Note: This section will be “flipped”, meaning that students will be expected to read before class and will use class time to work on problems in groups. See below for more information.

Text:


Prerequisite:

A solid knowledge of precalculus. This prerequisite can be satisfied by taking Math 5a at Brandeis or by achieving a satisfactory score on the online math placement exam (see [http://www.brandeis.edu/registrar/newstudent/testing.html#mathtest](http://www.brandeis.edu/registrar/newstudent/testing.html#mathtest)).

**IMPORTANT!** Most students who struggle in Math 10a do so because they lack a solid knowledge of precalculus.

For example, on an exam you will have to work with expressions like:

- \( \ln(3\sin t) \)
- \( \sec \left( \frac{\ln(x + 2)}{x + 2} \right) \)
- \( a^{-2\log_a(2)} \)
- \( \frac{e^{2x} - 5e^x + 6}{1} \)
- \( \tan(e^{3t}) \)
- \( \ln \left( \frac{1}{\sqrt{e}} \right) \)
- \( \ln(x^2 - 1) - \ln(x + 1) \)

If you are unsure whether Math 10a is the right course for you, please contact the course coordinator, Becci Torrey (rtorrey@brandeis.edu).

**Learning Goals for Math 10a:**

- Understand and be able to apply key ideas of calculus, including:
  - Develop a basic understanding of limits and learn to compute a variety of limits.
  - Understand the definition of the derivative, and its interpretation in terms of slope and instantaneous rate of change.
  - Compute derivatives of polynomial, rational, exponential, logarithmic and trigonometric functions, as well as combinations of these functions.
  - Use derivatives to find and sketch all the important features of graphs of functions (even quite complicated functions).
  - Use derivatives to analyze the behavior of functions, e.g., finding the extrema of functions and determining the end behavior of functions.
  - Use derivatives to solve a variety of optimization problems and applied rate of change problems.
  - Compute antiderivatives of polynomial, rational, exponential, logarithmic and trigonometric functions.
  - Understand basic ideas of differential equations.
Learning Goals for Math 10a: (cont.)

- Hone quantitative reasoning skills by solving problems that challenge you to understand the material on a deeper level by presenting the material in ways not demonstrated explicitly in class.

- Improve communication skills, particularly for communicating technical information, by practicing writing (on homework, quizzes and exams) and speaking (to classmates, evening help tutors and your instructor) with precision about these mathematical concepts.

- Develop a sense for how the specific skills learned in math 10a will transfer to other disciplines by solving applied problems from other fields, such as biology, chemistry, physics and economics.

Syllabus:

We will cover the following topics this semester:

<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>The Tangent and Velocity Problems</td>
</tr>
<tr>
<td>2.2</td>
<td>The Limit of a Function</td>
</tr>
<tr>
<td>2.3</td>
<td>Calculating Limits Using the Limit Laws</td>
</tr>
<tr>
<td>2.4</td>
<td>Continuity</td>
</tr>
<tr>
<td>2.5</td>
<td>Limits Involving Infinity</td>
</tr>
<tr>
<td>2.6</td>
<td>Derivatives and Rates of Change</td>
</tr>
<tr>
<td>2.7</td>
<td>The Derivative as a Function</td>
</tr>
<tr>
<td>2.8</td>
<td>What does $f'$ say about $f$?</td>
</tr>
<tr>
<td>3.1</td>
<td>Derivatives of Polynomials and Exponential Functions</td>
</tr>
<tr>
<td>3.2</td>
<td>The Product and Quotient Rules</td>
</tr>
<tr>
<td>3.3</td>
<td>Derivatives of Trigonometric Functions</td>
</tr>
<tr>
<td>3.4</td>
<td>The Chain Rule</td>
</tr>
<tr>
<td>3.5</td>
<td>Implicit Differentiation (including related rates)</td>
</tr>
<tr>
<td>3.7</td>
<td>Derivatives of Logarithmic Functions</td>
</tr>
<tr>
<td>3.8</td>
<td>Rates of Change in the Natural and Social Sciences</td>
</tr>
<tr>
<td>4.2</td>
<td>Maximum and Minimum Values</td>
</tr>
<tr>
<td>4.3</td>
<td>Derivatives and Shapes of Curves</td>
</tr>
<tr>
<td>4.4</td>
<td>Graphing with Calculus and Calculators (no calculators used)</td>
</tr>
<tr>
<td>4.5</td>
<td>Indeterminate Forms and L’Hôpital’s Rule</td>
</tr>
<tr>
<td>4.6</td>
<td>Optimization Problems</td>
</tr>
<tr>
<td>4.8</td>
<td>Antiderivatives</td>
</tr>
<tr>
<td></td>
<td>Differential Equations</td>
</tr>
</tbody>
</table>

