

MATH122, Fall 2019: Calculus II

Instructor	Maggie Rahmoeller Email: rahmoeller@roanoke.edu	Phone: (540) 375-2505 Office: Trexler 270J																																							
Class Meetings	MWF: 10:50AM-11:50AM in Trexler 263																																								
Office Hours	By appointment only through drmaggie.youcanbook.me/ (or email me if no time slots are available). You can book up to 3 days in advance but you have to book at least 15 minutes before the time slot.																																								
Course Description	This course provides a continuation of the study of calculus. Topics to be studied include applications and techniques of integration, applications and the calculus of functions of several variables, and sequences and series and their applications.																																								
Intended Learning Outcomes	By the end of this course, successful students will be able to: <ul style="list-style-type: none">• apply the theory of differentiation and integration to model and solve real-world problems.• apply techniques of differentiation and integration to solve problems involving functions of two or more variables.• determine the behavior of infinite series and understand the role of power series and Taylor series in modern mathematics.• recognize the role of technology in Calculus, understand when it should be used, and be aware of its limitations.																																								
Required Materials	Textbook: <i>Calculus: Early Transcendental Functions</i> , by Smith and Minton, 4th Edition Technology: Laptop with Mathematica installed Mathematica Free Download: see https://webapps.roanoke.edu/www/it/mathematica/ Calculator: A calculator (optional) Prerequisite: MATH 121 (Calculus I) or the equivalent																																								
Commitment Hours	This course expects you to spend at least 12 hours of work each week inside and outside of class.																																								
Course Grades	The following table lists the weights for the various forms of assessment for this class. <table><tr><td colspan="3">Homework 20%</td><td colspan="3">Labs & Projects 20%</td><td colspan="3">Mastery Exams 60%</td></tr></table> A grade scale will be determined after final grades are computed, but will be no worse than the scale given below: <table><tr><td></td><td></td><td>B+</td><td>87-89</td><td>C+</td><td>77-79</td><td>D+</td><td>67-69</td><td></td><td></td></tr><tr><td>A</td><td>93-100</td><td>B</td><td>83-86</td><td>C</td><td>73-76</td><td>D</td><td>63-66</td><td>F</td><td>0-59</td></tr><tr><td>A-</td><td>90-92</td><td>B-</td><td>80-82</td><td>C-</td><td>70-72</td><td>D-</td><td>60-62</td><td></td><td></td></tr></table>		Homework 20%			Labs & Projects 20%			Mastery Exams 60%					B+	87-89	C+	77-79	D+	67-69			A	93-100	B	83-86	C	73-76	D	63-66	F	0-59	A-	90-92	B-	80-82	C-	70-72	D-	60-62		
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Attendance & Make-Up Work	Attendance is critical to the understanding of the material in the course; it is both required and expected. Any absence that is not discussed with the instructor prior to the missed class is considered unexcused. Unexcused absences may result in the lowering of the final grade (for example, a B to a B-). When absent, excused or unexcused, you are responsible for all material covered in class. You will not be allowed to make up any work missed due to an unexcused absence. Should you miss a class or part of a class, email or talk to me as soon as possible to see if anything can be done to help you catch up.																																								

Late Work	Each day an assignment is late, your grade on that assignment will be reduced by one letter grade. I will not accept assignments that are more than three days late.
Homework	<p>A problem set will be due each Monday. These will be assigned on the previous Monday (except for HW 1) and each are worth a total of 25 points. There are two parts to each problem set. The first part is worth 15 points and will be graded based on correctness and presentation. Each week you will complete 3 problems in this first part. Each of these problems is worth 5 points - 4 points are for correctness and 1 point is for presentation. The second part of each problem set is worth 10 points and will be graded based on effort and completeness. This part will consist of the three daily homework assignments for the previous three class periods.</p> <p>When you turn in your problem set on Monday, make sure the first part is on top (the problems graded for correctness) and the second part below. Your homework should be neat, organized, and stapled. Solutions will be posted on the following Wednesday. You can collaborate on problems sets, but you must write up your own solution. If you are looking at another person's work or asking someone what to do next while writing up your problem set, then you are in violation of the academic integrity policy of Roanoke College.</p>
Quizzes	There may be written quizzes in this class. They may either be in-class quizzes or takehome quizzes. I may occasionally warn you about an upcoming quiz but you should be prepared to take a quiz on any given day, including lab days. These quizzes will always be extra-credit - any points earned will go toward your test grade.
Labs	We will have 1 in-class lab and at least 3 out-of-class labs, all of which use Mathematica. You must work on these labs with a different partner each time.
Co-Curricular Activities	The MCSP department and Roanoke College offer many opportunities to engage with mathematical ideas outside of classes. Members of this class are encouraged to attend many of these activities, however attending at least two is mandatory. Examples include MCSP Conversation Series talks and student research showcases - if you're unsure if a given activity makes sense for this purpose, please email me to ask. Within one week of attendance you must submit a brief response to the activity. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience. Each response will be worth 10 points and count toward your homework grade.
Departmental Tea	Our department offers a weekly tea time for students and faculty - stop by the MCSP Study Lounge (Trexler 271) for tea and cookies on Thursdays from 2:15 - 3:15PM. Come meet other students as well as chat with the MCSP faculty members in a casual setting.
Accessible Education Services	Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Laura Leonard, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Laura Leonard at your earliest convenience to schedule an appointment.

