

Math 1070 Syllabus, Spring 2024

The Mathematics of Change

Instructor

Robin Pemantle pemantle@math.upenn.edu

Text

The Mathematics of Change, part I

written by the Penn Calculus Group and available for free on Canvas or at the URL:

<https://www2.math.upenn.edu/~pemantle/1070-public/1070-e-text.pdf>

Class meets in DRL 3N1H on Tuesdays and Thursdays from 10:15 to 11:45.

Recitations meet for 60 minutes twice weekly, at a place and time to be found on your course schedule. The last 30 minutes of the recitation time block you see on your schedule is for Gateway exams (see below).

Pre-requisites

Understanding of high school mathematics up to but not including calculus, in particular exponential and trigonometric functions, analytic geometry and fluency in algebra, manipulation of functions and equations, and graphing.

The first Gateway exam is devoted largely to making sure you have a solid understanding of these topics at the level needed for use in this course. A significant portion of students find the need to brush up on these skills. While we do not spend entire classes on background material, we will help you understand precisely what skills these are and will reinforce them in the early weeks.

Course content and broader goals

The content listed in the registrar's description is: Limits, orders of magnitude, differential and integral calculus; Taylor polynomials; estimating and bounding; probability densities. Mathematical modeling and applications to the social, economic and information sciences.

More broadly, the purpose of this course is to introduce you to calculus in a single variable, and how to use that to model phenomena in the real world. Applications span problems in

social sciences, life sciences, economics, business and physical science. The applications are not simply platforms for learning and practicing mathematical technique; the focus, rather, is on learning to mathematize a verbal scenario in a useful way.

A student who completes this course will be able to

- identify when a mathematical tools is appropriate to model a particular problem
- apply the mathematical tools of differential and integral calculus to solve interesting problems
- use critical thinking tools such as special cases, generalization and counterexamples to test and justify convincing mathematical arguments.
- articulate mathematics coherently and comprehensibly in writing and speaking

Pedagogy and philosophy

This is an active learning course, meaning that class time will be spent on solving problems in small groups and discussing problems as a class. This format supports the goals of modeling, articulation, argumentation and problem solving. Students begin each unit with assigned reading from the textbook. After some class time devoted to questions and answers, the remainder of each unit is devoted to solving and discussing problems. Preparation for class is expected, and checked via quizzes. Assistance with questions on the reading will be available before the due date via online chat as well as office hours.

Grading

The grade breakdown reflects course priorities, as follows.

- 20% Gateway skills exams
- 15% Attendance and participation
- 22% Weekly quizzes on the reading and class work
- 20% Written homework
- 8% Oral midterm exam
- 15% Final exam

The Gateway skills exams are on computational skills, taken on a pass/fail basis, with four attempts allowed and deadlines for passing each one given on the course calendar. The intention is that every student can and most will pass all of these exams, leading to full credit for the basic skills component of the course.

The grading philosophy is that students come in with very different backgrounds and should not be competing for grades with students who have seen more of the material before. It is likely this course will be very different from previous math courses you have taken, and that this will be as new to students with some calculus exposure as it is to students with no previous calculus exposure. With regards to mathematical modeling and argumentation, students with different backgrounds will generally be starting on the same footing. Students who have seen some calculus before will spend less time passing the Gateway exams than will students who have not, but will receive the same credit for passing.

The attendance grade is based on the fact that a portion of the learning is experiential. Much of the in-class work teaches material you need for the quizzes, homework and exams. However, there is also a component where students learn problem solving, collaborative work and articulation of mathematical conjectures and arguments. Past experience has shown that these high level skills, which are on the official syllabus, do not make good exam problems. Therefore, 15% of the course credit is given for showing up, discussing and working through problems beyond those that are appropriate for a timed exam.

Grading is not curved. By the above formula, a score of 90% guarantees you at least an A-, a score of 80% guarantees you at least a B-, and a score of 70% guarantees you at least a C-. I reserve the right to give students scores higher than the ones guaranteed by the formula if I believe they have demonstrated greater understanding than the grading formula indicates.

Workload

There are two mandatory class sessions of 90 minutes each per week. Recitations run for 60 minutes on Mondays and Wednesdays. The Wednesday recitation includes a quiz. The Monday one does not, however this where Q & A on the reading takes place, and is therefore equally important even though we do not enforce this in the attendance grade.

In keeping with university and department policy, the outside of class workload will be estimated at two to three times the number of contact hours, that is, 10–15 hours outside of class each week. As a rough guideline, we expect five hours for reading the textbook and answering self-check questions, five hours on homework, and two hours on other assignments, study and review.

Please note: many courses assign less work than this guideline! This course should probably be viewed as a heavy time commitment. In particular, you are expected to read one chapter each week, before covering the material in class, so that you are prepared to practice skills in class and spend class time learning to apply your knowledge. One chapter may not seem like a lot but reading math effectively is slower than reading most other texts. Students with a high courseload or multiple serious extracurricular commitments might think twice about taking this course.

Academic integrity

For exams, the usual university rules apply. If you're not familiar with these, for which a link is supplied on the Math 1070-001 Canvas homepage. For written homework, it is expected and in fact encouraged that you will collaborate with other students. Specifically, you may:

- talk to other students in the class and share ideas,
- talk to me, TAs, or tutors,
- look at our textbook or other textbooks, video lectures, etc,
- talk to students in other classes about the general ideas in the course.

Do not, however:

- look for answers to these specific problems on the internet,
- look at complete solutions written by current or previous students,
- talk to students not currently in the class about the specific problems,
- ask your TA to walk you through a complete solution to a homework problem.

In the end, no matter how little or how much collaboration you have done on a problem, all work you hand in must be typed or hand-written by you and only you. If you turn in work on a problem where you feel that you relied entirely on others for the solution and you did not actively contribute, you should acknowledge your collaborator(s) at the top of your solution. Adopting this practice will help you stay out of sticky situations later on and it costs you nothing now.

Make-up work and accommodations

Attendance credit for classes missed for legitimate reasons can be made up by **turning in the worksheet for that day**. The maximum attendance credit is 26 classes, so two of the 28 classes can be missed with no penalty, though you should still be sure to learn the material. The first time you ask to make up an attendance credit it will always be granted. On subsequent occasions, I will want to know what's going on.

Students receive accommodations for disabilities directly from the Student Disabilities Service. This is something you need to arrange for yourself. Individual instructors cannot make determinations. Our role is to do whatever we are told by Disability Services in order to provide the accommodation.