Before we get started....

There are two main components to any university course: the learning (we all know what that is) and the assessment (i.e., gauging student learning from assigned tasks, or "grading"). This class operates very differently in <u>both</u> aspects. I do this because I think (a) it makes for a better, more engaging class and (b) it benefits and enriches student learning.

First, I teach this course using a *flipped classroom* model. As a consequence I will rarely lecture or simply "hand out" knowledge to you. Instead, you will gain knowledge through *discovery and discussion.* You will learn Calculus by trying things (and struggling!) by yourself *outside of class time*, followed by explorations in small groups using guided activities in class. Here's how. Before we begin a new topic in class, you will spend a significant amount of time prior to our class meeting exploring the concepts yourself, mainly through readings, videos, and exploratory problems. This *class preparation* is vital to your success in the course and therefore counts as a significant part of your grade. This typically creates some initial stress or confusion at the beginning of the semester, as students are likely to ask "How can I possibly learn Calculus this way by myself?"

To be clear, **you won't**. When you come to class the next day, we will dedicate our time together to working in small groups to solidify our understanding of the concepts from the class prep assignment. We will work in groups on a carefully scaffolded set of activities that—with enough of your hard work—begin to piece together the full story of the topic at hand. Your professor (and TA) will circulate among the groups, engaging you in discussion and critique of your work on the activities. The discussions you have with your groupmates and your professor are where the learning truly occurs. However, none of this works without you having done some explorations yourself before class begins. So again, the class prep work is key not only to your own success, but to the success of your group as well.

Second, the grading scheme in this course is unique. I believe two things are undeniably true: (1) people learn at different rates and (2) everyone makes mistakes. Traditional grading by "one shot" exams ignores both of these facts. Therefore, I do not use traditional exams. Instead, I use an assessment construct known as *mastery grading.*

In mastery grading, students have *multiple attempts* to exhibit mastery of the key topics of the course. For our course, I have written a list of 12 *learning targets* that I believe capture the most important concepts and skills in Calculus I. Your job is to exhibit mastery in these 12 learning targets. To earn mastery for any given topic a student must complete a *single* multi-part problem on that topic with *perfection.* This is a tall order, but that's the difference between mastery and basic understanding. There is an advantage and a reward for this: *once you earn mastery on a learning target, you never need to attempt problems on that topic ever again.* When you exhibit mastery on a problem you earn irrevocable progress toward a higher grade, along with the pride that you have truly mastered that material. Since you've mastered it, you never again need to prove to me that you understand it: if that topic shows up on a subsequent quiz, you should skip it.

Just as with the flipped classroom model, this initially increases anxiety among the students. As the course progresses, the anxiety level declines (and completely fades away for many students). You probably have some of these questions yourself.

- *What happens if I fail to master a topic on a quiz?* You simply try it again later. We will have multiple opportunities to exhibit mastery throughout the semester, mainly through short quizzes. (Some targets may be assessed through homework or lab assignments, depending on my mood. This is rare, though.)

- *Do I really never have to do mastered problems ever again?* Correct, and that's the beauty. If you master a topic on a quiz and it shows up on the next week's quiz, you don't have to do it (in fact, you shouldn't). It is possible that you could sit for a quiz that covers six topics and only "owe" me mastery on two or three of them. In that case, you should only study those two or three things. *This allows you to focus your energies on what you still need to learn, not what you already know.*

- *Then how are quizzes graded?* They're not: the only thing that matters is whether or not you master a topic. When you take a quiz you will not receive a traditional score (like 88 points out of 100, a B+). Instead, each problem will be marked to indicate whether or not you earned mastery on that topic.

- *Wait a minute. What happens with partial credit?* There isn't any. You can't "partially" master something.

- *Doesn't this mean that different people will be taking different quizzes?* Yes, it does, because people will be learning at different rates. And that's the point: mastery grading is customized, giving you multiple chances to prove you know the material *whenever it is that you happen to learn it.*

- *How will I know what problems I need to do?* Your progress toward mastery will be housed in your Canvas gradebook. Each student will also have a mastery "scorecard" that they may refer to during mastery assessments.

