Syllabus for MAT 203 - Multivariable Calculus

Stony Brook University Summer Session I, 2016

May 31, 2016

1 Welcome!

Congratulations on your successes in mathematics so far and welcome now to your next big challenge, MAT 203 - Multivariable Calculus! This course will greatly broaden your experience with mathematics and equip you with very powerful tools for tackling problems in complex quantitative systems such as weather patterns, stock market price movements, the behavior of electrically charged objects, population growth and fluid dynamics, to name just a few. You can expect this course to be challenging and time demanding, but ultimately very rewarding and incredibly useful. You will learn to think in a new way about mathematical problems and you will master more of the tools needed to solve them.

2 Office Hours and Course Coordination

I (John Sheridan) will be both your lecturer and the course coordinator. The best ways to reach me are via email: `john.sheridan@stonybrook.edu` and by coming to office hours:

- Math Learning Center (MLC) Hours: Mondays and Wednesdays 1:00-2:30 PM
- Extra Office Hours: Mondays 2:30-3:30 PM

Note that the MLC is located in room S-240A in the basement of the Math Tower building. My office (where the extra hours will be held) is among the offices located *behind* the MLC. Please email me if you can not find it.

Let me stress that coming to office hours will be a ***great benefit*** to your progress in the course. Office hours are not limited to people who are struggling with the course, they are for every student - discussing material in a more relaxed setting in a smaller group is a natural and important part of the learning process. I encourage and expect many people to come to my office hours to discuss the lectures and homework problems over the duration of the course. You are all very welcome and need not have a specific question in mind when coming.

3 Lectures

Lectures for the course will take place on Mondays, Wednesdays and Thursdays from 9.30am to 12.35pm, beginning on Wednesday, June 1st and ending on Thursday, July 7th. There will be **no lecture on Independence Day (Monday, July 4th)**. The lectures will be held in room E4330 in the Melville Library on West Campus.

The lectures are an extremely important aspect of your course for two reasons:

- This summer version of MAT 203 is an **accelerated** version of a semester-long course. This means that every lecture you attend is equivalent to **3 normal lectures**, which is the number of lectures you would normally receive over **one week** of a semester.
- Unlike in the semester-long course, the summer course **does not have a recitation component** (also known as precept/drill section/problem session). This means that the lectures will be your **main resource for fully worked examples** of course material. Understanding and practicing examples is the only way you will learn this material.

You will notice that each lecture is quite long (slightly over 3 hours). I realize that this is a long time to focus without stopping, so we will try and break the lecture up into 1-hour chunks and take 5-10 minute breaks in between. We will also use the opportunity to punctuate the lecture with group work and in-class problem solving in order to get plenty of practice.

4 Homework

(Please see forthcoming document "**Homework Guidelines**" for explanations on what is expected from you on the homework and how to prepare your homework for submission)

The homework is arguably the **most** important aspect of your experience in this course. There will be a lot of assignments - you should roughly expect to spend more time on homework than at lecture each week. The exact amount of time will of course depend on you. Homework will be collected at the beginning of lecture on the due date. Late homeworks will not be accepted.

For the vast majority of you, multivariable calculus is a powerful computational *and* analytical tool that you will use further in your majors and in your careers. It is therefore important not only that you can compute with it, but that you can also understand it conceptually at a relatively deep level. To facilitate this, there will be two types of homework problem: **computational** and **conceptual**.

To succeed in MAT 203, **you will need to perform well in both types** of homework. The computational problems will tell you which strategies to apply and you will practice applying them. The conceptual problems, on the other hand, will require you to **devise your own solution strategy**. To do this, you will need to become very comfortable with breaking down complex word problems into mathematical chunks, solving the chunks, and building those solutions back up into a solution to the original problem. **In the conceptual homework, the answer is not the important part - the solution strategy is the important part.**

5 Exams

There will be two midterm exams and one final exam in this course. The midterm exams will be on **Monday, June 13th** and **Thursday, June 23rd**. The final exam will then take place on **Thursday, July 7th**. All exams will take place during class time. For the midterms, you will be given the first hour and a half of the lecture time to complete the exam. For the final, you will have the full three hours.

There will be no make-up exams and therefore no circumstances (other than documented medical emergencies) under which absence from any exam can be excused.

6 Grading

(This grading scheme is yet to be confirmed. I will confirm it by the end of the first week at the latest)

The grade boundaries for the course **will not be curved**. Instead, the grading will be based on an absolute scale with grade boundaries outlined here (the percentage is the minimum required to achieve the corresponding grade):

A	:	95%	$C+$	:	65%
$A-$	:	90%	C	:	60%
$B+$	:	85%	$C-$	:	55%
B	:	80%	D	:	50%
$B-$	:	75%	F	:	0%

The weighting of the various course components in determining your final grade will be as follows:

Homework	:	35%
Midterms	:	15% each
Final Exam	:	30%
Participation	:	5%

The *Participation* component will be judged based on attendance and contribution to lectures and office hours, and for general engagement with the course.

You will note that since the grading will not be curved, your result at the end of the course depends only on your own performance - not on the performance of your peers. For this reason, it is in your own interest to learn and work together on the homework and study together for the exams. However, **all work submitted must be your own work in your own words**. This cannot be stressed enough. Any instances of similar or duplicate work, plagiarism, or complicity of any sort (not deemed acceptable in "Homework Guidelines") will not be tolerated. Such instances will be reported to the university's Division of Undergraduate Education at which point a judicial process will begin investigating the possibility of academic dishonesty.

7 Topics Schedule

Week 1:
• Functions of several variables
• Graphs, contours and loci
• Vectors in space, including dot and cross products
• Curves and surfaces

Week 2:
• Partial derivatives, directional derivatives, gradients
• The chain rule, tangent vectors and normal vectors
• Extrema and optimization
• Lagrange Multipliers

Week 3:
• **Midterm 1**
• Integration in two variables, polar coordinates
• Integration in three variables, spherical/cylindrical coordinates
• Applications of integration

Week 4:
• Further applications of integration
• **Midterm 2**

Week 5:
• Vector fields, conservative fields and gradient fields
• Line integrals, Fundamental Theorem of Line Integrals, Green's Theorem
• Flux integrals, divergence of vector fields, Divergence Theorem
• Curl of a vector field, Stokes' Theorem
• **Final Exam**