

MA 1021A Fall 2024

Calculus I Syllabus

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1 Contact Information

Name	Email	Office Hours	Section	Lec/Dis Time	Location
Dr. Binan Gu	bgu@wpi.edu	T 1-2 pm, R 2-3 pm, F 3-4 pm	AL05	MTRF 4:00 - 4:50 pm	SL 406
Marcos Delgado	mdelgado1@wpi.edu	TBA	AD05	M 12:00 - 12:50 pm	SH 313

2 Course Description

This course introduces fundamental concepts in modern calculus, with **limits** being the most important one. Furthermore knowledge includes continuity, differentiation and derivatives, and their applications in graphing, root-finding and optimization problems.

Recommended background: solid pre-calculus, algebra including trigonometry, logarithm and powers. Although the course will make use of computers, no programming experience is assumed.

3 Textbook

Main textbook: *OpenStax Calculus Volumes 1* – free e-versions: Volume 1.

Supplementary Textbook:

1. *Calculus by Gilbert Strang*. Free e-book on canvas. We quote A LOT from this brilliant book, even though the language is a little old-fashioned.
2. *Thomas' Calculus : Early Transcendentals 14th Edition*,
J.R. Hass, C.E. Heil, M.D. Weir, P. Bogacki, Pearson ISBN: 9780137559879, 0137559879

4 Course Objectives

This course continues the exploration of fundamental ideas in modern calculus and mathematics – limits. Forming a solid understanding of limits in various mathematical contexts prepares the learner for adapting methods taught in advanced undergraduate

courses in mathematics, science and engineering. Good mathematics is simple and connected by logic which requires a solid understanding of **basic** definitions of mathematical objects.

Goal for Each Topic

For each topic, your main job is to understand

- Why is this topic introduced and studied?
- What are its fundamental connections to prior knowledge in this area?
- Learn the chronology of the topics introduced in this class, and understand the logic from one topic to the next.

Main Topics

The primary substance of this course are the following working knowledge (core knowledge in bold):

- Basic functions and their properties.
- Basic connection from calculus to kinematics (in physics).
- **The Limit of a Function, its Rigorous Definition and the Limit Laws**
- **Continuity (and its connection to limits).**
- **Differentiation and the Derivative (and its connection to limits).**
- Differentiation Rules and Implicit Differentiation.
- Related Rates
- **Linear Approximations and Differentials**
- **Optimization**
- The Mean Value Theorem
- **Curve Sketching**
- Root-finding and Newton's Method
- Antiderivatives and the Definite Integral
- **Fundamental Theorem of Calculus**

Term Goals

Two end goals are measured equally in this class:

1. (Understanding) The ability to recall definitions, provide motivating examples and argue with mathematical logic.
2. (Mechanical) The ability to calculate.

Personal Goals

There are a few personal goals I wish everyone achieves by the end of the class.

1. **Learn how to learn.** This includes

(a) Forming good learning habits:

- i. Consistent contact with the course material, i.e., study a little every day.
- ii. Work on one problem a day.
- iii. Read for 10 minutes ahead of the lecture.
- iv. Read for 10 minutes after the lecture.

(b) Eradicating bad learning habits:

- i. Give up too quickly before using **all** available (permitted) resources, i.e., lecture notes, examples, office hours and your brain.
- ii. Immediately look for solutions online.
- iii. Procrastinate until the due date.
- iv. Cram before the exam.

2. Learn about yourself: what are your strengths and weaknesses, academically, and mentally, before, during, and after this class?

5 Course Organization

The class typically meets 5 times per week: 4 lectures on MTRF, and 1 discussion section on M. Students are responsible for all material presented in lecture and discussion. My expectations for these activities are:

Lectures:

The 200 quality minutes we spend together every week in lecture are meant to **introduce** the subjects. Students are expected to **know of** (i.e. *Lehr*) the introduced topics after every lecture. **Mastery** comes later after exercises. Lecture videos are captured by Echo360 and can be accessed through the course Canvas page.

There will be complementary videos on worked examples posted every week. Students are responsible for learning these examples in depth.

Practice Problems:

The majority of your association with this course lies in **problem solving outside the classroom**. Students are expected to take the intuitions gained from lectures and put them into careful examinations by doing suggested practice problems (i.e. *Kunst*). Solutions to these problems are neither collected nor graded, but they form the main topics of discussion during the Discussion section. The problem selection is a combination of examples of the types of problems to be found on the exams, along with problems that are more detailed and which enhance learning the topics at a deeper level.

