Math 121: Calculus I **2019**

Calculus, Smith and Minton 4th edition, Chapters 1-4,7

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Course Objectives: *Continue to learn how to do mathematics!* Mathematics is a problem-solving discipline, and we all have room to improve. To develop as problem-solvers, we must focus on technique and not on memorization. In this course, we focus on the basics of calculus, the gateway to understanding the modern world. A common complaint about calculus is that there are too many formulas, and the formulas are confusing. The way to avoid this problem is to not memorize formulas! If you spend time learning the thought process and concepts behind the formulas, and *practice working problems*, the formulas will make sense and be familiar enough that no memorization is needed. Like all math courses, thinking is the key!

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

- Apply the "infinity principle" to problems of interest in the world
- Solve numerous problems using derivatives and integrals
- Apply several calculus techniques, and know which to use in a given situation
- Recognize calculus principles in graphical and written descriptions of problems
- Use technology (*Mathematica)* to solve calculus problems of importance

Attendance Policy: Attendance and attention in class is essential! Work hard in class and you will have little need for studying the night before a test. You are responsible for everything done in class, through attendance and sharing class notes with classmates. If you miss a class, e-mail or call me before class is over and explain why. With the first unexplained absence, you and your advisor and the registrar will be warned that another unexplained absence will result in removal from the course. **If you have two unexplained absences, you will be dropped from the course.**

Equipment: We will use Mathematica in class, on homework assignments and on tests. You are encouraged to get a copy installed on a laptop or desktop. This is free! Take advantage of this great offer. We will practice using Mathematica in class. There will be homework problems and test questions that will be very hard to work without Mathematica! There will be specific homework assignments to get practice using Mathematica. Please note that Mathematica is used extensively in higher-level mathematics courses.

Study Problems: In each section of the book that we cover, I will give you a list of problems to study. Work as many of these problems as you can! Test questions will be based on these problems and the problems we work in class. There are some topics in the book that you are not responsible for learning; the study problems will indicate what topics you will see on tests.

Quizzes: Every class, other than test days, will start with a brief 5-minute quiz. The quiz ends at 10:55, so get to class on time! Quiz topics may be "old" problems for recall, problems similar to ones done in class the previous class, or "graph" problems to work. You will be graded on a scale of 0 (not turned in), 1 (not a reasonable effort), or 2 (reasonable effort, not necessarily perfect).

Reports: A small number of "graph" problems and book exercises will be listed for reports to complete. *You must turn in at least one report every quarter* (8/28 to 9/20, 9/23 to 10/11, 10/21 to 11/8, 11/11 to 12/6). Your best 5 grades count, with at least one grade per quarter. You may work these by yourself but I encourage you to work in pairs; however, do not repeat partners. Get to know your colleagues and learn from each other!

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

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 reflection paper, giving a brief summary of the talk and expanding on some aspect of particular interest to you. Reports are due within a week of the talk. A sample is shown below.
One report must be turned in before fall break.

Recitation: You must be enrolled in the recitation portion (MATH 121R) of the course. The recitation will review important concepts needed for calculus (such as trigonometry and exponential functions) and provide practice time for concepts introduced in MATH 121. While MATH 121R operates as a separate course content-wise, please realize that grades from MATH 121R feed into MATH 121, counting 10% of the grade. Consult the recitation course syllabus for additional information on policies and grading.

Tests: There will be six test days and a final exam. Each test will cover all topics covered to that date, emphasizing material since the previous test. Test dates are F 9/13, F 9/27, F 10/11, F 11/1, F 11/15 and W 12/4. The exam is Tuesday, 12/10, 8:30-11:30 and is comprehensive.

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

Academic Integrity: The college policy is fully supported. Tests are closed notes, closed book unless noted. Electronic devices other than computers are not allowed in test situations, and computers may only be used for computation purposes in Mathematica.

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" math 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 distract you from the end-of-semester studying that you need to do.

Grading:

Reports: 14%	Daily work and co-curricular: 8%
Technology assignments: 8%	Recitation: 10%
Tests: 48%	Exam: 12%

Grades may be curved up based on extenuating circumstances, including improvement as the semester goes on.

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		

Community: Welcome to the mathematics community! I hope you will take advantage of the opportunity to get to know me and the outstanding faculty in our department. You may get to know us and other students in the MCSP Study Room (Trexler 271) which is near most of the faculty offices. There is an active Math Club and there is a weekly department tea, which is an informal time to chat, play games, and eat cookies (and drink tea, if you like). Ask me for more information on these and other opportunities such as Stat Crew that I help run.