Academic Integrity

Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! No electronic devices other than calculators can be taken out during any class or testing period (this includes cell phones) unless written consent is given by the professor (e.g. Mathematica may be allowed for some tests). Note that looking at or using your cell phone during a test or quiz is considered a violation of Academic Integrity regardless of your purpose or intent in doing so.

Subject Tutoring Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4 pm - 9 pm, Sunday - Thursday. We are a Level II Internationally Certified Training Center through the College Reading and Learning Association (CRLA). Subject Tutors are highly trained Roanoke College students who offer one-on-one tutorials in a variety of general education and major courses such as: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, INQ 250, and Social Sciences. Tutoring sessions are available in 15, 30, or 45-minute appointments. Feel free to drop by for a quick question or make an appointment at https://libguides.roanoke.edu/subject_tutoring for a longer one-on-one appointment. For questions or concerns, please contact us at 540-375-2590 or subject_tutoring@roanoke.edu.

Exams We will be making use of “Mastery-Based Examination,” a system that is probably very different from what you are used to; do not hesitate to ask me questions in class or my office at any time. In the mathematics community many are working with and researching this technique, and one of the best starting sources for understanding can be found at <https://mbtmath.wordpress.com>. Much of what you’ll find on this syllabus is taken from this resource.

Short Description: You only receive credit for answers that demonstrate you completely understand (have mastered) a topic. But, you get many chances to display mastery throughout the semester with no penalty at all for earlier attempts.

Long Description: The course has been boiled down to 22 essential types of questions, or “topics,” and your mastery of questions on these topics is assessed through seven mastery testing days, one smaller mastery testing opportunity between testing days, and the final exam period. Each problem submitted is graded as either “mastered” or “not mastered” and a grade of “mastered” indicates that you have demonstrated full understanding of the concept being tested and further work on the topic is not necessary. Once you have mastered a problem you need not ever attempt it again on a future exam, including the final exam. There is no penalty whatsoever for multiple attempts taken to achieve mastery.

Your overall exam grade is then determined by the number of topics you have mastered throughout the semester; see below for more about how the number of topics translates to a grade for the exam portion of the class and what the topics are!

Why such a different examination policy? A typical policy that has four tests on which material on test 1 is not revisited until the final exam promotes a “fixed mindset” mentality and does not encourage growth in learning; allowing multiple attempts to achieve mastery on a single topic is a “growth mindset” – we firmly believe that you can all do this! It may just take some of you a little longer or shorter for certain topics. Rather than thinking “I can’t do this” you should be thinking “I can’t do this, yet” and work towards getting it done.

Notes on Mastery-Based Examination (in no specific order, credit to Austin Mohr):

- Clear content objectives, students continually know exactly what they need to work on to improve.
- Credit only for eventual mastery. No partial credit.
- Multiple attempts with complete forgiveness.

- A points-based system sets arbitrary deadlines by which time perfection must be attained or else penalties apply.
- Perseverance:
 - Points: Try a problem once, maybe twice, hope for the best.
 - Mastery: Keep trying until you succeed (and I know you can).
- Use of feedback on exams:
 - Points: Do you agree with the instructor's grading?
 - Mastery: What can I do to fully demonstrate that I understand the concept (improvement!)?
- Reduced Anxiety:
 - Points: Every exam has the potential to damage your GPA.
 - Mastery: No one exam can harm your grade.
- Intelligent Test Preparation: You may actually choose to skip problems on a test. Better to achieve mastery on some than to demonstrate mediocrity on all. Given time constraints of the latter tests, most students will only be able to focus on 5-8 problems in 90 minutes.
- Formative Assessment:
 - Points: How many points is this error worth?
 - Mastery: Will the student benefit from studying the concept again?
- No longer will any of us have to wonder just what exactly a 7/10 means on a problem compared to an 8/10.
- In most points-based systems, a blank exam question is a heavy blow to a student's grade. On the other hand, a student who provides a couple relevant formulas and something resembling the beginning of a solution may receive half credit or more. In the presence of constrained study time, a good strategy is to learn some basics about every test item. Such a student may earn half credit on most items together with a few lucky shots on easier items, which amounts to a passing grade overall. Take a moment to consider whether this experience has adequately prepared the student to apply mathematical thinking to nontrivial problems in the future.

