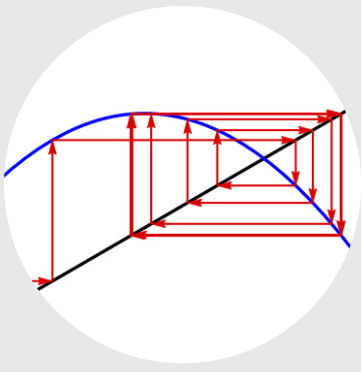




Calculus: Dynamics and Integration

Math 118

Instructor Info —



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Student Hours: see Moodle



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Course Info —



Monday, Wednesday



001: 10:30-11:25a (Sabloff)
002: 2:30-3:55p (Sabloff)
003: 11:30a-12:55p (McGee)
004: 1:00-2:25p (McGee)



001/002: KINSC H011
003/004: Observatory

Overview

Math 118 provides a bridge from “some exposure to single-variable calculus” to “readiness for multivariable calculus”. We will begin by discussing two topics that are rarely seen in a single-variable calculus course: *discrete dynamical systems* and *differential equations*. These ideas are used to describe systems that evolve over time; they are widely applicable in the natural and social sciences. You will use ideas from calculus (both old and new to you) to examine qualitative, numerical, and exact methods for analyzing these systems. The last few weeks of the course are a more traditional treatment of *integrals and some of their applications*.

The course will involve a focus on *modeling*, since discrete dynamical systems and differential equations are tools for describing real-world process that evolve in time (discrete time in the first case, continuous time in the second).

Prerequisite: Calculus I (Math 105) or equivalent, or placement into 118.

Learning Objectives

Content: You will learn how to ...

- Use mathematical language to *model* real-world phenomena
- Understand families of functions, i.e. functions and models with parameters
- Work with multiple representations of models (graphs, tables, diagrams, formulae, ...)
- Analyze approximation and convergence (How can you find good approximations to a solution to a problem, and how can you tell how precise an approximation is?)

Broader: You will ...

- Contribute to a classroom environment that is lively and collaborative
- Help one another understand the material in the class, through discussions that respect everyone’s voice and perspective on the class material
- Become more comfortable with math being less about “getting an answer” and more about marshaling a variety of types of evidence to formulate a convincing argument supporting a particular conclusion.
- Build mathematical persistence, not expecting the answer to arise immediately every time, but rather being prepared to revisit questions more than once, and to seek out available resources when you need help
- Improve your ability to communicate your mathematical findings both orally and in writing with precision, clarity, and a sense of your audience.

Growth, not ability:

There is a widespread belief that you are either “good” or “bad” at math, and if you are “bad” at it, then you will always be bad at it no matter how hard you try. This is **false**, and the mathematics community bears a lot of responsibility for perpetuating this myth. In reality, mathematics is just like any other discipline or skill: you can improve more and more with attentive practice.

Text

We will follow a set of lecture notes created by various people at Haverford. These are available as a PDF on the course Moodle page.

Moodle

Materials for this course, including course announcements, assignments, and deadlines, and overall course information will be posted on the Moodle website. You will need to check Moodle and your email regularly.

Equity and Inclusion

You are *all* welcome and belong here. We will always work to make our classroom a safe space for everyone to contribute, learn, and grow no matter your identity, background, or circumstances.

In particular, remember that we are not all coming to this class with the same privileges, resources, time, and knowledge. **As a community, mathematicians and scientists need to do a much better job of making our disciplines more accessible to people of all races, genders (including gender non-conforming folks), sexual identities, and class backgrounds.** While this is a priority for all of us in the classroom, we do not claim to know how to best honor this commitment, and so **we are open to feedback from you when it comes to making the course more accessible and inclusive to all identities.**

We expect that our classroom will be a place where *all* of us respect one another and support each others' learning. It's not equally easy for all of us to speak up in a large group, and the voices of historically underserved/marginalized students are most easily drowned out in group work. Please keep this in mind when working together.

Grading

Your grade for the course will be determined according to the following weighting:

Pre-Class Responses 5%

Online Problem Sets 5%

Written Problem Sets 15%

Mastery Quizzes (2) 10% (i.e. 5% each)

Projects and Final 65% total (20% for the lowest two and 25% for the highest)

You must take the final exam in order to pass the class.

