

MATH 122 A, Fall 2021: Calculus II

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Class Meetings	Wednesdays, Fridays: 12:00-1:00 PM in Trexler 263	
Zoom:	https://roanoke-edu.zoom.us/j/5403752449	
Office Hours	Mondays, Wednesdays, Fridays: 1:10-2:10 PM by appointment in Trexler 270G or on Zoom	

Course Objectives This course provides a continuation of the study of calculus. Topics to be studied include more applications of the definite integral, sequences and series and applications of them, and vectors and functions of one variable.

- Intended Learning Outcomes**
- By the end of this course, successful students will be able to:
- apply the theory of differentiation and integration to model and solve real-world problems.
 - recognize a differential equation and be able to both solve basic differential equations and discuss what a differential equation tells you about the process it models.
 - determine the behavior of infinite series and understand the role of power series and Taylor series in modern mathematics.
 - understand functions of several variables and their applications.
 - recognize the role of technology in Calculus, understand when it should be used, and be aware of its limitations.

Required Materials Textbook: *Calculus: Early Transcendental Functions*, by Smith and Minton, 4th Edition
Lab Technology: Laptop with Mathematica installed
Mathematica Free Download: see <https://webapps.roanoke.edu/www/it/mathematica/>
Calculator: A calculator with graphing capabilities
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.
HW/Labs 15% Mastery Exams 85%

A grade scale will be determined after final grades are computed, but will be no worse than the scale given below:

		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		

Reading

The key to learning a topic in mathematics is participation. We will strive to have an active, rather than passive, classroom environment. Near the end of the syllabus is a day-by-day outline of the sections that will be discussed in class. You are fully expected to have read the upcoming section before the class meeting! This does not mean you need to understand everything, but rather you should be familiar with the definitions and concepts from the sections. You should also reread the section *after* class so that you can clarify topics from class and help prepare you further.

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 four mastery testing days, smaller mastery testing opportunities between testing days, and the final exam periods. 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 four 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. There are also four mini-mastery days listed on the schedule, and on these days, 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 9 AM the day of a mini-mastery attempt with your choice of topics to attempt. Finally, you will have two opportunities 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
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Homework

At the end of each class period during which content is discussed, practice problems will be assigned. It is expected that students work all these problems. To keep you from procrastinating and to measure understanding, an overwhelming majority of class days will begin with a “problem of the day”. When you enter the classroom there will be a problem displayed for you to work and turn in. This problem will be due 5 minutes after the start of our class time regardless of when you enter the classroom.

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 count as a homework assignment.

Final Exam

Friday, December 17 at 2:00-5:00PM

Class Safety

The College has issued a mask mandate for the start of the semester that requires masks to be worn in indoor common spaces such as our classroom. You must wear a mask in this class. If you arrive without a mask, you will not be allowed to stay and may lose credit for attendance or in-class work. The Bookstore sells masks if you need to make a quick purchase. If the mandate is extended, you will be required to continue to wear a mask.

If you have a temperature of 100.4 or higher or other COVID symptoms, don’t come to class. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about COVID symptoms. If Health Services informs you that you should isolate and not attend class for multiple days, inform me so that we can make a plan to keep you current in the course. All absences caused by consultation with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused but you will need to do the work and graded assignments even if we extend a deadline for you.

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. 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.

MCSP Conversation Series

The Department of Mathematics, Computer Science and Physics offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face our discipline. Members of this class are invited be involved with all of these meetings; however participation in **at least two** of these sessions is mandatory. After attending, students will submit a one page paper reflecting on the discussion **within a week of attending the talk**. This should **not** simply be a regurgitation of the content, but rather a personal contemplation of the experience. These reaction papers will be counted as homework and should be uploaded to Inquire using the appropriate link.

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 located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60-minute appointments at www.roanoke.edu/tutoring. If you have a question, feel free to stop by, or contact us at subject_tutoring@roanoke.edu or 540-375-2590. See you soon!.

Wed	Sep 1	7.1	Introduction and Projectile Motion
Fri	Sep 3	7.1	Projectile Motion
Mon	Sep 6	5.1	Area Between Curves
Wed	Sep 8	5.2	Volume
Fri	Sep 10	5.6	Applications of Integration
Mon	Sep 13	5.6	Applications of Integration
Wed	Sep 15		Mastery Day
Fri	Sep 17	5.7	Probability
Mon	Sep 20	6.2	Integration by Parts
Wed	Sep 22	6.6	Improper Integrals
Fri	Sep 24	12.1	Functions of Several Variables
Mon	Sep 27	12.3	Partial Derivatives
Wed	Sep 29		Mastery Day
Fri	Oct 1	12.7	Extrema of Functions
Mon	Oct 4	12.7, 12.8	Extrema of Functions and Lagrange Multipliers
Wed	Oct 6	13.1	Double Integrals
Fri	Oct 8	13.1	Double Integrals
Mon	Oct 11	13.2	Area, Volume, Center of Mass
Wed	Oct 13		Mastery Day
Fri	Oct 15	13.2	Area, Volume, Center of Mass
Fall Break			
Mon	Oct 25	9.4	Polar Coordinates
Wed	Oct 27	13.3	Double Integrals in Polar Coordinates
Fri	Oct 29		No Class
Mon	Nov 1	8.1	Sequences
Wed	Nov 3		Mastery Day
Fri	Nov 5	8.2	Series
Mon	Nov 8	8.2	Series
Wed	Nov 10	8.5	Ratio Test
Fri	Nov 12	8.5	Ratio Test
Mon	Nov 15	8.6	Power Series
Wed	Nov 17	8.7	Taylor Series
Fri	Nov 19	8.7	Taylor Series
Mon	Nov 22		Mastery Day
Wed	Nov 24		Thanksgiving Break
Fri	Nov 26		Thanksgiving Break
Mon	Nov 29		Mathematica Lab
Wed	Dec 1	8.8	Applications of Taylor Series
Fri	Dec 3	8.8	Applications of Taylor Series
Mon	Dec 6		Review

Tentative Schedule

Wed Dec 8

Mastery Day

Fri Dec 10

Review

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: Local Extrema	12.7
11	Multivariable Functions: Absolute 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

Fri Dec 17 **Exam Block 2-5PM AM: Mastery Day Topics**