The "broad and superficial" strategy employed above earns no credit under a masterybased system. Instead, a student who wishes to earn a passing exam grade must fully understand an appreciable subset of the main ideas of the course, and a student wishing to earn an A grade must fully understand most or all of the main ideas of the course. Even if students spend no time studying a particular item, we contend that the experience of pursuing deep understanding on the other items leaves them in a stronger position to engage deeply with the troublesome topic when it is needed in the future. Moreover, depth of understanding is critical to one's ability to apply existing mathematical knowledge in novel domains.

There are seven mastery days listed on the day-by-day schedule part of this syllabus. On these days, you will have the opportunity to attain mastery in any of the topics we have covered up to that date...with one caveat: **you must attempt to master any new topics available that day**. There is also one mini-mastery day listed on the schedule, and on this day, we will use 30 minutes during a regular class period so that you can attempt mastery in up to two topics of your choice; you must contact the instructor prior Midnight the day before a mini-mastery attempt with your choice of topics to attempt. Finally, you will have one opportunity during the final exam week in order to achieve mastery.

The exam portion of your course grade will be based on the number of topics mastered; here is a conversion of the number mastered to a percentage for the exam portion of the grade.

Topics Mastered	22	21	20	19	18	17	16	15	14	13	12
Exam Percentage	100	97	94	91	88	85	82	79	76	72	68
Topics Mastered	11	10	9	8	7	6	5	4	3	2	1
Exam Percentage	64	60	55	50	45	40	35	30	20	10	0

Final Exam The final exam will be given during the scheduled time for the final exam for **Block 3**, Tuesday Dec 10 8:30 - 11:30AM, in Trexler 263.

Topics

Topic #	Name	Textbook Section
1	Integration: Projectile Motion	5.5
2	Integration: Area Between Curves	5.1
3	Integration: Volume	5.2
4	Integration: Physics	5.6
5	Integration: Probability	5.7
6	Integration: By Parts	6.2
7	Integration: Improper	6.6
8	Multivariable Functions: Basic	12.1
9	Multivariable Functions: Partial Derivatives	12.3
10	Multivariable Functions: Directional Derivatives	12.6
11	Multivariable Functions: Extrema	12.7
12	Multivariable Functions: Double Integrals	13.1
13	Multivariable Functions: Area, Volume, Center of Mass	13.2
14	Polar Coordinates: Basic	9.4
15	Polar Coordinates: Double Integrals	13.3
16	Sequences	8.1
17	Series: Core	8.2
18	Series: Ratio Test	8.5
19	Power Series	8.6
20	Taylor Series: Core	8.7
21	Taylor Series: Error	8.7
22	Taylor Series: Applications	8.8

Wed	Aug 28	5.5	Intro and Projectile Motion
Fri	Aug 30	5.5	Projectile Motion
Mon	Sept 2		Lab 1: In-Class
Wed	Sept 4	5.1	Area Between Curves
Fri	Sept 6	5.2	Volume
Mon	Sept 9	5.6	Applications of Integration
Wed	Sept 11	5.6	Applications of Integration
Fri	Sept 13		Mastery Day
Mon	Sept 16	5.7	Probability
Wed	Sept 18	6.2	Integration by Parts
Fri	Sept 20	6.6	Improper Integrals Lab 2 assigned
Mon	Sep 23	12.1	Functions of Several Variables
Wed	Sep 25	12.3	Partial Derivatives Lab 2 due
Fri	Sept 27		Mastery Day
Mon	Sept 30	12.6	Gradient and Directional Derivatives
Wed	Oct 2	12.7	Extrema of Functions
Fri	Oct 4	13.1	Double Integrals
Mon	Oct 7	13.1	Double Integrals
Wed	Oct 9	13.2	Area, Volume, Center of Mass
Fri	Oct 11		Mastery Day
Fall Break			
Mon	Oct 21	13.2	Area, Volume, Center of Mass
Wed	Oct 23	9.4	Polar Coordinates
Fri	Oct 25	13.3	Double Integrals in Polar Coordinates
Mon	Oct 28	8.1	Sequences
Wed	Oct 30	8.2	Series
Fri	Nov 1		Mastery Day
Mon	Nov 4	8.2	Series
Wed	Nov 6	8.5	Ratio Test for Series & Mini Mastery
Fri	Nov 8		Career Services Day
Mon	Nov 11	8.5	Ratio Test for Series
Wed	Nov 13	8.6	Power Series Lab 3 assigned
Fri	Nov 15		Mastery Day
Mon	Nov 18	8.7	Taylor Series
Wed	Nov 20	8.7	Taylor Series Lab 3 due
Fri	Nov 22		Mastery Day
Mon	Nov 25	8.8	Applications of Taylor Series
Thanksgiving Break			

Tentative Schedule

Mon	Dec 2	8.8	Applications of Taylor Series Lab 4 assigned
Wed	Dec 4		Mastery Day
Fri	Dec 6		Review Lab 4 due Sunday Dec 8, Midnight
Tuesday	Dec 10		Final Exam: 8:30 - 11:30AM, Trexler 263