In case of disruptions, we may also compute an alternate grade with different weights. If we do this, we will inform you of this computation and you will receive the higher of the two grades.

Weekly Assessments

• Class Time and Lecture Responses

We are excited to use a “flipped classroom” format in this class! Before each class meeting, you will be expected to prepare by watching one or more pre-recorded lectures and/or reading the relevant sections of the textbook. You will then answer a standard set of questions on Moodle. The reading questions will be graded on a “complete / incomplete” scale (where “complete” means that you gave the questions a serious effort — a sentence or three per question is usually sufficient). Class time will build on the pre-recorded lectures / readings by answering your questions from Moodle and asking you to discover and engage more deeply with the material in small groups.

• Problem Sets

Weekly problem sets will be due on **Wednesdays at 4pm**. They will consist of two parts.

1. Online Exercises

The online portion of the assignment will consist of several problems to help you master fundamentals. We strongly encourage you to attempt the online problems *as early as possible* without your notes and other resources. If you have trouble, afterward you can look at your text, talk to your peers, ask questions, and then make further attempts. This will give you important feedback about how well you are learning the course material.

To reduce stress over getting every last problem correct, we will count 80% correct as full credit for this portion of the problem set.

2. Written Problems

The other part of the weekly assignment will consist of written problems that are designed to help you deepen your understanding of the material. They will be graded for correctness and clarity of solution.

See the “Writing Clear Solutions” document (on Moodle!) for a description of how to write up your findings.

We expect you to keep up with the weekly problem set deadlines to maximize your active learning in class. That said, we understand that there are circumstances that may interfere with your learning schedule. To that end, there is a 24-hour, no-questions-asked **grace period** for problem set submissions. Problem sets turned in during this grace period will be marked late for our records, but there will not be any grade penalty.

Other late homework could result in a 50% penalty, depending on the circumstance.

Projects

Instead of midterm exams, you will complete two written projects, which are your golden opportunity to think about how to express and justify your mathematical reasoning clearly and precisely. You will work in small groups (with about two other students) on these assignments. You will investigate a mathematical model and then write a short paper explaining and justifying your findings.

Summative Assessments

- **Mastery Quizzes**

After each of the Discrete Dynamical Systems topic and the Differential Equations topic, you will complete a short take-home quiz to assess your understanding of the fundamental ideas and processes introduced. The problems in the quizzes will be on roughly the same level as the online exercises.

- **Final Exam**

The final exam will be self-scheduled during the final exam period.

When Life Happens

Life happens to all of us, and it is important to recognize each other's humanity. Moreover, it is important to emphasize that your health and well-being are the most important outcomes of this class. The grace period on the problem sets is built into the course for exactly when life happens.

Please be in touch with us (and your dean!) as early as possible in case of significant illness, a family emergency, or a religious obligation. We will work with you to find an optimal path forward. **In general, please do not hesitate to come talk to us about extension requests. Do not presume to know our minds — ask!**

Collaboration

Collaboration on problem sets is *highly* encouraged, but should be approached carefully. There is a fine balance between learning from working with your fellow students and finding your own way through the material. What you turn in for written HW should reflect your personal understanding of the problems, so **you must write the solutions yourself without referring to notes from your collaborative work**. If you find you are not able to do this, then that is likely a sign that you have not yet fully understood that particular problem and you should pause and seek advice from us or one of the other help resources. Please indicate on your assignment who your collaborators were.

So as to ensure productive collaborative work, you should not be working in groups larger than four people on any given problem at any given time. Two- or three-person groups are better than four. *Large groups of people “working together” are not really working together.* **If at any time in the semester you want to be working in a group but do not have a group of students to work with, please let us know and we will help you find a working group.** If at any time in the semester, you find yourself in a group of students in which people are not feeling respected, please let us know as well.

Note that you are not allowed to use materials aside from the text, materials from Moodle, reserves in the library, and, of course, class notes in this course. These materials have been carefully curated to help you learn. **In particular, do not use resources from the internet without express permission.** Please help us ensure that we can maintain an environment of trust and respect throughout the semester by working with integrity and coming to us if you have any questions.