I believe that teaching this way—using a flipped classroom together with mastery grading—gives the students the maximum amount of respect. It also gives each learner numerous opportunities to exhibit their proficiency in the course topics, doing so without penalizing "early" failures. And *everyone*—myself included—struggles and fails when learning a new and serious subject, so why should that result in penalties? In this course, it does not.

MATH 121-01: CALCULUS I
DR. RANDALL HELMSTUTLER
FALL 2024

Teaching Assistant: [redacted]

Meeting Times: 8:00–9:15 TTh, 9:00–9:50 F

Location: Farmer 140

Textbooks: All materials are open resources and available digitally at no cost. Printed versions are available for purchase.

- *Active Calculus* by Matthew Boelkins, et. al., `https://activecalculus.org/acs/`

- *Active Calculus Single-variable Workbook (Chapters 1–4)* by Matthew Boelkins, et. al.

Course Materials: `http://canvas.umw.edu` and `https://edfinity.com/`

Office: Farmer 122

Phone: 654–1329

Email: `rhelmstu@umw.edu` [preferred method of contact]

Office Hours: By default, office hours will be held face-to-face in my office. My drop-in office hours are:

MWF	11:00–12:00
TTh	10:45–11:45

Private appointments are more than welcome. An announcement will be posted to Canvas in the event that office hours must be cancelled, rescheduled, or held virtually instead of face-to-face. Permanent Zoom links for virtual office hours may be found in the modules section of our Canvas page. Moreover, if you would like to meet virtually, please inform me of this in advance.

Useful Technology: First off, do *not* buy an expensive graphing calculator for my class. While such technology is nice, there is no need to pay for it anymore. (Your phone probably contains a more powerful calculator anyway.) The following resources may be needed at some point during the semester, all of them either free or freely available on our campus network:

Desmos scientific calculator	`http://www.desmos.com/scientific`
Desmos graphing calculator	`http://www.desmos.com/calculator`
Microsoft Excel or Google Sheets	
Wolfram Alpha	`https://www.wolframalpha.com/`

THE COMPONENTS OF YOUR GRADE

Learning Targets: There are 12 learning targets in this class. The complete roster of learning targets may be found at the end of this syllabus and is subject to change based on the pace of the course. Credits for these learning targets are earned through *mastery assessment* quizzes. This means that a student earns credit for a learning target only by exhibiting perfect completion (*mastery*) of a single assessment associated to that target. Learning target assessments receive an

essentially binary grade: you either mastered the problem or not. Opportunities to exhibit mastery of the learning targets will occur bi-weekly (at a minimum). Guidelines for completing mastery assessments may be found on our Canvas page. More details follow at the end of this syllabus. *Your mastery of learning targets is one of two primary factors determining your base grade in the class.*

Class Preparation: You will be given a class preparation assignment for each section of the *Active Calculus* textbook that we cover. This will usually happen at least twice per week. These assignments may be found on our Canvas page, embedded in the appropriate weekly module. Class preps will have multiple components including reading the textbook, watching short videos, and completing a preview activity from the textbook. The purpose of these assignments is to introduce you to a new idea *before* we begin working with it in class; the goal is *not* for you to learn this idea fully (yet). These assignments must be completed *well before* class meets in order to be effective. As a result, late or missing class preps will automatically receive a grade of zero and there are no make-ups. Each class prep is graded on a binary scale: you either completed it with satisfaction or not. Tips and guidelines for completing the class preps may be found on our Canvas page. *Your class prep completion score is one of two primary factors determining your base grade in the class.*

Edfinity Homework: In order to gauge our understanding of the course content and to prepare for mastery assessments, each student will complete weekly homework assignments in the Edfinity adaptive learning environment. Each student must have their own Edfinity account (around $29), which may be purchased through the UMW bookstore or on your own. Unlimited attempts will be allowed on each Edfinity homework set and only your highest score on the set will be recorded. *Your semester Edfinity homework average is a secondary factor in determining your final grade in the class.*

Written Homework: We will have four formal written homework assignments where you will explore course concepts more intensely. These assignments are graded as either complete or incomplete, with one resubmission allowed per assignment. *Your number of written homework sets successfully completed is a secondary factor in determining your final grade in the class.*

Tokens: To extend some grace and leniency, each student will start the semester with three (virtual) tokens. A student may elect to spend one token in order to:

1. be granted a 48-hour extension for a class prep or written homework assignment,

2. resubmit an incomplete class prep assignment within 48 hours of the original due date,

3. resubmit an incomplete written homework assignment a second time (deadline to be negotiated),

4. earn a score of 100% on any single Edfinity homework set, or

5. be granted a third chance to exhibit mastery of a learning target on which the original grade was P* (deadline to be negotiated).

