

MATH 180 : Calculus A : Spring 2022 (4 credits)

CLASS: MWF 11-11:50am, CST 103

LAB: Tuesday 1 pm, CST 103

Instructor	Anand L. Pardhanani CST 210	Email: pardhan@earlham.edu Phone: 765-983-1683
Office hours	The following hours are tentative - I'll finalize office hours after the 1st week M: 10-11am. T: 10-11am. W: 10-11am. And by appointment or walk-in. The best way to contact me, in order of preference, is: [1] in person, [2] by email, [3] by phone. Open door policy: I keep my posted office hours to a bare minimum, to avoid being locked into a rigid schedule all semester. However, I am happy to assist students well beyond my office hours. Students are encouraged to just drop by whenever needed. Anytime my office door is open you're welcome to stop by and check whether I am available. Also, please do not hesitate to make an appointment if my posted office hours don't work for you.	
Class website	https://cs.earlham.edu/~pardhan/courses/calculus/ The website is a central component of this class, and you are responsible for regularly checking it for announcements, homework assignments, labs, and supplementary handouts. I prepare for class with the assumption that students have reviewed the website and followed through on posted instructions.	

Textbook

Single Variable Calculus: Concepts and contexts, by James Stewart, 4th Edition, Brooks/Cole, 2010. (ISBN: 0-495-55972-5)

Tutoring & help resources

No one succeeds in math without stumbling and needing help from time to time. Seeking timely help is smart, responsible, and the key to success in this class. You have at least 3 options here

- Your professor: My office hours are specifically set aside to help you with this class. I encourage you to visit as often as you need, throughout the semester.
- Your classmates: Get acquainted with them early and form study groups.
- Drop in tutoring: In the study area outside CST 300. Days/times TBA.

Course content & description

The simplest way to describe calculus is: Cool, beautiful, and useful! It is cool because of the depth of insights it can give with relatively little effort. It is beautiful by its very nature. And it is useful because it is applicable across the board, in virtually every discipline -- science, medicine, business, fine arts, sports, political analysis, social activism, engineering, and more!

This course is an introduction to the foundations of calculus and its applications. The focus is on functions of one variable, with particular emphasis on the notion of limits, derivatives and differential calculus. Main topics include limits, continuity, the derivative, methods of finding derivatives, applications of derivatives, and basic integration concepts. We will cover Chapters 2-5 of the textbook. This course also includes a lab component, which is designed to explore applications and to enhance conceptualization.

Students will be expected to attain proficiency on the above topics at 3 distinct levels:

- (i) Conceptual understanding of major ideas;
- (ii) Computational & problem solving skills; and

(iii) Self-confidence and appreciation of how to use these ideas in their own fields of interest. This class fulfills the Quantitative and the Abstract Reasoning components of Earlham's General Education requirements.

Course credits and work load

This course is worth 4 credits. Three of these credits correspond to the 3 lecture hours each week. The remaining credit is for the weekly lab. As with other science courses at Earlham, each lab credit essentially corresponds to 3 hours of work. Thus, you should expect to spend about 3 hours, on average, to complete each Calculus lab. In addition, students should expect a workload outside class of about 6-9 hours each week for self-study, homework, and general prep.

Student learning outcomes

Upon successful completion of this course, students will be able to

1. Understand deeply what the derivative is, the range of insights it offers, and how to utilize it in a variety of settings.
2. Use derivative concepts to solve various application problems, and construct simple mathematical models for real-world applications.
3. Understand the mathematical definition of key concepts such as limit, derivative and intergral.
4. Compute limits, derivatives and intergrals using garphs, algebraic methods, and numerical computation.
5. Use technology as an integral part of the process of formulating and solving problems.
6. Work together in teams, and learn cooperatively with other students.

These aspirations broadly support all 5 learning goals of the Math Department, and the 7 goals of an Earlham education (see the [Appendix attached to this Syllabus](#)).

Prerequisites

Proficiency in the algebra & geometry of functions upto the precalculus level is expected. Students must score at least 76 on Earlham's Quantitative Skills Assessment (QANS).

Assessment & grading policy

In my approach to grading, correct process and method receive far more credit than correct answers. I always ask you to show all your work, and I grade all of your work!

Your final grade will be based on combined performance on: (1) homework, (2) labs and classwork, (3) weekly quizzes, (4) three exams during the semester, and (5) a comprehensive final exam. Each will contribute the following proportions:

Homework	Lab & classwork	Quizzes	Three exams	Final exam
10%	15%	15%	15% + 15% + 15% = 45%	15%

I will replace your lowest exam grade with your final exam, if it improves your overall grade. In other words, this applies if your lowest performance is not on the final. Please be advised that, from previous experience, roughly half the students tend to have their lowest performance on their final exam.