Note: Some topics may be added or omitted as time permits.
Exams:
There will be two midterm exams and a final exam. **TENTATIVE exam dates:**

- Exam 1: (around) Tuesday, October 9, 7–9 p.m.
- Exam 2: (around) Tuesday, November 6, 7–9 p.m.
- Final Exam: during Final Exam period, will be scheduled by registrar

Midterm exams will be held in the evening. If you have an academic conflict (such as a class, lab, or another exam) with a midterm exam, inform your instructor **at least one week before the exam.** If the conflict can’t be resolved, we will offer you a make-up exam.

Flipped Class Structure:
The original idea behind “flipped” classes is that the traditional lecture format for teaching academic material is surprisingly ineffective. There is fairly good evidence, coming from studies conducted at the university and high school level, that passively listening to explanations in a lecture leads to far less understanding than actively trying to solve problems and answer questions. The evidence suggests that most of the actual learning happens not in lecture, but when students sit down with their notes and their problem sets and try to do their exercises. The point of flipping a class is to use class time for working on exercises so the teacher is there to help when students have questions. To make this possible, students read the material beforehand and come to class to complete their problem sets where the teacher is available to them.

We’ve added some regular structure to help you stay organized. Each section of the textbook will have three assignments: an **A** assignment, a **B** assignment, and a **C** assignment.

- For the **A** assignment you will be asked to read a section of the textbook and take notes. You will be given a reading guide consisting of some reading comprehension questions and instructions which will help you to make a ‘cheat sheet’ with all the important information for that unit. By the end of the semester you will have a folder filled with these cheat sheets which will be your own mini calc text which you can then use for the rest of your time at university.

- For the **B** assignment you will be given a large number of practice problems using the information you recorded on your cheat sheet from the **A** assignment. You will be expected to write up partial or complete solutions to all of these problems. They will be graded for ‘good faith effort’ (did you try them or not?) and not for perfect solutions; the point of these problems is to help you formulate questions and turn the information from the reading into a practical understanding. Although these problems will not be carefully graded you will receive A LOT of feedback on them both from me and your other classmates.

- In the **C** assignment you will be given 2-3 harder problems to assess your understanding. These will be graded carefully and constitute the majority of your grade for the unit.
In class we will focus primarily on the B problems. The class will be divided into groups and every day I will assign each person in your group one of the B problems to present to the rest of the group. You do not have to present a perfect solution, but you do have to be able to clearly describe the attempt you made, and share your opinion on why it did or didn’t work. The point of this is that your group should discuss the solutions to the B problems, identify any tough questions you have about the material, and ultimately gain a better understanding. The TA and I will be engaged with this process to answer questions and help you navigate the topics and learn the problem solving methods. This is where I hope you’ll gain the most out of the class!

In class, we’ll be working on the B problems but in between classes you’ll also be working on the A and C assignments. Here is an example of how a week’s worth of assignment due dates might look, finishing section 2.3 through starting section 2.6:

<table>
<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3-B</td>
<td>2.3-C</td>
<td></td>
</tr>
<tr>
<td>2.4-A</td>
<td>2.4-B</td>
<td>2.4-C</td>
</tr>
<tr>
<td>2.5-A</td>
<td>2.5-B</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.6-A</td>
</tr>
</tbody>
</table>

For longer or harder sections, we will slow things down so there is more time in class to work on the material.
I will post the assignments on Latte in advance so that you can work ahead if you know you will be busy on particular days.