Additional Resources

- **Student (Office) Hours:** Please stop by to see us (either of us!) during student hours! Ask questions! Meet your classmates! Snuggle Prof. Sabloff's dog (she'll be an occasional office guest)! We have set aside this time specifically to help you learn and be successful in the course. Student hours will come in two flavors this semester:

Appointment Slots Sign up on our calendars for one-on-one meetings, though you are welcome to come in small groups — in fact, we encourage that!

Supervised Collaboration We will gather to work in small groups on problem sets, with one of the instructors available to answer questions.

See Moodle for times and locations.

- **Calculus Resource Center:** The CRC is a space dedicated to collaboration among Math 118 students and tutoring from Math 118 course assistants. The CRC is open on Monday and Tuesday evenings; please see the “Resources and Weekly Schedule” document for times and places.
- **Math Question Center:** The MQC is place you can go to discuss problem sets with your classmates and ask questions of upperclass student tutors. The MQC is open Sunday through Thursday evenings; please see the “Resources and Weekly Schedule” document for times and places.

- **Peer Tutoring:** Free peer tutors are available through the Office for Academic Resources; see <https://www.haverford.edu/academic-resources/peer-tutoring>.

Equal Access

ADS: We are committed to partnering with you on your academic and intellectual journey and recognize that you bring many strengths, perspectives and strategies as you navigate this journey. We encourage you to think proactively and strategically about leveraging these strengths, in partnership with the many resources on campus. These resources include CAPS (free and unlimited counseling is available), Office of Academic Resources, Writing Center, Student Diversity Equity and Access Team, Health Services, Professional Health Advocate, Religious and Spiritual Life, the GRASE Center, and the Advising Deans. At times you may experience challenges or stressors that impact your ability to fully engage intellectually. If the stressors are academic, we welcome the opportunity to discuss and address those stressors with you in order to find solutions together. If you are experiencing challenges or questions related to emotional health, finances, physical health, relationships, learning strategies or differences, or other related topics, we hope you will consider reaching out to the many resources here on campus. Additional information can be found at <https://www.haverford.edu/deans-office-student-life/offices-resources>.

Additionally, Haverford College is committed to creating a learning environment that meets the needs of its diverse student body and provides equitable access to students with disabilities. If you have (or think you may have) a disability related to mental health, chronic health, neurological state, and/or physical condition – please contact the Office of Access and Disability Services (ADS) at hc-ads@haverford.edu. It is never too late to request ADA accommodations – our bodies and circumstances are continuously changing. Please know that all inquiries and health-related information is handled in a sensitive and confidential manner.

Students who have already been approved to receive academic ADA accommodations and want to use these in this course should share their accommodation letter and make arrangements to meet with us as soon as possible to discuss how their accommodations will be implemented in this course. Please note that accommodations are not retroactive and require advance notice in order to successfully implement.

If, at any point in the semester, a disability or personal circumstances affect your learning in this course, please do not hesitate to reach out to us. We want to be sure you are aware of the full range of resources and options available to you.

It is a state law in Pennsylvania that individuals must be given advance notice that they may be recorded. Therefore, any student who has a disability-related need to audio record this class must first be approved for this ADA accommodation by Access and Disability Services and then must communicate approval to me. I will then make a general announcement to the class that audio recording may occur while respecting students' right to privacy by not identifying the individual(s).

Title IX: Haverford College is committed to fostering a safe and inclusive living and learning environment where all can feel secure and free from harassment. All forms of sexual misconduct, including sexual assault, sexual harassment, stalking, domestic violence, and dating violence are violations of Haverford's policies, whether they occur on or off campus. Haverford faculty are committed to helping to create a safe learning environment for all students and for the College community as a whole. If you have experienced any form of gender or sex-based discrimination, harassment, or violence, know that help and support are available. Staff members are trained to support students in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more.

The College strongly encourages all students to report any incidents of sexual misconduct. Please be aware that all Haverford employees (other than those designated as confidential resources such as counselors, clergy, and healthcare providers) are required to report information about such discrimination and harassment to the Bi-College Title IX Coordinator: <https://www.haverford.edu/users/ktaylor4>

Information about the College's Sexual Misconduct policy, reporting options, and a list of campus and local resources can be found on the College's website: <https://www.haverford.edu/sexual-misconduct>