

MATHEMATICS 2210
Calculus III: Multi-variable Calculus
Fall semester 2005

Time: MWF 11:50–12:40, LCB 219

Instructor: Professor Grant B. Gustafson¹, JWB 113, 581-6879.

Office Hours: JWB 113, MWF 8:55-9:30am. Other times will appear on my door card and on the internet due date page.

Telephone: 581-6879. Please use email whenever possible.

Email: ggustaf@math.utah.edu

Web site: <http://www.math.utah.edu/~gustafso/>

Tutoring: The Math Department Tutoring Center, located in LCB, is open for free tutoring from 8 a.m. to 8 p.m. on M-Th, and from 8 a.m. to 2 p.m. on Friday. Some of the math tutors welcome questions from Math 2210 students (others have no experience in 2210 topics). To see the times and specialities of various tutors, use the web address www.math.utah.edu/ugrad/tutoring.html.

Texts:

Calculus, 8th Edition, by Varberg, Purcell and Rigdon (the required text).

Student Solution Manual, for the Varberg text *Calculus*

WWW documents for 2210 at web site <http://www.math.utah.edu/~gustafso/>. All are pdf or text documents that can be printed from Netscape, Mozilla firefox or MS internet explorer web browsers. Author: G.B. Gustafson.

Prerequisites:

Math 1210 and 1220 or an equivalent first-year single variable Calculus course. Old Math courses 111-112 of 1997-98 fulfill the requirement.

A passive knowledge of `maple` is assumed. The entire course can be done without `maple`, but all computer code examples are supplied in `maple` only. A good replacement for persons without computer training is a graphing calculator and Microsoft's `Excel` or the MathWork's `matlab`. To cooperate with the engineering programs on campus, some `maple` contact is required in the course work for 2210. The co-requisite is Physics 2210 (old 301), with actual use of physics minimal.

Persons without the passive knowledge of `maple` and `unix` may attend one of the *tutorials* on the subject offered during the first two weeks of the term. The instructor for these tutorials is Angie Gardiner, 585-9478, gardiner@math.utah.edu. The dates and times are printed on Angie's door MC 155A (building LCB). See also the tutoring web address cited above. Free tutoring is available in the LCB tutoring center 8:00 a.m. to 8:00 p.m. daily except until 6:00pm on Friday, closed weekends and semester holidays.

Course content:

This course is an introduction to multi-variable calculus. Chapters 13 to 17 in the Varberg text plus class notes and `www` documents will make up the course material.

¹Pronunciation: In the phrase *Gust of Wind* change *Wind* to *Sun*

Grading:

Final grades will be based on:

Textbook problems, briefly called the **dailies**, about 150 scores.

Written midterm examinations (3).

An in-class 2-hour final examination that counts as two additional midterm scores.

Written In-Class Exams:

There are three (3) midterm exams. There is a 2-hour in-class final exam as scheduled by the university. The midterm and final exams are graded by G.B. Gustafson.

Hand-written Dailies:

There will be 120 dailies due during the semester, including textbook problems and some maple problem sets. They will be graded by a staff of readers employed by Angie Gardiner and by G. B. Gustafson.

Computerized Wed Records:

The scores on your first midterm exam are used as a key to finding your electronic text format record at the web site. Text format records are copied without names or identifiers to the web site as available, after the first exam, and up through the final exam. Errors in the record should be reported by email to ggustaf@math.utah.edu. Periodically, a paper print is made of the record, which is given to you for comparison to your records.

The web records are sorted by rank in class, at the moment. Rank in class is computed using the average on exams. It ignores dailies. Rankings change after each exam. Errors in records might change rankings.

An example: Chris Mayfield discovered his final exam scores were not recorded. He reported the error by email and subsequently received a course grade change (two levels higher!). Without his effort, the error might not have ever been discovered and corrected. Because he moved up two grade levels after the error fix, the rankings of many classmates were affected.

Recommendations for scholarships, graduate school and job positions or summer employment always quote the rank in class. Generally, a rank in the top 10 is noteworthy, whereas lower rankings are detrimental to applications. This depends in part on the size of the class: a class size of 100 makes the top 20 ranks significant.

Textbook problems:

Textbook problems to be submitted for grading are listed on the **gradesheet** for the course. Visit the web site for extra copies. The due dates for problems appear only on the web site and they are dynamically updated to reflect the reality of what was discussed in class. Generally, problems are submitted shortly after they are discussed in class.

All students must complete each textbook problem and submit their work in their own handwriting. Collaboration is permitted and encouraged on textbook problems in teams of 2 or 3. You must submit your own separate handwritten report. Partner citations are not required.