There will be no quizzes in this class!

Grades:
Your grade in the course will be based on the following:

• Section A’s (5% of your grade).
  – Should be written out neatly, well-spaced, and complete.
  – Will be graded on a (+, ✓, −) scale, you will be asked to show your completed A to me in class.
  – Before class (or immediately after) take a picture of your A or a scan and upload it to Latte using the homework submission feature. I will review them and address any frequent questions in the next class.
  – No late homeworks will be accepted, but your three lowest A grades will be dropped.

• Section B’s (5% of your grade).
  – Should be written out neatly, well-spaced, and complete.
  – Will be graded on a (+, ✓, −) scale, you will be asked to show your completed B to me in class.
  – You will be asked to present one of your solutions to your classmates.
  – No late homeworks will be accepted, but your three lowest B grades will be dropped.
• Section C’s (10% of your grade).
  – Should be written out neatly, well-spaced, and complete.
  – Will be graded for points with partial credit possible. These will be graded carefully and thoroughly so pay attention to details and write neatly!
  – To be turned in at the start of every class.
  – No late homeworks will be accepted, but 25% of your lowest C grades will be dropped.

• Two midterm exams (each 25% of your grade).

• Final exam (30% of your grade).

Calculators:
Calculators are not allowed during exams or quizzes. You should have access to a scientific calculator for homework, but you do not need a graphing calculator.

LATTE:
All course materials for Math 10a will be available online on LATTE. Log in at http://latte.brandeis.edu using your Unet username and password.

Self-quizzes:
There is a link called “Self-quizzes” on your Math 10a LATTE course page. The Math 10a self-quizzes cover all the material being studied in Math 10a. Complete solutions to each self-quiz are given. These self-quizzes are optional and for your use only, and have no effect on your grade.

Office hours:
You are encouraged to attend your instructor’s office hours whenever you have questions about the course material. If you can’t attend office hours, don’t hesitate to ask for an appointment for another time.

Evening help sessions:
You are welcome to attend the Math Department’s evening help sessions whenever you like. These are drop-in sessions that are available to students in Math 5a, 10a and 10b every Monday, Tuesday, Wednesday and Thursday evening anytime between 7:00 pm and 9:00 pm. Help sessions are held in Goldsmith 101 and will begin on Tuesday, September 4th.

Four-Credit Course (with three hours of class-time per week):
Success in this 4 credit hour course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (readings, papers, discussion sections, preparation for exams, etc.).

Students with disabilities:
If you are a student who needs academic accommodations because of a documented disability you should present your letter of accommodation to your instructor as soon as possible. If you have questions about documenting a disability or requesting academic accommodations you should contact Beth Rodgers-Kay in the Office of Academic Services at x63470 or at brodgers@brandeis.edu. Letters of accommodations should be presented at the start of the
semester to ensure provision of accommodations. Accommodations cannot be granted retroactively.

**Academic Integrity:**

You are expected to follow the University’s policy on academic integrity, which is distributed annually as section 4 of the Rights and Responsibilities Handbook (see [http://www.brandeis.edu/studentaffairs/srcs/rr/index.html](http://www.brandeis.edu/studentaffairs/srcs/rr/index.html)). Instances of alleged dishonesty will be forwarded to the Department of Student Development and Conduct for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University. If you have any questions about how these policies apply to your conduct in this course, please ask.

**Name/Pronouns:**

If you have a preferred name and/or preferred pronouns you would like me to use, please let me know either by email or in person. Thanks!

**Course coordinator:**

Professor Becci Torrey, Goldsmith 222, x63054, rtorrey@brandeis.edu.