MATH 10a: Techniques of Calculus (a)
Fall 2015

Section 1
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Office hours: see LATTE

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).

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:

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

If you are unsure whether Math 10a is the right course for you, please contact the course coordinator, Prof. 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 to 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.

- Acquire (or improve) ability to accurately represent mathematical expressions on a computer by practicing online homework with instant feedback.

Syllabus:
We will cover the following topics this semester:

<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
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<tbody>
<tr>
<td>2.1</td>
<td>The Tangent and Velocity Problems</td>
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<td>2.2</td>
<td>The Limit of a Function</td>
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<td>2.3</td>
<td>Calculating Limits Using the Limit Laws</td>
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<td>2.4</td>
<td>Continuity</td>
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<td>2.5</td>
<td>Limits Involving Infinity</td>
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<td>2.6</td>
<td>Derivatives and Rates of Change</td>
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<td>2.7</td>
<td>The Derivative as a Function</td>
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<td>2.8</td>
<td>What does $f'$ say about $f$?</td>
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<td>3.1</td>
<td>Derivatives of Polynomials and Exponential Functions</td>
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<td>3.2</td>
<td>The Product and Quotient Rules</td>
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<td>3.3</td>
<td>Derivatives of Trigonometric Functions</td>
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<td>3.4</td>
<td>The Chain Rule</td>
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<tr>
<td>3.5</td>
<td>Implicit Differentiation (including related rates)</td>
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<tr>
<td>3.7</td>
<td>Derivatives of Logarithmic Functions</td>
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<td>3.8</td>
<td>Rates of Change in the Natural and Social Sciences</td>
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<td>4.2</td>
<td>Maximum and Minimum Values</td>
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<td>4.3</td>
<td>Derivatives and Shapes of Curves</td>
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<td>4.4</td>
<td>Graphing with Calculus and Calculators (no calculators used)</td>
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<tr>
<td>4.5</td>
<td>Indeterminate Forms and L’Hôpital’s Rule</td>
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<tr>
<td>4.6</td>
<td>Optimization Problems</td>
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<td>4.8</td>
<td>Antiderivatives</td>
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<td></td>
<td>Differential Equations</td>
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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: Thursday, October 8, 7:00–9:00 p.m.
- Exam 2: Thursday, November 5, 7:00–9:00 p.m.
- Final Exam: Tuesday, December 15, 9:15 a.m.–12:15 p.m.

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.

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

- **Homework (10% of your grade).**
  - Homework assignments will be collected once or twice a week.
  - **No late homeworks will be accepted,** but your three lowest homework grades will be dropped.
  - We encourage you to discuss homework problems with your classmates, but you must write up your own solutions. You may not use any solution manuals.

- **Quizzes (10% of your grade).**
  - Short quizzes will be given regularly.
  - **No make-up quizzes will be given.** Missed quizzes count as zeroes. However, the lowest 25% of your quiz grades will be dropped.
  - There will also be a series of online homework assignments that will, altogether, count as one quiz grade. These online assignments will be graded for completion only. These assignments will be on a program called WeBWork and/or on a program called CalcTutor (developed by a PhD student in Computer Science here at Brandeis).

- **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 1st.

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). 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.

Course coordinator:

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