There are certain **rules** for writing up the textbook problems. A full accounting of the *format rules* contributed by University of Utah students appears on the internet course page as *format for submitted work*. Kindly apply the ideas therein to your written work, both textbook problems

and take-home midterm exam problems.

In-class midterm exam problems:

A midterm sample in-class exam is supplied a few days before the in-class exam. Exam problems are modeled after the sample exam.

Books, tables, notes and calculators are not allowed on exam day.

An in-class Midterm exam has different presentation rules, and none of the textbook problem rules apply in this case. Basically, the in-class exam is a first draft.

Computer projects:

There will be a few computer projects assigned during the semester, related to the classroom material. They will be written by hand and use the software package `maple`. There is a Math Department Computer Lab in building LCB at which registered students automatically own accounts, and there are other labs around campus where `maple` is also available, for example at the College of Engineering. Drop-in free tutoring in the computer lab in building LCB starts the second week of the semester.

Final exam:

Two hours are reserved for this written exam. As published by the university, the final exam is Monday, Dec 12, 1-3pm, in the regular classroom.

The final exam is comprehensive. About one hour of the exam covers the last three weeks of the course. The remaining time covers all topics that appeared on the previous three midterm exams.

No notes, calculators, tables, books or aids of any kind are allowed on the final exam. Please bring pencils and eraser. Paper will be supplied.

Withdrawal:

It is the Math Department policy, and mine as well, to grant any withdrawal request until the University deadline. This promise also means that such a withdrawal requires no explanation. Withdrawals are always initiated by the registered student. All paperwork is the duty of the student. My job is the signature.

ADA statement:

The American with Disabilities Act requires that reasonable accommodations be provided for students with physical, sensory, cognitive, systemic, learning, and psychiatric disabilities. Please contact me at the beginning of the semester to discuss accommodation (113 JWB or 581-6879), which is to say, accommodation shall be made.

Grading Scale:

A = 95-100, A- = 92-94, B+ = 88-91, B = 84-87,
B- = 80-83, C+ = 75-79, C = 65-74, C- = 60-64

This scale is determined from 40% passing use GPA increments. It is used for grading and for final letter grade reporting. This scale is for internal use only.

Grading Details:

Rite of passage: A passing grade in the course requires at least 84 of the 150 dailies (includes computer projects) to be submitted. A grade of *E* is assigned if less than 84 Dailies are submitted.

The scores on the 84 dailies are expected to be passing at *C* level or higher.

The right of passage is absolute, similar to the European system, which requires a body of work to be presented before written and oral final exams are taken. For example, the Czech *vypočet* is a requirement to show a body of completed work as the entrance requirement to administration of written and oral final exams. Similar requirements exist for the schools of law and medicine at the University of Utah.

Final grade: It will be determined as follows:

$$\text{Final Grade} = \frac{30}{100}(\text{Dailies Average}) + \frac{70}{100}(\text{Midterm} + \text{Final Average}).$$

An example: the Dailies Average for 142 textbook problems and maple labs is 91% and the Exam Average of the three midterms and the final exam is 86%. The final grade is $0.3(91) + 0.7(86) = 87.5\%$, which by the scale above is a *B*. While 87.5 rounds to 88, a *B+*, the deciding factor is really the exam average of 86, which is squarely a *B*. The final grade is *B*. If the dailies average was 93 or higher, then the final grade would be 88.1 or higher for a *B+*.

A grade of *E* is assigned if less than 84 Dailies are submitted. Please read the **Rite of passage** paragraph above.

Purpose of the textbook problems. The *purpose* of the problems is to practice doing mathematics, that is, to write out in detail the solutions to problems. A textbook problem is generally an engineering-style “crank” problem, usually devoid of proofs. The process:

- **Understand the problem.** Understanding usually involves reading the *problem notes* and the textbook. Answers are usually not provided. You may get an outline of the solution, to increase the probability that the project gets completed on schedule. Problems are discussed in class in great detail, often with the aid of transparencies and Xerox copies of same. Slides cover a similar problem or sometimes the exact problem considered in the project. The classroom slides are mirrored at the web site as pdf files, ready to print from an internet browser.
- **Background reading.** To solve a problem, a second opinion of the theory and method is essential. It might be that you can flesh it out of your book’s examples, the college algebra text, the calculus text or some engineering mathematics book. No matter, go to a source that works for you. This is *reading* and not a tutorial.
- **Scratch Paper Write-up.** The initial creation of a solution is the essence of the learning process. Everyone learns by repetition, and here is where you do it. Use a pencil and a big eraser, lots of paper, and flesh out a first draft at full speed. This is not the paper you turn in.
- **Final Copy.** The final copy of the solution uses the scratch paper draft as raw material to *present* the details of the solution. As such, it is more than a collection of formulas on paper. There is no strict requirement, except that *neatness* and *completeness* are a must.
- **Final Copy Format.** The most successful format to date was invented by several engineering mathematics students over the years 1990–2005. This format is described in some detail below and also in the internet document *format for submitted work*.