Extra credit problems may be assigned during lecture time. They normally involve filling out the details of a derivation and/or more challenging problems within the context of the course. Grades earned from these problems will be complemented to your overall HW grade (see below), though they will not help one exceed the maximum number of points possible.

Discussion:

Students have an opportunity to sit down and work through the practice problems on a topic with an instructor and have their individual questions addressed. It is through the Discussion that the student can get major questions asked so that after Discussion, the student can continue to work through the practice problems to develop mastery.

In each Discussion session, everyone will solve some of the practice problems posted under Discussion on a clean piece of paper, to be submitted at the end of the Discussion. You will be graded by your attendance and performance in class, each out of 1 point. Discussion performance includes asking good questions, helping your classmates and completing more than 75% of the assigned problem numbers. These points will be added to your HW grade with a 1:1 conversion rate (without exceeding the maximum HW points – see non-exceeding bonus points below).

Canvas:

Course materials can be found on the Canvas page. The material is organized by the section number of the topic in the text. In the event that lectures need to be delivered remotely, they will take place through Zoom.

Students are expected to spend an additional **8-12 hours per week** studying outside of class. This includes reading the text, organizing notes, and solving problems.

Communications:

The primary interface for communication with the instructor & course staff will be email, the Canvas course website, office hours, discussions, & Piazza. All information about the course will be maintained on the course web page in WPI's Canvas system. Check it often.

Check your WPI email daily. Students can expect a response to email within 24 hours on weekdays and within 48 hours on weekends.

6 Assignments

There are three different types of assignments for this course.

Written Homework

Written Assignments weigh considerably in this course. Take them seriously. These assignments involve handwritten solutions to mathematical problems from the course textbook and my lecture notes. Written solutions should be **second drafts** and thoroughly demonstrate your thought process, including justifications of steps. These assignments are due once a week, and they can be accessed through the Assignments Module on Canvas.

Collaborations among classmates are welcome. Every HW submission must declare a list of collaborators at the beginning, though each student is expected to compose his/her own solutions. **Extensive similarities between assignments without collaboration declarations will be considered as plagiarism and will be penalized severely.**

If the solution depends on online sources or textbooks, the student is responsible for citing them with a reference style of your choosing. Uncited solutions, if confirmed, will be considered as plagiarism and will not receive any credit. Please review the AI Policy as the end of the syllabus.

Return-and-correct Policy

Each student has 1 day to correct his/her solutions after HW is returned. Resubmissions may be graded without penalty if the initial submission has sufficient effort in solving **every** problem. Poor attempts at the initial submission will receive little credit and no resubmission opportunities.

Every resubmission shall contain the original copy or state clearly which problems you are correcting. You must address every query for the correction to be considered valid, e.g., it is not allowed to just correct one out of two mistakes. The corrections should be written using a different colored pen/pencil, either in a side column clearly marked for short corrections, or on new sheets of paper for long corrections.

File Type

The initial submission and later corrections are to be submitted as a **single PDF file** via the canvas assignment module.

Grading Rubric

For each HW, we select five problems and grade each out of the four equally important points. We will comment on which criterion is missing from your assignment, to which you must pay more attention when revising.

Type	Submission Qualities
Presentation	Quality is neat and easily readable. Ample spacing between each problem.
Completion	Every problem has a committed attempt.
Syntax	Correct use of basic mathematical symbols: = (equal to), $\implies$ (implies), $\lim$ (limit sign before evaluation), $\rightarrow$ (converges), $\int f(x) dx$ (correct variable), etc.
Correctness	Completely correct, clear, & thorough write-up of problem solution, citing appropriate rules & theorems where appropriate.

Poor work policy

The instructor and the PLA/Grader reserve the rights to reject HW with poor presentation and careless completion without further review of its content. The first rejection acts as a warning, and its resubmission incurs a penalty of 15% of total points; any HW rejection after the first offense automatically receives a score of zero.

Late Work Policy

Any late HW abides by a “15% of total points off per day late submission policy” unless a valid excuse is supported with proper documentation.

Bonus Points

- Exceeding bonus points

This type of bonus points includes extra credit problems assigned in class, bonus problems in (some) quizzes and (some) HW sets. They may help you achieve more than 100% in the assignments containing them.