Math 121 Schedule

Date	Sections	Topics	Study Problems
W 8/28	1.1	Introduction	
F 8/30	1.2	Concept of Limits	p.75 W1,1-4,7-9,11-12,15-18,23-24,29
M 9/2	1.3	Computation	p.85 1-2,5-8,13-18,21-22,25-26,43-46
W 9/4		Mathematica Introduction (worksheet)	
F 9/6	1.4	Continuity	p.94 1-6,11-18,21-24,29,60,63
M 9/9	1.5	Infinite Limits	p.103 1-6,9-12,15-16,23-26,33-34,70
W 9/11	2.1	Tangents, Velocity	p.134 1-6,13-16,23-24,39-40
F 9/13	TEST #1		
M 9/16	2.2	The Derivative	p.143 1-2,5-12,15-18,27-28,43-44,47-48
W 9/18	2.3,4	Derivative Rules	p.151 1-8,15-18,25-6 p.158 1-2,5-10,35-6
F 9/20	2.5	Chain Rule	p.165 5-12,23-24,35-36
			END OF 1st Quarter
M 9/23	2.6,7	Derivative Rules	p.173 1-6,19-24 p.181 1-10,19-22
W 9/25		Derivative Recap	
F 9/27	TEST #2		
M 9/30		Mathematica Derivatives (worksheet)	
W 10/2	3.2	L'Hôpital's Rule	p.230 1-12,21-26,41-42
F 10/4	3.3	Maxima/Minima	p.241 3-18,25-28,55 p.249 3-10,17-20
M 10/7	3.4,5	Increase/Concavity	p.249 27-30,33-6 p.257 1-4,7-12,15-20
W 10/9	3.6	Curve Sketching	p.257 37-40 p.267 1-16
F 10/11	TEST #3		END OF 2nd Quarter

FALL BREAK

Math 121 Schedule

Date	Sections	Topics	Study Problems
M 10/21	3.1	Linear App.	p.220 1-8,13-16(a),25-30
W 10/23	2.8	Implicit Derivatives	p.191 3-10,29-32
F 10/25	3.7	Optimization	p.276 1-4,11-15,23-24
M 10/28	3.8	Related Rates	p.283 9-12,15-18,29-30
W 10/30	3.9	Rates of Change	p.292 1-6,29-32,37-41
F 11/1	TEST #4		
M 11/4	4.1	Antiderivatives	p.307 W3,5-12,17-24,31-34,45-48
W 11/6	4.2	Sums	p.315 5-14,23-26
F 11/8	4.3	Area	p.321 1-4,5-8,19-22
			END OF 3rd Quarter
M 11/11	4.4	Definite Integral	p.332 3-8,15-20,23-24,35-40,45-52
W 11/13		Mathematica Integration (worksheet)	
F 11/15	TEST #5		
M 11/18	4.5	Fundamental Theorem	p.341 1-10,15-22,25-28,51-54
W 11/20	4.6	Substitution	p.349 W1,5-8,11-16,31-36,45-48
F 11/22		Integration Recap	
M 11/25	7.1	Modeling	p.507 9-14,17-22,29-34,45-46
Thanksgiving Week			
M 12/2	7.2	Separable DEs	p.515 1-2,5-10,21-24,chart/steady 29-32
W 12/4	TEST #6		
F 12/6	Review		END OF 4th Quarter
T 12/10	EXAM 8:30-11:30		

Attitude Quiz

Don't be afraid to fail! If you haven't failed frequently, you aren't trying very hard. Another way to look at it is that a missed problem isn't really a failure, it just means that you need more time to try again. Research shows that many of the techniques we learn the best are the ones that we struggle with at first. Give honest answers to the following and think about how you want to approach this course and others at Roanoke College.

Prep: Rate yourself 3 (I come to class with questions) to 0 (I don't prepare for class)

Class: Rate yourself 3 (I always learn in class) to 0 (I just try to stay awake in class)

Resourceful: Rate yourself 3 (I ask professor, others for help) to 0 (I give up easily)

Relentless: Rate yourself 3 (I get stuck often) to 0 (I wait to see problems done in class)

Positive: Rate yourself 3 (being confused is okay) to 0 (I don't try if it looks hard)

Tough: Rate yourself 3 (I try problems every day) to 0 (I only do work the night before)

Complete: Rate yourself 3 (I think about whether my answers make sense) to 0 (I just want to get the right answer)

15 and above is a good score. 7 or below and you're not giving yourself much of a chance to succeed (although it may be comfortable because you're not trying hard enough to fail very often, either).

From Jessica Lahey (in the book *How Humans Learn* by Joshua Eyler): "A fear of failure can poison learning by creating aversions to the kinds of experimentation and risk taking that characterize striving."

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 121 Information Sheet

Name:

Email:

Cell phone:

Intended Major:

Hometown:

List the math/stat course(s) you took last year.

How hard do you expect calculus to be? How interesting?

Why is calculus important?

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