Letter grade boundaries for this course are not set in advance. They will be determined at the end of the semester based on factors such as overall class performance, level of difficulty of tests, quizzes, and assigned work, etc. At a minimum, the following standard scale for letter grades will be honored:

A+: 97.0-100; A: 93.0-96.9; A-: 90.0-92.9;

B+: 87.0-89.9; B: 83.0-86.9; B-: 80.0-82.9;
C+: 77.0-79.9; C: 73.0-76.9; C-: 70.0-72.9;
D+: 67.0-69.9; D: 63.0-66.9; D-: 60.0-62.9; F: below 60.

NOTE that you must also satisfy the following requirements to receive a grade of C- or better:

- * Take all the exams (3 during the semester, plus the final).
- * Complete at least 75% of the labs, and turn in 75% of the assigned homework.
- * Take at least 75% of the weekly quizzes.

Quizzes & exams

Quizzes: There will be short quizzes every week. The quizzes will be based on readings, homework, classwork and/or other assigned tasks, and require no extra effort beyond staying current with the class, doing homework on time and understanding the material. I will drop your lowest quiz grade in computing your average.

Exams: There will be three in-class exams during the semester, plus a comprehensive final exam at the end of the semester. The tentative dates of the in-class exams are:

Exam 1: Feb. 22. Exam 2: March 29. Exam 3: May 3.

Final exam: The final exam date and time is set by the registrar's office. According to their calendar, the final exam will be held **Thursday, May 19, in CST 103 at 10:30 am.**

The final exam date and time is not negotiable. Please arrange any travel plans accordingly.

Lab sessions

The goal of calculus labs, just like labs in other disciplines, is to learn through focused, hands on exploration. On lab days you will work mostly in pairs or groups, and have opportunities to discover and apply key calculus concepts. There will be follow-up reports to turn in -- some may be individual and others may be group reports.

Classwork

The goal of classwork is to learn through thinking and doing problems in class. You will frequently work on these assignments in pairs or groups, and have opportunities to develop deeper understanding and/or more comfort with topics covered in that class. Classwork will sometimes be turned in for grading. Other times it will be just for your practice.

Homework assignments

Note: All assignments will be posted on the class website - they will not be handed out in class.

Reading: These will be assigned for each day of class, to be completed before class on that day. Reading ahead is a critical element for learning the material in this course. The time you invest in reading pays off in two different ways. One, your performance improves because you understand the material better, you ask questions, and attain a higher comprehension level. Two, you understand the material faster, so you spend *less time* later reviewing elementary ideas and introductory material when preparing for quizzes and exams.

Problem sets: Homework problems will be assigned from the textbook for each section that we cover. In general, each week there will be two sets of problems -- one set is for your practice, and the other set is to be turned in for grading. I will drop your lowest homework grade when computing your average.

I strongly advise you to complete all assigned homework by the indicated due dates, including the practice problems. The quizzes are designed with the assumption that you have done all the assigned work.

Important dates

- * Last day to add this course: February 4.
- * Last day to drop: April 15.

* Date of final exam: May 19.

NOTE: Last drop date applies to Earlham students only. Students cross-registered through IU-East or other institutions must follow the dates and rules of their own institution.

Academic integrity

After several years of writing standard, boiler-plate stuff in this section, I have decided to replace it with a more authentic message from my heart to yours. Before getting into details, I would like to share 3 key ideas that profoundly shape my thinking, and prompt me to explore more effective ways towards academic integrity:

1. Academic infractions are a much bigger problem at Earlham than many of us would like to believe or admit.
2. The problem is **NOT** our students! Earlham students are as good (or better!) than their peers at other institutions in terms of moral values and ethical standards.
3. Infractions at Earlham can be significantly reduced using a combination of strategies, collectively developed by students and faculty.

These three points summarize my overall perspective, and will frame the rest of my discussion on this subject.

By far the single biggest phenomenon that has radically transformed today's academic integrity / infraction landscape is technology -- particularly the internet and cell phones. In my view, Earlham's traditional approach to academic integrity has been rendered completely obsolete by these technologies. If I were an Earlham student today, I would encounter many situations where the temptation to infract would be extremely high, because these technologies make it so easy, and the risk of getting caught is virtually zero. This is the main reason why I say that you, the student, are not the problem. You are human, just like me and my faculty colleagues. It is a fact of life that many humans succumb to temptation when the rewards are sufficiently high, and the risks sufficiently low.

