

SARAH • LAWRENCE • COLLEGE

MATH 3005: COURSE SYLLABUS

FALL 2016

Calculus I:

The Study of Motion and Change

Level: Open (with permission)

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Office: 1 North

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Meeting Times

Seminars:

Section 1: **Mondays & Wednesdays – 7:00 pm - 8:25 pm – Science Center – Room 201.**

Section 2: **TBD.**

Individual student conferences to be scheduled on alternating weeks.

What is this class?

Our existence lies in a perpetual state of change. An apple falls from a tree, clouds move across expansive farmland blocking out the sun for days, meanwhile satellites zip around the Earth transmitting and receiving signals to our cell phones. The calculus was invented to develop a language to accurately describe and study the change we see. The ancient Greeks began a detailed study of change but they were scared to wrestle with the infinite and so it was not until the 17th century that Isaac Newton and Gottfried Leibniz, among others, tamed the infinite and gave birth to this extremely successful branch of mathematics. Though just a few hundred years old, the Calculus has become an indispensable research tool in both the natural and social sciences. Our study begins with the central concept of the limit and proceeds to explore the dual of differentiation and integration. Numerous applications of the theory will be examined. For conference work students may choose to undertake a deeper investigation of a single topic or application of the Calculus or conduct a study in some other branch of mathematics or a related field.

Learning Goals

To develop an understanding and appreciation of the mathematical concepts and tools in single-variable Calculus that provide the ability to model continuously changing quantities. Additionally, by the end of the semester students will be able to:

- demonstrate proficiency in treating mathematical content at an appropriate level.
- demonstrate competence in the use of numerical, graphical, and algebraic representations.
- demonstrate the ability to interpret data, analyze graphical information, and communicate solutions in written and oral form.
- demonstrate proficiency in the use of mathematics to formulate and solve problems.
- demonstrate proficiency in using technology such as handheld calculators and computers to support their use of mathematics.
- demonstrate proficiency in the use of mathematics to structure their understanding of and investigate questions in the world around them.

Who should take this class?

This course is intended for students interested in advanced study in mathematics or science, students preparing for careers in the health sciences or engineering, and any student wishing to broaden and enrich the life of the mind.

Prerequisites

Prerequisites: the minimum required preparation for study of the Calculus is successful completion of study in trigonometry and pre-calculus (including the concept of functions). Students concerned about meeting the course prerequisites are encouraged to contact the instructor as soon as possible.

Required Texts

- *Calculus with Early Transcendentals*, 1st Edition, by Michael Sullivan, Kathleen Miranda. W.H. Freeman.
- *WebAssign* Access (for online HW).
- Richard Hammack, *Book of Proof*, 2nd Edition. **Nota Bene:** This OPTIONAL TEXT is available for FREE from the author's website!

A few comments about the required texts.

- Students are not required to purchase a physical copy of the book as an electronic version is provided at no additional cost with a purchase of access to WebAssign—Note bene: access to the ebook ends after the semester ends! Therefore, for students who will continue with Calc 2, Physics based Calculus, Chemistry, etc, I recommend that you buy a physical copy.
- WebAssign access can be purchased directly online (with a credit card) or with the textbook (if bought with the textbook, don't lose this "key code"!!!)
- This is an optional text that we will not cover in class, but it is recommended for students who plan to read and study the proofs in calculus. This handy book will "demystify" proofs and the various standard techniques in arguments and logic.

Required Calculator

None, but you may bring a calculator or laptop with you to seminar if you wish. We will discuss the free programs Desmos, Geogebra, Wolfram Alpha, and SAGE and how it can help in learning.

Expectations

Course Readings

For each seminar meeting there will be an assigned reading from the course text or a supplemental handout. As this is a lecture-free course, these readings will form the basis of our seminar discussions. In preparation for each seminar meeting, students absolutely must complete the assigned reading and be fully prepared to discuss the ideas encountered in the readings and/or work out problems alone or in groups at the blackboard. See "Course Readings and Seminar Exercises" hand-out (to be supplied on MySLC) for the scheduling of readings.

Reflection pieces

The ability to read mathematics successfully—for deep understanding and long term retention—is a skill that requires considerable effort to develop. It is also a skill that is often not developed in traditional high school courses. In this course you will have much opportunity to improve your technical reading/learning

skills. As a first step, please consult the “Suggestions for Effective Reading of Mathematics” document (to be supplied on MySLC).

Students are required to prepare a summary (as little as a few sentences but sometimes they may be a paragraph or two; but no more!) and question (consult the “Suggestions for Effective Reading of Mathematics” document; to be supplied on MySLC) for each section of assigned reading in advance of each seminar meeting called “Reflection Pieces.” These are due online two hours before seminar.