To redeem a token, the student must send an email to me outlining which of the above options they wish to invoke, along with all supporting details. That email and any subsequent replies from me will serve as a receipt and contract.

YOUR SEMESTER GRADE

At UMW we issue the following standard letter grades: A, A–, B+, B, B–, C+, C, C–, D+, D, F. (Note that we do *not* issue grades of A+ or D–.) Your semester letter grade in this class is determined in two stages:

- your learning targets earned and class prep completion rate determine your *base grade*

- your aggregate Edfinity homework average and written homework credits determine any additional *bumps* to your base grade.

A *bump* is an increase to your base grade by one step in the chain of 11 letter grades. So, for instance, a base grade of C– with one bump becomes a C, a base grade of B– with one bump becomes a B, a base grade of D with two bumps becomes a C–, and so on.

The following rules apply to base grades and bumps:

- your base grade is the *highest* letter grade in which you meet *both* conditions in the first two columns of the base grade scheme

- one bump may be earned by meeting the indicated Edfinity average threshold in the bump table

- one bump may be earned by meeting the indicated written homework threshold in the bump table

- the base grade of A– is limited to only one bump (obviously)

- there are no bumps available to the base grade of F.

To determine your base grade, find the highest row in which you meet <u>both</u> conditions on learning targets earned (LTs earned) and your class prep completion percentage (CP average):

LTs earned	CP average	Base grade
11 or more	90% or higher	A–
9 or more	80% or higher	B–
8 or more	75% or higher	C–
7 or more	75% or higher	D (level 1)
exactly 6	80% or higher	D (level 2)
None of the above		F

From your base grade, you may earn up to two additional bumps by meeting the thresholds indicated below for your Edfinity homework average and your written homework credits:

Base grade	Edfinity average	Written HW credits	Max possible
A–	90% or higher	4 of 4	A
B–	85% or higher	3 of 4	B+
C–	80% or higher	3 of 4	C+
D (level 1)	75% or higher	3 of 4	C–
D (level 2)	85% or higher	4 of 4	C–
F	No bumps available		F

FREE ADVICE: It is to your strategic advantage to maintain class prep and Edfinity percentages above 90%.

Here are some examples of how this works in practice:

LT	CP	Base grade	Edfinity	Written HW	Bumps	Final grade
11	95%	A–	85%	4 of 4	1	A
11	85%	B–	90%	4 of 4	2	B+
9	85%	B–	80%	3 of 4	1	B
9	75%	C–	75%	3 of 4	1	C
7	88%	D (level 1)	78%	2 of 4	1	D+
7	88%	D (level 1)	80%	3 of 4	2	C–
6	80%	D (level 2)	75%	2 of 4	0	D
6	75%	F	75%	2 of 4	0	F

NOTE: It is impossible to pass this class by earning 5 or fewer learning targets. Likewise, it is impossible to pass with a class prep completion rate less than 75%.

Caution! Although this scheme of grading is very simple, the Canvas gradebook is not capable of computing your grades correctly. Therefore, you must recognize that *the computation of your grade as shown in the Canvas gradebook will always be wrong!* Never rely on Canvas to determine your semester grade: only the syllabus can do this.

I reserve the right to make changes to the base grade or bump schedules, doing so only to the students' advantage (so to increase grades, not lower them). Such changes will be announced to the class.

Attendance Policy: I will record attendance each day, though this does not factor into your course grade (unless missing class means that you've missed an in-class assignment). In the event of an absence it is the student's responsibility, not the instructor's, to see that steps are taken to rectify any deficiencies that occur from missing class.

Final Exam: Our in-class final exam is scheduled for 8:30–11:00 a.m. on Thursday, December 12th. This is your last opportunity to exhibit mastery of the learning targets.