Yet, the fact remains, a growing rate of academic infractions is a terrible thing to ignore: They sink an institution's reputation, decrease the value of students' education, lower student & faculty morale, and more. Clearly, we need to explore and develop new strategies that are more effective for our times, and also preserve Earlham's distinctive approach to such matters. We will set aside some class time to discuss and formulate specific policies for helping students (joyfully!) meet and exceed the highest standards of integrity in this class. In the meantime, I invite you to reflect on some practical ways that would most help and support you in avoiding the use of inappropriate sources when taking tests and quizzes in this class.

I would like to conclude with the following excerpt from the Earlham Academic Integrity Policy: "The College trusts students who enroll at Earlham to be honest seekers of truth and knowledge. This trust is extended to all students by other students and by teachers ... Giving or receiving aid inappropriately on assignments and tests, or plagiarizing by using another person's words or ideas without credit, constitutes a serious breach of our trust in one another and in the integrity of the search for truth. Those who believe they have witnessed violations of academic integrity should feel the obligation to speak about this to the suspected offender. The witness also should feel obligated to report the suspected offender to the instructor if the person fails to offer a satisfactory explanation and refuses to report him or herself. ... Violations of academic integrity, because they undermine our trust in one another and in the credibility of the academic enterprise, are taken very seriously. Penalties for violations range from failing assignments or tests to suspension or

expulsion from the College. "

Attendance

Attending every class throughout the semester is expected. Besides the obvious benefits of regular attendance, most classes will involve graded activities such as quizzes, labs and/or other assignments. In general, there will be no makeups if a student misses such activities. Note, however, that most graded class activities do drop a reasonable number of lowest scores to accommodate for excused or unforeseen absences.

Excused absences

In the simplest terms, excused absences seldom happen! And when they do, you either know the details well ahead of time, or the absence is due to an illness or emergency.

In an illness or emergency, the requirements for an excused absence are: (1) I am notified of your absence in writing or via email within a reasonable timeframe of your absence. (2) The expected duration of your absence is communicated to me.

If your absence is due to participation in a College-sponsored event, such as athletics or other official event, you must notify me in writing or via email at least one week before your absence. In particular, if your absence may result in your missing a test, quiz or assignment deadline, please read the section below on "Athletics & Extracurricular Activities."

If your absence is due to participation in, or observance of, a religious holy day you must notify me in writing, or via email, at least one week before your absence.

Other absences may be considered excused if they satisfy the following conditions: (1) You have notified me in writing, or via email, at least 1 week ahead. (2) You have shown me documentation in support of your plans/reasons. (3) Your reasons justify the absence (as determined by me).

Makeups

Homework assignments: Past-due assignments will not be accepted.

Quizzes, classwork, labs: There will be no makeup for missing these, regardless of reason.

Exams: Make-up exams will not be given except in cases of a serious illness or emergency.

Athletics & extracurricular activities

I welcome and support student participation in athletics and other extracurricular programs at the College. However, I expect any such participation to prioritize your curricular responsibilities and academic success. Therefore, in this class, the same rules and yardsticks apply to all students, regardless of your participation in athletics or other events. In particular, I would like to emphasize the following policies regarding class attendance, exams, and due dates:

1. Participation in, or travel for, a College-sponsored event constitutes an excused absence only if you notify me in writing (or by email) at least one week prior to each absence.
2. I will not offer any makeup exams or quizzes for College-sponsored absences. If your travel schedule requires missing an exam or quiz, I will arrange for you to take the exam before you travel, or for a faculty/staff member traveling with you to administer the exam during your trip. To avail of this option, you must notify me, in person, at least one week before your date of absence (preferably 2 weeks).
3. Assignment & homework due dates are firm -- no exceptions for extracurricular conflicts! If you have to miss class on a date when something is due, turn it in **before** your absence.

Academic accommodations

Students with a documented disability (e.g., physical, learning, psychiatric, visual, hearing, etc.) who need to arrange reasonable classroom accommodations must request accommodation memos from the Academic Enrichment Center (main floor of Lilly Library) and contact their instructors each semester. For greater success, students are strongly encouraged to visit the Academic

Enrichment Center within the first two weeks of each semester to begin the process. For further details, please visit

<https://earlham.edu/academics/academic-support-and-special-programs/academic-enrichment-center/accessibility-services/>