Problem Sets

In addition to completing the daily readings, students are required to prepare a collection of exercises online using WebAssign, which may be worked on alone or in groups. Due dates will be provided through WebAssign. I will post the “class key” on MySLC for signing up for our section in WebAssign. Note: You may sign up for WebAssign for free for the first two weeks, after that you will be required to pay for the service with a credit card (or if you buy the book with WebAssign access bundled together then you will use the code provided).

Other Assignments

There may be additional collections of problems to be written up and done “by hand” called Hand-In Homeworks and/or Take-Home Examinations, which are done independently without the consultation of others or the internet. These will be announced with at least two weeks anticipation before they are due.

Additionally, there might be one short paper assigned approximately in the middle of the term.

There are no in-class quizzes or exams in this course. Reflection pieces, WebAssign problems, problems sets, and the paper permit assessment of student progress in learning the topics in this course.

Conference Work

Each student in the course will be expected to design and complete an independent project for conference work. Individual conferences will be held biweekly. Student conference work may be dedicated to a deeper investigation of a single topic studied in the course, study in a different branch of mathematics (e.g., statistics, game theory, linear algebra) or some other mathematically-themed investigation. Conference time will also provide an additional, out-of-class opportunity for discussion of ideas generated in seminar.

Important dates¹:

10/7 Friday: Conference proposal

11/16 Wednesday: Conference draft

12/16 Friday: Conference project and presentation

Late Work Policy

You may ask for extensions on WebAssign homework directly from WA. I reserve the right to deny extensions for any reason. Late work will not be accepted for other assignments. However, two extensions will be granted to any student who requests an extension at least 24 hours in advance of the original deadline. Extension requests can be presented in person, over the phone, or via email. Except in unusual circumstances, each student will be granted only two deadline extension during the semester.

¹Dates subject to change

Additional Help

I encourage students who are having difficulty with the course material to meet with me for individualized help. Students are also encouraged to develop and maintain an email dialogue with me so that I may provide more timely assistance with smaller-scale questions.

Students of this course can also access the free services (including free, walk-in tutoring) of the Mathematics Resource Center. More information about these services will be provided later.

Evaluations

At the end of the semester an individual course evaluation and course grade will be given to each student. This evaluation will be based primarily on the student's level of preparation for seminar, contributions to seminar discussion and quality of work on the problem sets, papers, and conference project. There will be no formal examinations in this course.

Self-Evaluations

Introspection is an important component of the learning process: a student's evaluation of his or her own work is as important, if not more important, than any teacher's evaluation. As such, students will be required to write a brief statement of self-evaluation on each assignment (problem sets and conference project) and an additional, more comprehensive self-evaluation at the end of the term.

Attendance

Both lecture and discussion session attendance is absolutely mandatory. Students who miss more than two classes or discussion sessions (without a documented reason) run the risk of receiving reduced course grade. Number of classes missed and number of classes with significant tardiness will be indicated on the course evaluation. If a class is missed, the student is responsible for obtaining class notes and assignments, and the student is expected to be fully prepared for the next class session.

Note: Except in cases of emergency or a full 24 hour advanced notice, there will be no rescheduling of missed conferences. However, when unavoidable situations occur, students may request an alternative conference time in advance of the regularly scheduled conference time.

Science & Math. Third Programs

Qualified students may enroll in this course as part of a Science and Mathematics third program. This registration option allows students to enroll in two science and mathematics courses that together constitute a third of the enrolling student's registration for the term. This seminar can be combined under this third program with another seminar or a lecture course and either a yearlong or semester course. Interested students should consult with the professors of both courses, and permission of both professors is required to enroll in the program.

Disability Services

If you have a disability that may interfere with your ability to participate in the activities, coursework, or assessment of the objectives of this course, you may be entitled to accommodations. Please contact Polly Waldman, Associate Dean of Studies and Disabilities Services, in Westlands 207C or x2235 or pwaldman@sarahlawrence.edu. Under the Americans with Disabilities Act and Section 504 of the Vocational Rehabilitation Act of 1973, all students, with or without disabilities, are entitled to equal access to the programs and activities of Sarah Lawrence College.

Course Outline

This is broad course outline of the topics covered. I will post a separate document with the entire course schedule of readings on MySLC shortly. Consult MySLC for updates.

- Chapter P: Preparing for Calculus
- Chapter 1: Limits & Continuity
- Chapter 2: The Derivative
- ★ Intermission: Philosophical Debates
- Chapter 3: More about Derivatives
- Chapter 4: Applications of the Derivative
- Chapter 5: The Integral
- ★ Postscript: What is Calc 2? What are math courses beyond calculus? What is mathematics?