Midterm Grades: A midterm deficiency will be entered for any student with either (a) three or more missing class preps, (b) cumulative Edfinity score under 75%, or (c) failure to master three learning targets by the time midterm grades are due to the Registrar.

Make-up/Extension Policy: All dates and deadlines are firm. Any adjustment must be requested beforehand, with one week's notice whenever possible. An extension or make-up will be granted only for a legitimate reason. Otherwise, late work is never accepted. (It should be noted that emailing or uploading something after the deadline counts as being late.)

Recording Policy: No one may make audio or video recordings of any course activity unless the student has an approved accommodation from the Office of Disability Resources permitting the recording of class meetings. In such cases, the accommodation letter must be presented to the instructor in advance of any recording being done and all students in the course will be notified whenever recording will be taking place. Students who are permitted to record classes are not

permitted to redistribute audio or video recordings from the course to individuals who are not students in the course without the express permission of the faculty member and of any students who are recorded. Distribution without permission is a violation of educational privacy law.

The Honor System: It goes without saying that the Honor System is deeply respected at this university and is strictly observed in this class. I will be very explicit about the groundrules for each assignment, but please talk to me if you have any questions about what is (or is not) allowed for any particular assignment.

Web/Email Updates: Important dates and other announcements will be addressed in class and posted to Canvas. You are expected to check your UMW email account and the class Canvas page regularly for the most up-to-date information.

Problems? Feel free to talk to me when you have concerns about the course, whether it is homework, concepts in general, or other course-related issues. If you have a conflict with my office hours, see me to schedule a private appointment.

Important Dates

August 30	Last day to add
September 2	Labor Day (no class)
September 13	Last day to drop
October 14–15	Fall break (no class)
November 1	Withdrawal deadline
November 5	Day on Democracy (no class)
November 27–29	Thanksgiving break (no class)
December 6	Last day of class
December 12	Final exam

Mastery Grading Scale

When you sit for mastery assessment of a learning target, your work on the target problem will receive one of four scores:

- **Not Assessable (N):** There was not enough correct work to truly assess your understanding of the learning target. You should invest significant effort into growing your skills and comprehension in this area. This score does *not* give mastery on the target.

- **Progressing (P):** Some good and thoughtful work was presented, but there are still gaps in your understanding of the topic. You are on your way to mastery with some more work. This score does *not* give mastery on the target.

- **Near-mastery (P*):** You have exhibited a solid understanding of the topic, but a *very minor* mistake was made. You have until the announced deadline to come by my office and correct this small mistake. Without a successful office visit, this score does *not* give mastery on the target. With a successful office visit, this score *does* give mastery on the target. The score of P* will be used sparingly and only in the case of a small calculational error.

  NOTE: The score P* will *not* be used on the final exam.

- **Mastery (M):** You have exhibited full understanding and capability with this topic. This score gives mastery on the target.

Label	Target	Sections
Pre	Algebra and Trig	
Lim	Limits	1.2
Der-D	Limit definition of the derivative	1.4
CD	Continuity and differentiability	1.7
Der-B	Basic rules of differentiation	2.1–2.2
Der-PQ	Product and quotient rules	2.3–2.4
Der-C	Chain rule	2.5
Der-R	Review of differentiation rules and applications	2.1–2.5
FB	Function behavior	3.1
Ext	Extrema	3.1, 3.3
FFT	The first Fundamental Theorem of Calculus	4.4
SFT	The second Fundamental Theorem of Calculus	5.2

Pre: Essentials for success in Calculus I, including basic algebra of functions and trigonometry.

Lim: Determining the limiting behavior of a function f around a point, both graphically and analytically.

Der-D: Applying the limit definition of the derivative f' of f to determine the general expression for $f'(x)$.

CD: Exhibiting understanding of properties of continuous and differentiable functions and how these concepts relate to each other and to the notion of limit. Functions will be analyzed graphically as well as analytically.

Der-B: Applying basic "shortcut" rules of differentiation to determine f' given f for constants, polynomials and powers of x, and the trigonometric functions sin and cos.

