Math 122: Calculus II **2016**
Calculus: Early Transcendentals, Smith & Minton, Chapters 5-12
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Course Objectives: *Continue to learn how to do mathematics!* Mathematics is a problem-solving discipline, and we are all constantly learning. The best way to learn is to focus on technique and not on memorization. My role as professor is to guide discussions and help you take the next step from wherever you are mathematically. One objective is for you to have a sound enough understanding of calculus that you can recognize it and apply it in future courses. This will not happen if you have just memorized your way through some problems. A broader objective is for you to be a good problem-solver, to help you excel at whatever entrance examinations and job situations are in your future. An objective related to problem-solving ability is critical reading. To that end, you will be asked to read the book and put new concepts into your own terms. Finally, an objective is to enjoy the course. Calculus is the gateway to the awesome world of modern science. Let yourself be amazed!

Intended Learning Outcomes: At the end of the course, successful students will be able to

- Apply appropriate tests of convergence to a variety of infinite series
- Apply power series to solve problems in modern mathematics
- Recognize and interpret differential equations in basic applications
- Apply vector calculus techniques to compute quantities of interest
- Recognize the role of technology in calculus, understand when it should be used, and be aware of its limitations

Attendance Policy: This class meets **four** days per week. Regular attendance is expected. This means both physical and mental attendance; for most students, taking notes is a good way of making the best use of class time. You are responsible for everything done in class, through your attendance and sharing class notes with classmates. If you miss a class, you must e-mail or call me before class is over and explain why. **If you have two unexplained absences, you will be dropped from the course.**

Equipment: We will use Mathematica, a powerful mathematical software package, in class, in labs, and on tests. A personal copy for your personal computer is recommended, so that you can have it in class daily. Regular visits to your Inquire site (for all of your courses) is required. Assignments, extra materials, and grades will be posted regularly.

Academic Integrity: The college policy is fully supported. Tests are closed notes, closed book. You may always ask me for help on homework and labs. **Do not** copy homework or any portion of a lab report. No electronic devices other than calculators are allowed in a test situation.

Study Problems: In each section, a group of problems will be assigned. You should attempt every problem before that section is discussed, and ask questions in or out of class about problems that you do not understand. Study problems are the basis for tests. Test questions will be similar to study problems.

I expect you to spend at least 12 hours of work each week inside and outside of class.

Daily Grades: You will be asked to read ahead and get a basic idea of what the next section is about. This means that you will typically be working on two sections at once: completing the study problems from one section while getting a first look at another section. If you do this every day, you will do well in the course and you will not need to study for tests much. Each (regular) class day, you will bring to class one copy and turn in another copy of: (1) two important facts and (2) two questions you have about the next section. On a rotating basis, you will be asked to share these with the class. The more work you do, the easier the class is!

Homework: You will turn in a small number (usually two) of homework problems each day. These are intended to keep you up-to-date, give you easy points to help your grade, and to get you using Mathematica on a regular basis. Once you overcome the language barrier, you will find Mathematica to be a fantastic resource.

Co-Curricular: During the course of the semester, you must attend at least two approved co-curricular events offered by the MCSP department. For each, write a two-paragraph description of the event, due within a week of the event. A sample is provided. Schedules for the talks can be found online at the MCSP department website and in Trexler hallways.
http://www.roanoke.edu/inside/a-z_index/math_cs_and_physics/conversation_series/spring_2016

Calculus Lab: We will meet in Trexler 372 every Thursday from 8:30-10:00. This time will be spent working in groups on various problems, often interesting applications of the calculus we are studying. This time is informal and should be **noisy**. Do not hesitate to ask questions of me and your classmates. The labs are done in Mathematica, so having

Extra Credit: You may earn extra credit in a number of ways. My intent is to encourage you to have fun with mathematics, and that is the grading criterion that I will use – so have fun learning! You may check out from the Roanoke College library and report on "popular" mathematics books. You may report on mathematical web sites that have good calculus demonstrations or extra material. You may do one of the extra credit options posted on Inquire during the semester. The main rule here is to do this now; waiting until the end of the semester will annoy me and (more importantly) distract you from the end-of-semester studying that you need to do.

Tests: There will be four tests and a final exam. Each test will cover all material discussed since the previous test. Anticipated test dates are (Th) 2/11, (Th) 3/3, (Th) 3/31 and (T) 4/21. The exam is Friday, April 29, 8:30-11:30.

Make-ups: In case of sickness or scheduling conflicts, get in touch with me ASAP.

