MATH 10a: Techniques of Calculus (a)
Fall 2020
Section 5DL
Instructor: Becci Torrey
e-mail address: rtorrey@brandeis.edu

Modality, Meetings, & Recitations:
This section will meet online on Zoom during the times scheduled by the registrar. Recitations are required (used for assessment) and will be held on Zoom. The 8 pm EDT recitation time is intended for international students. You are welcome to do the recitations at the 2 pm instead; please contact me if you would like to do this.

Calculus:
Calculus is one of the greatest intellectual achievements of humankind. The beautiful idea at the heart of this subject allows us to explore both the infinite and the infinitesimal. This gives us the tools to model and then analyze phenomena that change, i.e. pretty much anything!

Learning Goals for Math 10a:
1. Identify and apply key ideas and skills of Differential Calculus. This will be done by mastering the Outcomes detailed on the Latte page. See more on “Mastery Grading” below.
2. Transfer familiar concepts to unfamiliar contexts.
3. Hone your problem solving skills.
4. Develop and leverage a learning community for math.

Prerequisite:
A solid working knowledge of precalculus. You can check whether your precalculus is sufficient by taking the online math placement self-test (see http://www.brandeis.edu/registrar/newstudent/testing.html#mathtest). You can take our Math 5a (Precalculus) course to learn these skills.

IMPORTANT! We want you to succeed and experience shows that most students who struggle with Math 10a lack a solid knowledge of precalculus. For example, on an exam you will have to work with expressions like:

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

We want you to take the math class that is the best fit for you. We are happy to help you figure out which class that is. Please contact the course coordinator, Becci Torrey (rtorrey@brandeis.edu) if you have any questions.

Text:
Calculus, Volume I, by Gilbert Strang: https://openstax.org/details/books/calculus-volume-1
The textbook is freely available online, however, we will be reading it through Perusall (https://perusall.com/ – required). You will have to pay $10 to access the text through Perusall.

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.
How will we achieve the Learning Goals?

- **Collaborative Reading** (*Learning Goals #1, 2, & 3*)

  Ever try to read a math textbook on your own? It can be really hard. We will use a tool called Perusall to read collaboratively. Ask and answer each other’s questions directly in the text. Learn together, even when you’re home alone.

- **Supplemental Videos** (*Learning Goal #1*)

  Each reading assignment is accompanied by two videos: a short intro to the section, and a worked example (something on the harder side for that section). These are designed to motivate and explicate some of the core ideas from the reading.

- **Instructor Explication** (*Learning Goal #1*)

  I’ll answer questions that came up in the reading or in other assignments, or take some time to explain particularly difficult concepts or techniques.

- **Struggling Together** (*Learning Goals #1, 2, & 3*)

  We’ll work on examples and problems in our teams. This is an opportunity to really struggle with the ideas and techniques – struggling with challenges is how we learn. Talking through ideas and strategies with your teammates allows you to check your understanding and spot any holes in your reasoning. And I’ll always be there to help when your team gets stuck!

- **Team Quizzes** (*Learning Goals #1, 2, & 3*)

  We’ll have weekly quizzes that you’ll take alone first. After you’ve had a chance to engage with the material and select your answers, you’ll immediately turn around and take the exact same quiz with your team. Harness the power of your team to converge on the right answers and the correct reasoning.

- **Homework** (*Learning Goals #1 & 2*)

  Practice makes perfect! We’ll have homework assignments for each section so you can practice your new skills and deepen your understanding.

- **Friday Assessments** (*Learning Goals #1 & 2*)

  Every Friday you will have the opportunity to demonstrate your knowledge of the Content Outcomes covered up to that point in the course. Questions will be graded Credit/No Credit. You demonstrate mastery of any particular Outcome by earning credit for that outcome on two different Friday Assessments. Once you have mastered an outcome you can skip those questions on subsequent Fridays. If you don’t get credit on an outcome, it doesn’t count against you – but study up and try again next week!

