Instructor: Dr. Chris Lee Trexler 270D clee@roanoke.edu (540) 375-2347

Office Hours: I am available for office hours: Mon/Wed: 1:00 – 3:00pm Tue/Thu: 3:00-4:30pm
All office hours are by appointment. To make an appointment, please use the link:
https://drchrislee.youcanbook.me/

Course Meetings
Mondays, Wednesdays, and Fridays: 10:50-11:50am
Thursday: 8:30am - 10:00am lab, Trexler 372

Course Information
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 several variables.

Intended Learning Outcomes
By the end of this course, 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 equations 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.
- Utilize vectors in two-dimensional and higher-dimensional coordinate systems to model graphs and equations, and apply methods of Calculus to these graphs and equations.
- 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*; Smith and Minton, 4th Edition
Suggested Laptop

Prerequisite
Math 121 Calculus I or equivalent.

Course Grades
The following table lists the weights for the various forms of assessment for this course

Labs	20%
Tests	80%

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

0	*60*	*63*	*67*	*70*	*73*	*77*	*80*	*83*	*87*	*90*	*93*	
F	*D-*	*D*	*D+*		*C-*	*C*	*C+*	*B-*		*B*	*B+*	*A-*

A

Reading and Participation
The key to learning a topic in mathematics is reading and participation. We will strive to have an active, rather than passive, classroom environment. The last page 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.

Practice Problems: Mathematics is learned by practice, and there is no substitution for putting pencil to paper and working lots of problems. Practice problems will be assigned virtually every class period and students are expected to work them all. These problems are not an individual component of your grade, but tie directly to the topics being studied and will prepare you for the tests. On any given day students should turn in any problems on which they wish to receive feedback.

Late Work: Unless specific permission is given in advance of the due date, no late work will be accepted.

Attendance
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. I will assume that if you accumulate 3 unexcused absences you are not interested in completing the course and will drop you from the class (DF). 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.

MCSP Conversations
The Department of Math, 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 within one week of the presentation a one page paper reflecting on the discussion. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience.

Labs
The mathematics we will be learning has a large number of applications which we will explore during weekly technology labs. Most of our labs will be done using the Mathematica computer algebra system and will last 1.5 hours and typically require a problem set or lab write-up. The labs will be graded using a portfolio system. The first group of four labs will be marked up with comments and suggestions, but no numerical grade will be assigned. Then, you will pick one of the four labs to re-work, addressing suggestions and showing your best work. This will be graded. This process will then be repeated for the second set of four labs.

The Office of Disability Support Services, located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library, provides reasonable accommodations to students with identified disabilities. Reasonable accommodations are provided based on the diagnosed disability and the recommendations of the professional evaluator. In order to be considered for disability services, students must identify themselves to the Office of Disability Support Services. Students requesting accommodations are required to provide specific current documentation of their disabilities. Please contact Dr. Bill Tenbrunsel, Director of the Center for Learning & Teaching, at 540-375-2247 or e-mail tenbruns@roanoke.edu.
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If you are on record with the College's Office of Disability Support Services as having academic or physical needs requiring accommodations, please schedule an appointment with Dr. Tenbrunsel as soon as possible. You need to discuss your accommodations with him before they can be implemented. Also, please note that arrangements for extended time on exams, testing, and quizzes in a distraction-reduced environment must be made with the Center for Learning & Teaching at least 2 business days (M-F) *before every exam*.

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 an approved calculator, laptop, or iClicker can be taken out during any class. During periods of testing, only Mathematica will be allowed unless otherwise announced.

Cell Phones: This is very simple - no cells phones are allowed to be used or even visible in our classroom. This includes before, during, and after class. If a cell phone is seen, the student will be asked to leave the classroom and the day will be counted as an unexcused absence.

Testing:
We will be making use of "Mastery-Based Testing". This system is 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, one of the best starting sources for understanding can be found at https://mbtmath.wordpress.com. Much of what you'll find on the next two pages 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 18 essential types of questions, or "topics", your mastery of questions on these topics is assessed through four tests and the final exam. Each problem submitted is graded as either "Master" or "Not Mastered". A grade of Master 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 test, including the final exam. There is no penalty whatsoever for multiple attempts taken to achieve mastery.

