covered during the preceding week will be collected for grading. (See the schedule at the end of this course description for the list of problems due each week.) Late homework will not be accepted.

The homework assignments will be graded as follows: each problem for which you write up a complete solution earns one point (this means drawing a picture if appropriate, and writing out all steps of the answer in full sentences, complete with justifications; just writing the problem and copying the answer from the back of the book is not sufficient). In addition, one problem will be chosen each week for careful grading: depending on whether your work on that problem is correct, you will receive up to 10 additional points. You won't know in advance which problem will be graded.

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 a day 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.

The best way to be sure you get the most out of your homework is to work with others. I strongly urge you to form a study group and work collaboratively on the homework problems. This way you'll learn more, and you'll maximize your chances of getting all the problems correct. The only limitation on collaboration is that, after you and your study group have worked out how to do the problems, you must each write up your own solutions in your own words.

Quizzes: There will be a short quiz in section every Thursday, covering the material from approximately the preceding week and a half. Each quiz will consist of one or two short questions, usually very similar or even identical to ones you've done for homework. Only your top 7 quiz scores (out of a total of 10) will count in your final grade. No makeup quizzes will be given.

The first quiz (Thursday, September 28) will consist of review questions 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 in Math 126, and should help you decide whether you are ready for this course or not. See "Sample Questions for Quiz #1" below for more information. Scores from the first quiz will be available in your section meetings on Tuesday, October 3. You may still drop the course without charge through October 3.

Midterm Exam: There will be one midterm exam, given in lecture on Monday, October 30. The midterm will consist of four or five problems, very much like some of the harder problems you'll be doing in your homework and quizzes. No makeups will be given for the midterm.

Final Exam: The final exam for all sections of Math 126 will be given on the Math Common Finals Day, Saturday, December 9, 1:30–4:20 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 extra emphasis on the last half of the course. Each problem will be comparable in difficulty to the problems on the midterm.

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, October 27. **Other than for religious reasons, no exceptions will be made to the 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. If extraordinary circumstances of grave personal import preclude taking the final exam at the scheduled time, students who file petitions accompanied by the appropriate written documentation, by the deadline, may be granted permission to take a makeup final exam. Approval of such petitions is by no means automatic. Plans for sporting events, travel or work on exam day, etc. do not constitute extraordinary circumstances.

SOURCES OF HELP

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

- *Office hours*: Professor Lee and all of the TA's have regular office hours each week, and we welcome you to come ask us questions.
- *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, or for study groups to meet, whether or not they need help. The schedule is printed on the front of this Course Description.
- *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 two- and three-dimensional objects.
- *Mars:* This is an experimental interactive on-line computer service, accessible from the Math 126 web page, which will contain supplementary texts and interactive worksheets for Math 126. See "Electronic Communication," below.
- *Sample tests:* In addition to the sample tests in your lecture notes, reprints of Math 126 exams from 1993–1994 can be purchased from Professional Copy 'n' Print, 4200 University Way NE (634-2689). Also, exams from last Spring's Math 126 course are available from the Math 126 web site (see "Electronic Communication," below).

ELECTRONIC COMMUNICATION

E-mail: If you need to get in touch with Professor Lee or your TA for any reason, the best and fastest way to contact us is by electronic mail. Our e-mail addresses are listed on the first page of the course description.

World-Wide Web: There is a web site for Math 126, which will contain copies of this course description, homework assignments, handouts, quizzes, exams, solution sets, and general announcements about the course. It will also contain a link to *Mars*, an experimental interactive web server, described below. To visit the web site, start up a web browser such as Netscape, Mosaic, or Lynx, 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 → Math 126.

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

Mars: Mars (The MAthematics Research/education Server) is an experimental interactive MOO (Multi-user, Object-Oriented) server connected to the World-Wide Web. It is being set up and maintained by Mathematics graduate student Michael Brundage. Mars will be accessible from the Math 126 web page, and will contain supplementary texts and interactive worksheets for Math 126, as well as an interactive "bulletin board" for students in the course to communicate with each other.

GRADES

Your grade will be based on a weighted average of the following scores. Roughly speaking, an overall score of 90% will get you a 4.0, 45% a 1.0, and grades in between will be linearly interpolated. Any grade below 1.0 will be considered failing.