Other sources of help

1. **The Academic Enrichment Center:** The Academic Enrichment Center (AEC), located in Lilly Library, provides assistance with study habits and skills as well as a peer tutoring service. The AEC is staffed by trained peer tutors for either pre-arranged group tutoring sessions (provided for many math, science and social science courses) or one-on-one tutoring sessions for other courses. Peer tutoring is a free service offered to all Earlham students. Please visit <https://earlham.edu/academics/academic-support-and-special-programs/academic-enrichment-center/peer-tutoring/> for more information.
2. **The Earlham Writing Center:** The Writing Center is dedicated to providing students with advice and resources about writing. Students can meet one-on-one with trained consultants who will contribute feedback to writers at any stage of the writing process: brainstorming, drafting, researching, revising, and polishing. This is a free, walk-in service on the main level of Lilly Library. In addition to dropping by, students may also schedule an appointment in advance using the online scheduler found at: <http://www.earlham.edu/writing-center/>. Also, if you want help with specific grammar topics related to your own writing, <https://www.grammarly.com/edu> is available for all Earlham students to proofread their papers and learn more about grammatical errors.

[Syllabus Appendix \(click here to view\)](#)

Appendix to the Syllabus

Math department student learning goals

Curiosity: an encounter with mathematical meaning, beauty, and joy.

Mathematics is an art as well as a craft. Depending on how one counts, somewhere between five and all of the classical seven liberal arts have significant mathematical content. We'd like to help students encounter seriously both the beauty and the utility of an art without which neither the world around us nor the last two and a half millennia of human culture are at all intelligible.

Craft: using mathematical tools.

Mathematics is a craft as well as an art. Much of our work involves exposing our students to the concrete mathematical tools they need to succeed in other disciplines and in a world shot through by mathematics. Those tools range from fancy machinery for quantum physicists to using simple algebraic or differential equations to model phenomena in biology and economics to techniques to manage randomness in data in the social sciences to the basic vocabulary needed to read newspaper stories with numbers in them.

Confidence: an ability to create and use mathematics themselves.

Mathematics is also the product of human beings, who work individually and collectively to discover or invent mathematical truth. We work to inculcate in our students a spirit of inquiry and to empower them to discover that they are able as individuals and working with others to make mathematical discoveries and to utilize mathematics in creative ways. Math is the work of humans, and as humans, our students have all the prerequisites they need to do and to use mathematics.

Communal Inquiry: mathematical community and communication.

Mathematics is a communal enterprise, and even a glance at the words shows that one can't have community without communication. We'd like our students to practice mathematical communication. This means that they need to learn to verify and to convey to others the results of their mathematical inquiries by writing precise, concise, and completely persuasive arguments in idiomatic mathematical language. In mathematics, the products of this writing are called *proofs*. It also means that students need to practice reading carefully and critically the mathematical works of others so as to be able to share in a community of inquiry and to learn new mathematics on their own.

Continuity: lasting mathematical experience.

Mathematics does not end with what one learns in four years at college. We wish to equip our majors for further study in mathematics at the post-

baccalaureate level, though we accept that with our current program, the path available to most students wishing to do graduate work will require them using as a stepping stone a Masters program at something other than a first-tier university. We would also hope that our non-majors might carry the spirit of joy, skill, confidence, and cooperative inquiry with them after they leave Earlham.

Earlham College learning goals

(See <https://earlham.edu/registrar/curriculum-guide/learning-goals/>)

Students should be able to:

- **Communicate** effectively and work collaboratively across diverse contexts via multiple media. Effective communication involves both social and expressive skills and the ability to communicate in multiple settings and cultures.
- **Investigate** and analyze information, materials, problems and texts using a variety of techniques. Thoughtful and careful analysis requires the ability to collect, understand, interpret and evaluate multiple pieces of evidence, with systematic understanding and overt application of qualitative, quantitative, analytical and abstract reasoning.
- **Integrate** knowledge, experience, and skills across domains and contexts. Integration involves connecting and developing ideas, as well as synthesizing and transferring learning to new and complex situations.
- **Diversify** personal and cultural experiences, ways of knowing, and social relationships. The practice of diversity involves embracing opportunities to explore outside their interests and typical frame of reference.
- **Create** and innovate across a variety of disciplines. Creativity and innovation require a willingness to take risks, be open to new possibilities, and produce new knowledge and artistic and social forms.
- **Reflect** critically on their learning experiences, ethical and vocational choices, lifestyle, and beliefs in light of multiple understandings of the world. Reflection involves the ability to examine past experiences and apply their lessons to future contexts.
- **Apply** knowledge and skills to real world problems and situations as well as to improve their own mental, spiritual and physical well-being. Applying learning effectively is a key skill of a lifelong learner.