Grading: The lab reports count 15% of the final grade. Daily grades, homework, co-curricular and class participation count 14%. The exam counts 15%. Each test counts 14% of the final average. Grades may be curved up based on participation, one unusually low test score or other extenuating circumstance.
A: 93-100 A-: 90-92 B+: 87-89 B : 83-86 B-: 80-82 C+: 77-79 C: 73-76 C-: 70-72
D+: 67-69 D: 63-67 D-: 60-62 F: 59 and below

MATH 122 DAILY SCHEDULE

(Note: W2 refers to writing exercise #2, but #2 refers to "regular" exercise #2.)

1/18 Review
Review Mathematica Lab 0

1/20 Section 7.1
Turn in Lab 0 Problem 8
Differential Equations
Study: p506 W1,W2,#1-4,9-12,19-22,29-32,53-54

1/21 Lab 1: Differential Equations

1/22 Section 7.2
Turn in p.516 #6, Lab 0 Problem 10
Separable equations
Study: p516 #3-10,21-24,51-52

1/25 Section 5.5
Turn in p.420 #6, 16a (M)
Projectile Motion (1-D)
Study: p420 #3-12, 29-30,35a, 37

1/27 Section 5.7
Turn in p.441 #2, 22 (M)
Probability
Study: p441 #3-10,19-22,27-30,45-46

1/28 Lab 2: Projectile Motion

1/29 Section 8.1
Turn in p.550 #2, 6a, 49a(M)
Sequences
Study: p550 W1,#11-24,35-38,61-62

2/1 Section 8.2
Turn in p.559 #2, 29 (M)
Series, geometric series, k-th term test, harmonic series
Study: p559 W1,W2,#1-6,8-9,11-12,17-20,27-28,49,59

2/3 Section 8.3
Turn in p.570 #2, 45 (M)
Integral test, p-series
Study: p570 #1-10,21-24,49

2/4 Lab 3: Golden Calculations

2/5 Section 8.3
Turn in p.570 #6, estimate sum (M)
Comparison tests
Study: p570 W1,W2,#11-20,35-37,51

2/8 Section 8.4
Turn in p.578 #2, 26 (M)
Alternating Series Test, error estimation
Study: p578 #1-16,25-26,33-36

2/10 Review day
2/11 TEST #1

2/15 Section 8.5
Absolute convergence, conditional convergence, Ratio Test
Study: p585 W1,W2,W3,#1-12,23-30,61

2/17 Section 8.5
Turn in p.586 #18, 61a (M)
Review of series
Study: p585 41-60

2/18 Lab 4: Series
2/19 Section 8.6
Turn in p.593 #4, 17 P_6 (M)
Power series, interval and radius of convergence
Study: p593 W1,W3,#1-12,19-22,53

2/22 Section 8.6
Turn in p.593 #26a, 26b (M)
Finding power series, derivatives and integrals
Study: p593 #25-38,45-46

2/24 Section 8.7
Turn in p.605 #2, Figure 8.40b (M)
Computing Taylor series
Study: p605 W1,W3,#1-6,9-12,15-18 (not in closed form)

2/25 Lab 5: Series of Functions
2/26 Section 8.7
Turn in p.605 #26ab, Figure 8.40 P_{10} (M)
Estimating accuracy
Study: p605 #25-32,35-40,53-54

2/29 Section 8.8
Turn in p.613 #2
Study: p613 W1,#1-12,33-36

3/2 Review day
3/3 TEST #2

3/4 What is Mathematics Day

Calculus 2 FAQ

1. **Is Calculus 2 harder than Calculus 1?**
   The answer depends on a number of factors. Calculus 2 has fewer topics than Calculus 1, so the material is more unified. The main topic in Calculus 2 is infinite series, which is notably more abstract than differentiation and integration. Students who are used to cramming formulas often struggle with infinite series, which must be understood and not memorized. The main determining factor in whether it is harder is how you approach the course. If you learn more in class, keep up with the material better, and get more involved in class discussions, you will find that you have made Calculus 2 easier. Correcting for various factors, the grades are essentially the same in Calculus 2 as for Calculus 1.

2. **Why did I get a bad grade on the test? I studied 10 hours the night before the test.**
   You didn't prepare properly. If you did not listen and learn in class and reinforce that learning by immediately going over notes and working practice problems, then you put yourself in too big of a hole. Studying the night before should be limited to reviewing what you've already learned, making connections between different types of problems and making sure that you can understand the terms that will appear in a test question. And then get some sleep! Exhausting yourself memorizing stuff is not good.

3. **I missed class. When can you show me what you did in class?**
   It doesn't work that way. You should get class notes from somebody, read through the notes, try some practice problems, and come by with specific questions about the material. I will be glad to help you catch up, but an important part of class is the give and take between students and professor, and I can't recreate that in my office.