- Non-exceeding bonus points

This type of bonus points includes HW0 and Discussion Grades. They will only help you make up for the points you missed from HW assignments (only) and will not exceed the maximum points allotted for the assignment. For example, if you have scored 110/140 for all 7 HWs, and 15/20 for HW0 and 7/7 for the 7 Discussions, then your HW grade is $(110+15+7)/140 = 132/140$.

Labs

Provides instruction on use of software MATLAB and Desmos for Calculus applications. Students registered to labs (W | 12:00 PM - 12:50 PM) receive synchronous instruction in the first week introducing the topic and software commands required to execute the scheduled labs. Asynchronous videos assist the student through a systematic process leading to understanding of graphing, algebraic, and Calculus commands. In the next week, lab instructors offer office hours for questions.

Quizzes

A 10-minute Quiz is given at the beginning of each week's Discussion on Monday (M | 12:00 PM - 12:50 PM). Each quiz covers approximately the same amount of content and has approximately the same level of difficulty. **All quizzes are closed book, closed notes, and no electronic devices are allowed.**

The short quiz is meant to be a conceptual check that contains a few T/F questions and short responses, and no explicit calculations. The T/F always requires a reason or counterexample to justify your judgment, which should motivate you to gain the true ways of scientific inquiry.

The quiz schedules are as follows: 8/26, 9/9, 9/23, 9/30, 10/7. Please arrive on time.

Midterm Exam

On September 13, Friday, there will be a midterm exam, covering materials up to the Tuesday in the same week.

Common Final Exam

On October 10, Thursday (second last day of A-term), there will be a comprehensive common final exam.

Makeup Policy

Unless there is extenuating circumstances, no makeup quizzes/exams are allowed. Students requesting quizzes/exams to be taken at times other than the proposed dates must provide valid reasons with proper documentation (medical, familial, or religious reasons), or notices at least a week in advance. A temporary grade of Incomplete is assigned until all makeup exams are finished (typically given during the first week of B-term).

7 Grades

Written HW: $36\% = 6 \times 6\%$.

Labs: 10% .

Quizzes: $15\% = 5 \times 3\%$.

Midterm: better 11% , worse 8% .

Common Final Exam: 20% .

Tentative Final Grades: A (>90), B(80-89), C(70-79), NR (<70).

Remark. There is no need to ask me to round up your grade as I will consider this option for everyone. Rounding up to a higher letter grade is only possible when the following conditions are simultaneously met: 1) your current numerical grade is at most 1.00 point away (up to two digits past the dot) from a letter grade change, i.e., 89.00-89.99, but not 88.99; 2) your total quiz score is at least 80/100.

8 Special Arrangements

If you need course adaptations or accommodations because of a disability, or if you have medical information to share with me, please make an appointment with me as soon as possible. My office location and office hours are listed above. If you have not already done so, students who believe that they may need accommodations in this class are encouraged to contact the Office of Accessibility Services (OAS) as soon as possible to ensure that these accommodations are implemented in a timely fashion. The OAS is in Unity Hall, (508) 831-4908. Students who need accommodations for exams are required to make the arrangements to take these exams at the Exam Proctoring Center (EPC) on the day of the exam.

9 Additional Policies

Electronic Policy

All lectures (audio and video) are captured through course capture and can be found on the course Canvas page. **NO** recording of audio or video by students is allowed during lecture or during discussion. Laptops, phones, and tablets should be turned off during the lecture and conference sessions. If you take notes (typing/stylus only) using these devices during lecture, then you should sit somewhere in the room where your screen activity is not distracting to your neighbors.

Exam Policy

Prior to the start of each exam, you must place all of your belongings (e.g., cell phone, study materials, smart watches, etc.) in your backpack and under your desk, so that no items are visible during the exam. **All quizzes this term are closed book, closed notes, and no electronic devices are permitted.** Cheating is an extreme offense. Students involved in plagiarism will be reported to the Dean without grace periods and negotiations.

AI Policy

AI engines such as ChatGPT have been prevalent in our daily life. One unfortunate use is in providing solutions to Homework Problems with (near) impunity due to the random nature of such engines. Artificial intelligence (AI) language models, such as

ChatGPT, and online assignment help tools, such as Chegg®, are examples of online learning support platforms: they can not be used for course assignments and will never be permitted in this course. Please review the WPI webpage “What is Academic Dishonesty”.

The Instructor and the PLA reserve the rights to withhold the alleged assignment(s) and conduct an oral exam on the material therein to verify that the student is capable of matching the understanding displayed in the solutions.