10%	Homework assignments
15%	Quizzes (only your best 7 scores count)
25%	Midterm exam
50%	Final exam

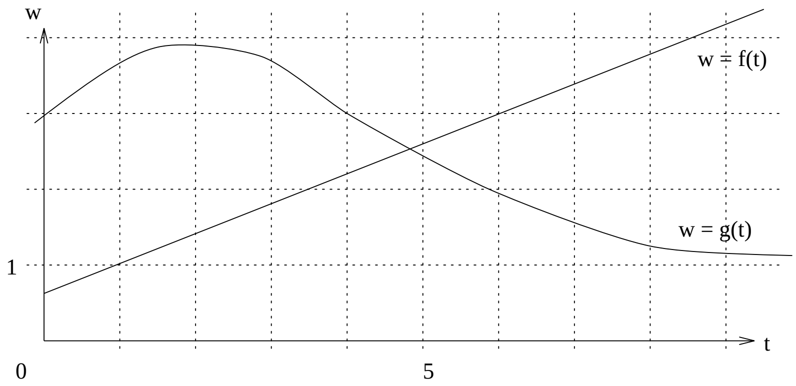
SAMPLE QUESTIONS FOR QUIZ #1

The first quiz, on Thursday, September 28, will consist of two review questions on material from Math 124. Here are sample questions to help you prepare. There will be time to discuss these sample questions in your section meeting on Thursday before the quiz.

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 $g(x) = 2.2$, so $x = 5.6$;
4. $H'(x) = f'(g(x))\, g'(x) = 0.2$ means $(0.4) \cdot g'(x) = 0.2$, so $x = 1.1$.

MATH 126 COURSE SCHEDULE **FALL 1995**

Week 1	9/27	Lecture 1: *Vectors in the plane* (§1)
	9/28	Quiz 1
	9/29	Lecture 2: *Vector components* (§1)
Week 2	10/2	Lecture 3: *Lines and curves in the plane* (§2)
	10/3	Homework 1 due: 1.10–1.19.
	10/4	Lecture 4: *Dot products* (§3)
	10/4	Quiz 2
	10/6	Lecture 5: *Projections* (§3)
Week 3	10/9	Lecture 6: *Coordinates, vectors, and lines in space* (§§4–6)
	10/10	Homework 2 due: 2.8–2.17, 3.9–3.17.
	10/11	Lecture 7: *Dot products & projections in space* (§7)
	10/12	Quiz 3
	10/13	Lecture 8: *Cross products* (§8)
Week 4	10/16	Lecture 9: *Planes* (§9)
	10/17	Homework 3 due: 4.4–4.5, 5.4–5.5, 6.4–6.8, 7.7–7.14, 8.5–8.11.
	10/18	Lecture 10: *Curves in space* (§10)
	10/19	Quiz 4
	10/20	Lecture 11: *Tangent & normal objects of curves* (§11)
Week 5	10/23	Lecture 12: *Functions of 2 & 3 variables* (§12)
	10/24	Homework 4 due: 9.9–9.15, 10.3–10.6, 11.4–11.6.
	10/25	Lecture 13: *Level objects* (§13)
	10/26	Quiz 5
	10/27	REVIEW
Week 6	10/30	**MIDTERM EXAM**
	10/31	Homework 5 due: 12.14–12.22, 13.7–13.13.
	11/1	Lecture 14: *Partial derivatives* (§14)
	11/2	Quiz 6
	11/3	Lecture 15: *The chain rule* (§15)
Week 7	11/6	Lecture 16: *Directional derivatives* (§§16,18)
	11/7	Homework 6 due: 14.14–14.31, 15.10–15.21.
	11/8	Lecture 17: *Linear approximation* (§17)
	11/9	Quiz 7
	11/10	HOLIDAY
Week 8	11/13	Lecture 18: *Tangent & normal objects* (§19)
	11/14	Homework 7 due: 16.9–16.16, 17.12–17.17, 18.8–18.17.
	11/15	Lecture 19: *Optimization: review of 1-dimensional theory*
	11/16	Quiz 8
	11/17	Lecture 20: *2-dimensional optimization: local theory* (§20)
Week 9	11/20	Lecture 21: *Constrained optimization* (§21)
	11/21	Homework 8 due: 19.6–19.8, 20.5–20.11, handout
	11/22	Lecture 22: *2-dimensional optimization: global theory* (§22)
	11/23	HOLIDAY
	11/24	HOLIDAY
Week 10	11/27	Lecture 23: *Double integrals: definitions* (§23)
	11/28	Homework 9 due: 21.9–21.14, 22.6–22.9.
	11/29	Lecture 24: *Double integrals: Riemann sums* (§24)
	11/30	Quiz 9
	12/1	Lecture 25: *Double integrals: recipe* (§25)
Week 11	12/4	Lecture 26: *Double integrals: polar coordinates* (§26)
	12/5	Homework 10 due: 23.4–23.7, 24.6–24.9, 25.6–25.10, 26.5–26.9, handout
	12/6	REVIEW
	12/7	Quiz 10
	12/8	REVIEW
Saturday	12/9	**FINAL EXAM 1:30–4:20**