Some Format Suggestions

1. Use engineering paper or plain white paper. Lined notebook paper and graph paper are not acceptable, because they cause inappropriate vertical white space for mathematics.
2. Reports are hand-written. They start with a problem statement followed by the book's answer or by a final answer summary. Supporting material appears at the end, like a tax return.
3. Mathematical notation is on the left, text on the right, about a 60% to 40% ratio. One equal sign per line. Justify equations left or align on the equal signs.
4. Text is left-justified on the right side. It includes explanations, references by keyword or page number, statements and definitions, references to delayed details (long calculations, graphics, answer checks).
5. Any of rules 1-4 can be broken.
6. Every report has an answer check. For odd-numbered problems it is usual to see "*the answer matches the textbook.*" For even-numbered problems, a full answer check is expected, unless the problem has an answer in the text.

Plagiarism is defined as

the unauthorized use of language and thoughts of another and the representation of them as one's own.

Textbook problems have **answers** and **solutions** published by Varberg, et al. They *own* the work. You are authorized to cite *answers* without reference, in the course of doing a problem. To copy their *solution* from the solution manual and represent it as your own work is plagiarism. A blatant violation is the submission of a solution no different than what is found in the solution manual, or a problem statement followed by no work or explanation, just the author's answer. Such circumstances are rewarded with zero credit.

Cooperative efforts are allowed and encouraged in groups of two or three. Kindly produce individual handwritten reports. There is no penalty for getting help from others – it is encouraged.

English language deficiencies will be tolerated but not excused. Graders prefer precise English comments. Concise comments are better than paragraphs of explanation. If English is your second language, then try to improve your writing skills: (1) shorten comments and (2) use page references to the textbook.

Presentation is expected to improve throughout the 14 weeks of the course. You are not expected to be an expert in the first week. Correctness of answers will be checked. The problem notes might contain answers plus a solution outline. In class, further details are communicated. Your job is to *improve* on the initial start into the solution. Add the particulars, make comments, chase down the details from algebra and calculus. The difficulty is generally college algebra, with basic first-year calculus running a close second. Writing up the solution identifies the stumbling blocks and forces a review of background material.

References are required on the first occurrence. After that, omit the citation. It is appropriate to refer to the previous assignment on which the citations originated. A statement like *References parallel Exercises 1-5* is enough.

Due dates. All due dates are updated dynamically, at www.math.utah.edu/~gustafso/. Consult this resource often. To repeat: the dates will often not be given in class! Sometimes, email communication about due dates and exams will be made from the registrar's list. If your campus information data is incorrect, then please visit the campus WWW site to update the information.

Makeups and Late Work. Due to the number of dailies being collected, work is considered late and therefore unacceptable when two (2) days have elapsed since collection in class. The lowest eight (8) dailies are dropped from consideration in order to eliminate makeups. If more than ten (10) textbook problems have zero scores, then please call 581-6879 or email ggustaf@math.utah.edu and discuss the situation and options for getting a passing grade in the course.

Missed Deadlines. There is an absolute deadline for each collection. After the stack is sent to the grading assistant, all late work received henceforth earns a zero.

Iterations and Redos. You may be asked to iterate your work from the first textbook chapter, in order to straighten out bugs in the presentation or to supply missing details. Kindly mark your work **REDO**. Submit whatever is requested, but no more, in order to keep the paper trail brief. The deadline for a **redo** is 5 days from the date returned. **Redo requests end** after all first chapter dailies have been graded and returned.

Missed Midterm Exams. Missing an in-class exam is a disaster and therefore there will be a scheme to makeup one exam. If you miss two exams, then please equip yourself with reasons in writing and see me in JWB 113, or write email to ggustaf@math.utah.edu, or leave a voice message at my office 581-6879, or talk with Paula Tooman at the math office 581-6851 in 233 JWB.