Test 1: Topics 1-4
Test 2: Topics 1-9.
Test 3: Topics 1-13.
Test 4: Topics 1-18.
Final Exam: Topics 1-18.

Your overall test grade is then determined by the number of questions/topics you have mastered.

# Mastered	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Test Grade	100	96	92	88	84	80	76	72	68	64	60	56	50	40	30	20	10	0

Notes on Master-Based Testing (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 a
- 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 I agree with the instructors grading
  Mastery – what can I do to fully demonstrate that I understand the concept (improvement!)
- Reduced Test Anxiety
  Points – every test has the potential to damage your GPA.
  Mastery – no one test 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 60 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 mastery-based 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, I 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.

Here is the list of 18 topics for which you will be seeking mastery during this course. Note that the earlier topics will be available on all exams, while you will have fewer opportunities to master later topics as they occur later in the semester.

1. Differential Equations
2. Applications of Integration
3. Sequences & Series
4. The Ratio Test
5. Power Series
6. Taylor Series
7. Applications of Series
8. Vectors
9. Dot & Cross Products
10. Applications of Dot & Cross Products
11. Vector-Valued Functions
12. Motion in Space
13. Surfaces in Space
14. Functions of Several Variables
15. Partial Derivatives
16. Double Integrals
17. Applications of Double Integrals
18. Double Integrals in Polar Coordinates

Course Schedule - This course expects you to spend at least 12 hours of work each week inside and outside of class.

Wed	Aug 30	TOPIC		Intro
Thu				**Lab 1**: Intro to Mathematica – Graphing / Computation
Fri		1	7.1, 7.2	Differential equations
Mon	Sept 4	2	5.5	Projectile Motion
Wed		2	5.6	Applications of Integration
Thu				**Lab 2**: Intro to Mathematica – Solving and M&M's
Fri		2	5.7	Probability
Mon	Sept 11	3	8.1, 8.2	Sequence & Series
Wed		3	8.2	Infinite series
Thu				**Lab 3**: Problem 1 – Bouncing Ball
Fri		4	8.5	Ratio Test
Mon	Sept 18	4	8.5	Ratio Test
Wed				Review
Thu				**Test 1**
Fri		5	8.6	Power Series
Mon	Sept 25	5	8.6	Power Series
Wed		6	8.7	Taylor Series
Thu				**Lab 4**: Series Tutorial
Fri		6	8.7	Taylor Series
Mon	Oct 2	7	8.8	Applications
Wed		7	8.9	Fourier Series
Thu				**Lab 5**: Problem 2 – Hidden Figures
Fri		8	10.1, 10.2	Vectors
Mon	Oct 9	9/10	10.3	Dot Product
Wed				Review
Thu				**Test 2**
Fri				What is Math?
Fall Break				
Mon	Oct 23	9/10	10.4	Cross Product
Wed		9/10	10.5	Lines and Planes in Space
Thu				**Lab 6**: Looking Ahead Tutorial
Fri		11	11.1	Vector-Valued Functions
Mon	Oct 30	11	11.2	Calculus of Vector-Valued Functions
Wed		12	11.3	Motion in Space
Thu				**Lab 7**: Problem 3
Fri		13	10.6	Surfaces in space
Mon	Nov 6	13	10.6	Surfaces in space
Wed				Review
Thu				**Test 3**
Fri		-	11.6	Parametric Equations
Mon	Nov 13	14	12.1	Functions of several variables
Wed		15	12.3	Partial Derivatives
Thu				**Lab 8**: Wild Card
Fri				
Mon	Nov 20	16	13.1	Double Integrals
Thanksgiving Break				
Mon	Nov 27	16	13.1	Double Integrals
Wed		17	13.2	Area, Volume, Center of Mass
Thu				**Lab 9**: Problem 4
Fri		18	9.4	Polar Coordinates
Mon	Dec 4	18	13.3	Double Integrals in Polar Coordinates
Wed				Review
Thu				**Test 4**
Fri				Review
Tue	Dec 12		**Final Exam**, 8:30-11:30am	