MATH 1271: CALCULUS I, FALL, 2011
LECTURE 30; KHKH 3-210; 12:20–1:10PM

Lecturer: Professor Al Marden, am@math.umn.edu; www.math.umn.edu/~ am
Office hours: MW 1:10—1:40PM, VinH 326, 625-5879(voicemail)
TAs:31,35 Sylvia Agwang(*agwan003@umn*); 32, 36 Matthew Brown(*brow2341@umn*);
34 Daniel Hess(*hessx144@umn*); 33, 37 James Kolles(*koll0023@umn*).

Text: Stewart, Calculus: Early Transcendentals, **7th** edition, Chapters 2-6

Course goal. To establish competency in basic calculus sufficient to enable application whenever and wherever needed.

Brief overview of Calculus I. The two big ideas of calculus come this semester: *Differentiation and Integration* will play the central role in our course. Calculus is essential for mathematics as well as for subjects from business and econ to neuroscience and high energy physics. Mathematical modelling of natural phenomena is everywhere! Success in Calculus opens many doors in the U. to further studies.

Here are the principal topics you will be responsible for this term:

(1) **The derivative $f'(a)$ at $x = a$ as limit of the difference ratio $\frac{f(a+h)-f(a)}{h}$ as $h \to 0$, $h \neq 0$.**
(2) Interpretation of derivative as slope of tangent line and instantaneous rate of change.
(3) Rules for finding derivatives of more complicated functions once derivatives of simpler ones are known, namely

$$(f \pm g)' = f' \pm g', \quad (fg)' = f'g + fg', \quad (f/g)' = (gf' - fg')/g^2, \quad (f \circ g)'(x) = f'(g(x))g'(x).$$

(4) Using these rules, and starting just with the constants, $f(x) = x$, trig functions, and exponentials, we will find formulas for the derivatives of all functions that can be built up from these simple ones by the operations:

$$f(x) \pm g(x), \quad f(x)g(x), \quad f(x)/g(x), \quad (f \circ g)(x) = f(g(x)), \quad f^{-1}(x).$$

(5) Finding derivatives by implicit differentiation of equations.
(6) How to use info about derivatives to solve max/min problems, and to qualitatively analyze graphs of functions with the help of l'Hospital's rule.
(7) **The integral as a summation process.**
(8) Interpretation of limits of approximating sums: areas, volumes of revolution, average values.
(9) Functions defined by integrals; how to compute the values of such functions; derivatives of such functions.
(10) The easy way to integrate those functions recognizable as derivatives of familiar functions.
(11) Manipulating an integral to change its appearance in hopes the integrand will then be recognizable as the derivative of a familiar function.

Prerequisites. It is *crucial* that you have a solid working knowledge of high school math *especially* easy facility in carrying out basic arithmetic and algebraic manipulations. Also you will need good knowledge of analytic geometry of straight lines, trig functions, and exponential functions, although we will briefly review these subjects in class. If you were "good at math" in high school you should not have trouble passing the course, if you do the necessary work. If you are not "up to speed" in high school math, you will have to work extra hard to pass the course.

Many of you have had some calculus in high school. If so, you may find some differences in content and differences in emphasis; we may use more abstract terminology and put more emphasis on understanding the techniques used. Yet ours is not a "theoretical" course. Nor is it a course that teaches applications to other subjects. Our philosophy is that if you have a solid grounding in calculus, then when you apply calculus in your courses in biology, business, engineering, . . . , whatever, you can concentrate on the subject at hand without worrying about the math itself.

Your TA. Your TA is your most valuable course resource. He or she is a hard working math grad student, typically not much older than you, who is taking advanced courses and seminars, perhaps doing research for a Ph.D. thesis. Part of the training is to work with students to help them learn calculus. Help them to help you! Ask questions when something in the course is giving you trouble. The job of the lecturer is to give the "big picture" and to work sample problems. The job of your TA is to go over the homework problems and to clear up difficulties and misunderstandings. 10% of your grade will be based on participation in your section. It will be your TA who grades your quizzes and midterm exams (possibly with other TAs) and assigns your final grade.

Homework The key to passing the course is the practice you will get by doing the homework. We learn math by doing it! This means working out each problem yourself, since only YOU can put the math inside your head. Work additional problems if that helps you nail down the technique. Either you can do the problem or you can't. In the latter case look at the book or your lecture notes; in most cases a similar problem is already worked out. If you still have a problem with the problem, consult a classmate, your TA, me, or go the help room. The sooner you deal with your problem the better as we quickly move from one topic to the next. **FALLING BEHIND PUTS A PASSING GRADE AT GREAT RISK.**

Calculators. A calculator or computer is not needed in the course, although you may have more fun if you have one and want to experiment. Simplification is never required (but don't interpret this in the extreme!) In fact heavy reliance on a calculator or computer will prevent you from getting hands-on experience working with standard functions or solving simple equations—valuable skills to possess.

No calculators, computers, or cell phones will be allowed on the midterm or final exams. Nor will heavy arithmetic or algebraic simplification be required. As some point out, the most powerful general purpose computer is the one inside your head. There will be no exam problems that one cannot handle.