Fall 2005 Tentative Daily Schedule

Week 1, Aug 24,26	Sections 13.1,13.2.
Week 2, Aug 29,31,Sep 2	Sections 13.3,13.4,13.5.
Week 3, Sep 7,9	Sections 14.1,14.2,14.3. Holiday Sep 5.
Week 4, Sep 12,14,16	Sections 14.4,14.5,14.6.
Week 5, Sep 19,21,23	Sections 14.7,15.1,15.2.
Week 6, Sep 26,28,30	Sections 15.3,Review. Exam 1 Sep 28.
Week 7, Oct 3,5	Sections 15.4,15.5. Holiday Oct 6,7.
Week 8, Oct 10,12,14	Sections 15.6,15.7,15.8.
Week 9, Oct 17,19,21	Sections 15.9,16.1,16.2.
Week 10, Oct 24,26,28	Sections 16.3,Review. Exam 2 Oct 26.
Week 11, Oct 31,Nov 2,4	Sections 16.4,16.5,16.6.
Week 12, Nov 7,9,11	Sections 16.7,16.8,17.1.
Week 13, Nov 14,16,18	Sections 17.2,17.3,17.4
Week 14, Nov 21,23	Sections 17.5,17.6. Holiday Nov 24,25.
Week 15, Nov 28,30,Dec 2	Sections 17.7,Review. Exam 3 Nov 30.
Week 15, Dec 5,7	Final Exam review. Lectures end Dec 8. Reading Day Dec 9.
Week 16, Dec 12	Final exam 1-3pm on Monday Dec 12.

Policy on Exams. The three (3) midterms plus the final represents 70% of the course letter grade. The final exam is doubled before determining the exam average, so that it counts as two midterms. Graded by G.B.Gustafson.

Policy on Dailies. The highest 142 daily scores will be counted. The lowest 8 of the 150 scores will be dropped. Any record with less than 84 daily and lab scores earns a grade of **E**, regardless of midterm and final exam scores. Deadlines set at web site www.math.utah.edu/~gustafso/. Work not in the stack sent to the assistant is late and it earns a grade of zero.

Tentative Due Dates 2210 Fall 2005

Chapter 13 (18 boxes)

26 Aug Page 564, 13.1: 9, 33,
29 Aug Page 565, 13.1: 41, 55, 62
29 Aug Page 569, 13.2: 3, 7
02 Sep Page 575, 13.3: 2, 6, 23
07 Sep Page 581, 13.4: 6, 14, 33, 42
09 Sep Page 589, 13.5: 9, 19, 37, 59

Chapter 14 (30 boxes)

12 Sep Page 591, 14.1: 6, 12, 29
14 Sep Page 603, 14.2: 6, 14, 23, 29, 36
16 Sep Page 608, 14.3: 2, 6, 15, 18, 21
19 Sep Page 612, 14.4: 2, 13, 24
21 Sep Page 617, 14.5: 4, 19, 28, 38, 48
23 Sep Page 623, 14.6: 13, 14, 16, 20
26 Sep Page 627, 14.7: 5, 6, 8, 27, 35
28 Sep: Exam 1

Chapter 15 (42 boxes)

30 Sep Page 639, 15.1: 4, 12, 18, 26, 43
03 Oct Page 644, 15.2: 13, 18, 26, 40, 47
05 Oct Page 648, 15.3: 4, 6, 8, 12, 20
06,07 Oct: Holiday
10 Oct Page 655, 15.4: 8, 12, 16, 20
12 Oct Page 660, 15.5: 4, 10, 24, 26
14 Oct Page 665, 15.6: 6, 12, 14, 18, 22
17 Oct Page 669, 15.7: 2, 8, 14, 22

19 Oct Page 674, 15.8: 7, 14, 20, 22, 33
21 Oct Page 681, 15.9: 2, 9, 16, 18, 21

Chapter 16 (31 boxes)

24 Oct Page 690, 16.1: 2, 6, 10, 23
26 Oct: Exam 2
28 Oct Page 694, 16.2: 6, 10, 15, 18, 22
31 Oct Page 700, 16.3: 14, 16, 20, 26, 30
02 Nov Page 705, 16.4: 5, 12, 18, 26
04 Nov Page 710, 16.5: 3, 12, 14
07 Nov Page 714, 16.6: 2, 6, 8, 10
09 Nov Page 721, 16.7: 6, 10, 20, 28
11 Nov Page 726, 16.8: 4, 12

Chapter 17 (29 boxes)

14 Nov Page 734, 17.1: 10, 16, 18, 20, 25
16 Nov Page 740, 17.2: 2, 8, 14, 21
18 Nov Page 747, 17.3: 2, 8, 12, 15, 22,
21 Nov Page 753, 17.4: 6, 7, 14
23 Nov Page 753, 17.4: 16, 23, 27
24,25 Nov: Holiday
28 Nov Page 758, 17.5: 4, 9, 12
30 Nov: Exam 3
02 Dec Page 764, 17.6: 1, 5, 16
05 Dec Page 768, 17.7: 4, 8, 19
07 Dec nothing due, final exam review day
12 Dec Final Exam 1-3pm (Monday)

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