Der-PQ: Applying the product and quotient rules to differentiate functions expressed as products or quotients. Will also include the remaining four trigonometric functions.

Der-C: Applying the chain rule to differentiate a composition of functions.

Der-R: A summary of all known differentiation rules so far, as well as interpretations and applications of the derivative (e.g., tangent line approximations and instantaneous velocity).

FB: Using knowledge of the first and second derivatives to determine the local behavior of a function through *sign charts*, to include intervals of increase/decrease, critical points, local extrema, and concavity data.

Ext: Determining any local and/or global extrema of a given function.

FFT: Applying the first Fundamental Theorem of Calculus in order to compute the definite integral $\int_a^b f(x)\ dx$.

SFT: Applying and interpreting the second Fundamental Theorem of Calculus as it relates to general antiderivatives and applications, especially position and velocity.

Course Objectives: Students in Calculus I will learn limits, derivatives, their applications, and integrals, as well as transcendental functions. Upon completion of the course, students will:

- Be able to evaluate limits graphically, numerically, and algebraically; and use the limit concept to describe a continuous function;

- Know how to calculate derivatives of polynomial, rational, trigonometric, and implicitly defined functions using both the limit definition and the derivative rules;

- Understand the interpretation of the derivative as a rate of change and solve problems involving this interpretation;

- Be able to use derivatives to find the extreme values of a function, sketch the graph of a function, and solve practical optimization problems;

- Understand the Riemann sum, the definite integral, and the indefinite integral;

- Understand the link between definite integrals and antiderivatives provided by the Fundamental Theorem of Calculus;

- Understand the exponential and logarithmic functions.

General Education Student Learning Outcomes: This course satisfies the Quantitative Reasoning component of UMWs general education requirements. As such, the learning outcomes of this course are as follows:

1. Students will demonstrate an ability to interpret quantitative/symbolic information.

2. Students will have the ability to convert relevant information into various mathematical/analytical forms (e.g., equations, graphs, diagrams, tables, words).

3. Students will be able to apply analytical techniques or rules to solve problems in a variety of contexts.

4. Students will gain an appreciation for how analytical techniques or rules are used to address real-world problems across multiple disciplines.

Accommodations and Accessibility Statement

The Office of Disability Resources has been designated by the university as the primary office to guide, counsel, and assist students with disabilities. If you receive services through the Office of Disability Resources and require accommodations for this class, please provide me a copy of your accommodation letter via email or in a private meeting by **Monday, September 9th**. I encourage you to follow-up with me about your accommodations and needs within this class. I will hold any information you share with me in the strictest confidence unless you give me permission to do otherwise.

If you have not made contact with the Office of Disability Resources and have reasonable accommodation needs, their office is located in Seacobeck Hall, room 005. The office will require appropriate documentation of disability.

Title IX Statement

University of Mary Washington faculty are committed to supporting students and upholding the university's *Policy on Sexual and Gender-based Harassment and Other Forms of Interpersonal Violence.* Under Title IX and this policy, discrimination based upon sex or gender is prohibited. If you experience an incident of sex or gender-based discrimination, we encourage you to report it. **While you may talk to me, understand that as a "responsible employee" of the university, I MUST report to UMWs Title IX Coordinator what you share.** If you wish to speak to someone confidentially, please contact the confidential resources below. They can connect you with support services and help you explore your options. You may also seek assistance from UMW's Title IX Coordinator. Please visit `diversity.umw.edu/title-ix/` to view UMW's *Policy on Sexual and Gender-based Harassment and Other Forms of Interpersonal Violence* and to find further information on support and resources.

Ruth Davison, Ph.D.
Title IX Coordinator
Lee Hall, Room 401
1301 College Avenue
Fredericksburg, VA 22401
Phone: 540-654-5656
E-mail: `rdavison@umw.edu`
Website: `diversity.umw.edu/title-ix/`

Confidential Resources

On-campus

Talley Center for Counseling Services
Lee Hall 106, 540–654–1053

Student Health Center
Lee Hall 112, 540–654–1040

Off-campus

Empowerhouse
24-hour hotline: 540–373–9373

Rappahannock Council Against Sexual Assault (RCASA)
24-hour hotline: 540–371–1666