4. **What do I need to get on the exam to get an A in the course?**
   You have the skills to take the grading scale in the course syllabus and your grades on all past assignments and compute your average, and then determine what you need to finish with an A average. More importantly, whether you need an 84 or a 97 on the exam, you should prepare to get the best score that you can on the exam.

5. **Why do you care if I walk out of class to get a drink of water or text in class?**
   It is a distraction for somebody to stand up in the middle of class, walk in front of the board and leave class. Is there an emergency and you need help, or are you just bored? Either one is upsetting. Texting in class announces to me that you have little interest in learning. There is a high correlation between students who have no interest in learning and students who do not learn. I try hard to make class worthwhile – please participate.

6. **What can I do to improve my overall performance in this class?**
   Start by going to every class and taking good notes. After class review your notes and try practice problems. As soon as you realize you have a question about something, go get help! (Good ways to get help include: **my office hours**, evening office hours for Calculus, my office hours, CLT tutors, my office hours, and starting a study group with other students in your class.)

Lab Expectations

Come to class on time and be ready to work. The labs are designed to be doable in 90 minutes. If you don't get started until 9:00 and then spend half of your time talking about non-calculus things, you will probably need to spend an hour outside of class to finish the lab, and you will probably not do well.

Bring a laptop with Mathematica – don't rely on a partner bringing one on time.

Bring pen/pencil and paper, the textbook and your class notes. For many of the labs, it will be useful to review material covered in class or past labs.

Keep a record of useful commands in Mathematica. Between doing homework problems and labs, you will start to learn the logic of Mathematica, but notes to yourself will make the learning process quicker.

Be prepared to think. You will not be told exactly what to do, you will need to apply past knowledge to solve new problems – hard to do asleep or hungover.

Be prepared to be a good partner for anyone in class. Take turns speaking and listening, solve problems together, do your part (and not everybody else's part).

The student assistants in lab have been trained to help you find your own solutions to problems. They have been told that they should *not* just give you answers. When you encounter difficulties, talk with your lab partner and with other lab teams to try to find a resolution. When you ask the lab assistants for help, be prepared to tell them what you have tried (and why you tried it) and, most importantly, expect to receive helpful hints to think about. If you do not get a direct answer to a question, do not think that the student assistant does not know the answer or that she/he is being unhelpful. Think about the hint, and ask follow-up questions if needed. Lab will be much more enjoyable and meaningful if you find your own solutions.

In summary:

Be on time!

Bring: laptop, pen, paper, textbook, notes.

Learn Mathematica!

Think!

Work with others!

Model Reflection Paper

(This is made up, but shows what I'd like to get from you. The two main elements are (1) brief summary of talk and (2) some original thought on the subject.)

The talk on September 7th was by Dr. Sue Dokoo of Pseudo Duke University. Her research is in the game of Sudoku and discussed different aspects of this game. I have seen other people playing it, but did not know the rules or any of the mathematics behind it.

In this game, a 9x9 playing space is provided. An example given was:

		6	2			5	8	
4		2	5					7
				7	8	6		3
5		1		6	7			8
	3						6	
6			8	2		9		1
7		4	3	9				
9					5	2		6
	5	3			1	4		

To "solve" the puzzle, one could just enter numbers in a brute-force kind of way to see if they could get a working configuration. However, sitting in a room full of mathematicians, taking a more analytical approach seemed to be the dominant strategy. Treating this as a constraint-satisfaction problem, you can identify that certain cells must contain specific values. This leads to the conclusion that there is exactly one solution to a "well-formed" Sudoku.

This got me thinking about well-formed Sudoku, and how they are generated in the first place. It seems unlikely that the seeds are randomly assigned, you run the risk of violating set-up rules. A bigger problem is that the seeds may not constrain the possibilities enough to make a unique solution. Another naïve approach might be to take a completed grid and start taking away numbers, but I suspect that you might have a similar issue in terms of necessary constraints.

One that I want to think about is: In forming a viable Sudoku, is it the number of seeds or the placement of seeds that is more critical? I suspect the latter. Also,

- What is the maximum number of seed numbers that can be provided and still result in an ambiguous (unsolvable) puzzle?
- What is the minimum number of seed numbers that can be provided to generate a (uniquely) solvable puzzle?

We were provided two puzzles – one was rated "Easy" the other "Difficult".

- What goes into the rating system?
- Does a difficult puzzle necessarily have fewer seed numbers?
- Is the rating of the complexity somehow determined by the deductive skills required?

Math 122 Information Sheet

Name:

Email:

Cell phone:

Intended Major:

Hometown:

List any other college math courses you have taken.

Briefly describe why you think math is useful.

What are your expectations and goals for this course?

What are some of the co-curricular or other campus activities you would like to participate in this year?