Math 20A, Calculus of Several Variables, Fall 2009
Course orientation and syllabus

Thomas Barnet-Lamb Goldsmith 205 tbl@brandeis.edu

Class website:	http://people.brandeis.edu/~tbl/math20a/
Schedule:	Tues, Fri 10.30am–12 noon
Office Hours:	Tues 2–3.30pm, Fri 3–4.30pm
Textbook:	Multivariable calculus, Concepts and Contexts, James Stewart

1 Course Grade

Your course grade will be comprised of:

- Weekly homeworks (35% of the grade)
- A midterm examination (30% of the grade). This will take place on **Oct 2nd**.
- The final exam (35% of the grade)

2 So, what is the course about?

Given the title of the course, you will be unsurprised to learn that one major theme in this course is that we take the techniques of single-variable calculus and apply them to contexts where there are more variables. So, for instance, you will have studied in single variable calculus how to differentiate and integrate expressions like $x^2 + x^3 + e^x$ which depend on a single variable x; now we will study what it might mean to 'differentiate' and 'integrate' expressions like $(x^2 + y^2)e^{xy}$ which depend on more variables (in this case, the two variables x and y)—and no less important, we will study why one might want to do so.

It may be slightly more surprising that this project will account for only about half of the 'meat' of the course. The rest revolves around a distinct but closely related theme—that of building bridges between mathematics and our visual intuition. The traffic on these bridges will be two-way: we will both find ways to use mathematical formulae to tell us about shapes we can visualize, and find ways to use visualization to understand mathematical formulae (from physics, economics, and so on) better. Much of the richness of working with two or more variables comes from the variety of ways we can make such connections; and much of the richness in multivariable calculus comes ultimately from the same source. Thus we will spend a lot of our time figuring out how to visualize shapes and manipulate them in our heads. By the end of the course, you will have attained a fluency in going backwards and forwards between mathematics and the visual, and a facility in manipulating visual images mentally; these will perhaps be the principal things you will take from this course into your later studies.

3 Content

We will aim to cover the following chapters of the textbook:

- Vectors and the Geometry of Space (approx 1.5 week; Sections 9.1–9.4, 9.7)
- Curves and Surfaces (approx 2.5 weeks; Sections 9.5, 9.6, Chapter 10)

- Partial Derivatives (approx 3 weeks; Chapter 11)
- Multiple Integrals (approx 3 weeks; Chapter 12)
- Vector Calculus (approx 3 weeks; Chapter 13)

I should warn you that the timings above are very approximate and I will adjust things as the course progresses.

For those students who are thinking of reading ahead, I should also advise you that while we will be following the textbook closely for much of the course, there are a few places where my presentation will be slightly different. *This will be particularly true for the material of Chapter 9.*

4 Technology

The use of a computer algebra system, such as Wolfram Research's *Mathematica*, is highly recommended, both to help you check routine calculus computations, as a glorified calculator, and as a tool to aid visualization of functions, surfaces *&c.* The *Mathematica* program is available on all Brandeis University workstation clusters for student use. It takes a little time to become comfortable with it, and I would encourage you to get to grips with the system sooner rather than later, since you will find that you can work more productively once you have done so.

I hasten to add a caveat. Since you will not have *Mathematica* available to you when you take your exams, it is important to ensure that you practice doing computations 'by hand' as you do your homework, lest you find yourself in uncomfortably unfamiliar territory when you must do so on the exams. Thus you should use *Mathematica* as a tool to check answers you have computed by hand, rather than use it to come up with them in the first place. Indeed, *Mathematica* does not justify its answers; so, since you will need to give appropriate justification to get full marks on homework, you would almost certainly not get full marks without doing the computation by hand anyway.

You may also find a graphing calculator useful in doing your homework; the TI-84, TI-85 and TI-89 models are all quite satisfactory. There is, however, no requirement that you have a graphing calculator, and *use of calculators is not allowed during the exams.*

I would remark, in general, that I expect that computer algebra systems will be significantly more useful to you than a calculator, and you may well find that you have no need of a calculator, since the computer algebra system will do essentially everything the calculator does, only better.

5 Official policies

5.1 Documented disabilities

If you are a student who needs academic accommodations because of a documented disability, please contact me and present your letter of accommodation as soon as possible. If you have questions about documenting a disability or requesting academic accommodations, you should contact Beth Rodgers-Kay in Academic Services (x6-3470 or `brodgers@brandeis.edu`.) Letters of accommodation should be presented at the start of the semester to ensure provision of accommodations. Accommodations cannot be granted retroactively.

5.2 Academic honesty

You are expected to follow the University's policy on academic integrity, which is distributed annually as section 4 of the Rights and Responsibilities Handbook. Instances of alleged dishonesty will be forwarded to the Department of Student Development and Conduct for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University. If you have any questions about how these policies apply to your conduct in this course, please ask.

See `http://www.brandeis.edu/studentaffairs/sdc/rr/index.html` for more information.