Exams and quizes: There will be three 50 minute midterm exams. EVERY Tuesday in your section, there will either be a 10 minute quiz taken from assigned homework problems, OR a midterm exam. The course ends with a 3 hour final common to all 1400+ students currently taking Calculus I.

Grading: The final will count for 45% and the 3 midterm exams together for 45%. The borderline 10% will be assigned by your TA based on your class participation and graded quizzes. In recent years the distribution of final grades was approximately 15% A, 25% B, 35% C, and 25% D and F.

We *very rarely* give the final grade of "incomplete". To get one, *you must have completed satisfactorily all but a small fraction of course work*, have a very compelling, well documented excuse, and an approved plan to complete the course. If circumstances result in your falling behind, to avoid a low or failing grade you should seriously consider dropping the course and retaking it later.

If you miss one midterm exam with a very compelling excuse (in advance if possible) given to me and your TA, your final exam will be given additional weight instead. But our experience is that it is not helpful to students to miss an exam.

EVERYONE HERE HAS THE TALENT TO SUCCEED; NOW DO IT!

Lecture Schedule. (Not everything in the listed sections will be covered.)

7 Sept and 9 Sept: §§2.1, 2.2, 2.3
12 Sept to 16 Sept: §§2.4, 2.5, 2.6
19 Sept to 23 Sept: §§2.7, 2.8, 3.1
26 Sept to 30 Sept: §§3.2, 3.3, 3.4
3 Oct to 7 Oct : Review on Mon, §§3.5, 3.6; **MIDTERM I TUESDAY**
10 Oct to 14 Oct: §§3.9, 3.10, 4.1
17 Oct to 21 Oct: §§4.2, 4.3, 4.4
24 Oct to 28 Oct: §§4.4, 4.5, 4.7
31 Oct to 4 Nov: Review on Mon §§4.8, 4.9, 5.1; **MIDTERM II TUESDAY**
14 Nov to 18 Nov: §§5.2, 5.3
21 Nov to 23 Nov: §§5.3, 5.4
24 Nov and 25 Nov: §5.5, Math Videos HAPPY THANKSGIVING
28 Nov to 2 Dec: §§6.1, 6.2
5 Dec to 9 Dec: Review on Mon, §§6.3, 6.5 **MIDTERM III TUESDAY**
12 Dec and 14 Dec: COURSE REVIEW

MIDTERM EXAM DAYS:

TUESDAY, October 4
TUESDAY, November 1
TUESDAY, Decmber 6

FINAL EXAM: THURSDAY DEC 16, 1:30 to 4:30

"You do not really understand something unless you can explain it to your grandmother" (advice to young researchers attributed to Albert Einstein).

Assigned homework problems:

Section	Page	Problems
2.2	96	4, 5, 6, 7, 8, 9, 29, 31, 37.
2.3	106	odd 11-31, 37, 41.
2.4	116	1, 2, 3
2.5	127	3, 4, 5-8, 23, 41, 47a,b, 51, 52, 69.
2.6	140	3, odd 15-31, 65a.
2.7	150	3a,b, 7, 11, 29, 33, 38.
2.8	162	3, 15, 21, 23, 27, 43.
3.1	181	odd 3-27, 34, 51, 55, 63.
3.2	189	odd 1-25, 47, 51.
3.3	197	odd 1-23, odd 39-45.
3.4	205	odd 7-37, 51, 59, 71.
3.5	215	odd 1-27, 31, 35, 45 odd 49-54.
3.6	223	odd 3-23, odd 39-49, 52.
3.9	248	odd 1-7, 13, 15, 16, 18.
3.10	255	odd 23-31.
4.1	280	3, 5, odd 47-55, 57.
4.2	288	1, 3, 5, 9, 15, 17, 19, 21a, 33.
4.3	295	odd 11-19, odd 31-41, 77.
4.4	307	odd 7-25, odd 29-61.
4.5	317	odd 1-17, 37, 51.
4.7	331	3, 7, 14, 19, 34, 35, 38.
4.8	342	3, don't graph: 7, 9.
4.9	348	odd 1-39, 55.
5.1	369	1, 3, 13, 17, 19, 22.
5.2	382	1, Riemann sum only 11, 17, 19, 29, 34, 35, 37, 39, 47, 49.
5.3	394	odd 5-39, 45, 53, 56, 57, 64, 69.
5.4	403	odd 1-11, odd 21-39, 51.
5.5	413	odd 1-33, 53-59, 77, 85.
6.1	427	odd 3-23, 44.
6.2	438	odd 1-17, do not evaluate 33a, 39, 43, harder: 50, 63.
6.3	441	odd 3-15, 21a, 23a, 29, 30, 37.
6.5	453	odd 1-7, 13, 17.
Ch. 2	166	Quiz: odd 1-13; Ex: odd 1-13, 19-33 **Review for final**
Ch. 3	264	Quiz: odd 1-9; Ex: 2a, odd 1-33 **Review for final**
Ch. 4	351	Quiz: odd 1-9; Ex: odd 1-13, 19-29 **Review for final**
Ch. 5	416	Quiz: odd 1-9; Ex: 2a, 3, 4, 8, odd 9-31,43-47 **Review for final**
Ch. 6	457	Ex: 1, 3, 7, 8, 9, 13, 19, 21, 30 **Review for final**