  *See more on “Mastery Grading” below.*

- **Closing the Feedback Loop** (*Learning Goals #1, 2, & 3*)

  We’ll have time each week to review your latest Friday Assessment with your team and ask questions.
Syllabus:
We will cover the following sections from our textbook this semester:

Note: Some topics may be added or omitted as time permits.

<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>A Preview of Calculus</td>
</tr>
<tr>
<td>2.2</td>
<td>Limit of a Function</td>
</tr>
<tr>
<td>2.3</td>
<td>Limit Laws</td>
</tr>
<tr>
<td>2.4</td>
<td>Continuity</td>
</tr>
<tr>
<td>3.1</td>
<td>Defining the Derivative</td>
</tr>
<tr>
<td>3.2</td>
<td>Derivative as a Function</td>
</tr>
<tr>
<td>3.3</td>
<td>Differentiation Rules</td>
</tr>
<tr>
<td>3.4</td>
<td>Derivatives as Rates of Change</td>
</tr>
<tr>
<td>3.5</td>
<td>Derivatives of Trig Functions</td>
</tr>
<tr>
<td>3.6</td>
<td>Chain Rule</td>
</tr>
<tr>
<td>3.8</td>
<td>Implicit Differentiation</td>
</tr>
<tr>
<td>4.1</td>
<td>Related Rates</td>
</tr>
<tr>
<td>3.9</td>
<td>Derivatives of Exp and Log Functions</td>
</tr>
<tr>
<td>4.3</td>
<td>Maxima and Minima</td>
</tr>
<tr>
<td>4.5</td>
<td>Derivatives and the Shape of a Graph</td>
</tr>
<tr>
<td>4.6</td>
<td>Limits at Infinity and Asymptotes</td>
</tr>
<tr>
<td>4.7</td>
<td>Applied Optimization Problems</td>
</tr>
<tr>
<td>4.8</td>
<td>l'Hospital's Rule</td>
</tr>
<tr>
<td>4.10</td>
<td>Antiderivatives</td>
</tr>
<tr>
<td>5.1</td>
<td>Approximating Areas</td>
</tr>
<tr>
<td>5.2</td>
<td>Definite Integral</td>
</tr>
<tr>
<td>5.3</td>
<td>Fundamental Theorem of Calculus</td>
</tr>
<tr>
<td>5.4</td>
<td>Integration Formulas and Net Change Theorem</td>
</tr>
<tr>
<td>5.5</td>
<td>Substitution</td>
</tr>
</tbody>
</table>

Text:


The textbook is freely available online, however, we will be reading it through Perusall (https://perusall.com/). You will have to pay $10 to access the text through Perusall. This is required.

If this is a problem financially, please contact either the course coordinator (Becci Torrey, rtorrey@brandeis.edu) or Academic Services (https://www.brandeis.edu/academic-services/index.html).
Grades:

**Letter Grade:**

At the end of the semester, your letter grade will be calculated using the following table. To earn the letter grade listed on the left you must meet the minimum shown in **ALL** columns for that row.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Fundamental Outcomes Mastered</th>
<th>General Outcomes Mastered</th>
<th>Homework</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>8 of 8</td>
<td>30 of 30</td>
<td>270</td>
<td>550</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>29 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-</td>
<td></td>
<td>28 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>8 of 8</td>
<td>27 of 30</td>
<td>240</td>
<td>450</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>26 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td></td>
<td>25 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>7 of 8</td>
<td>24 of 30</td>
<td>190</td>
<td>350</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>23 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-</td>
<td></td>
<td>22 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>6 of 8</td>
<td>21 of 30</td>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>20 of 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-</td>
<td></td>
<td>19 of 30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Again, the numbers shown above are **minimums** and you must meet **ALL** requirements to earn the specified letter grade.

Failure to meet any 1 of the D-range standards will result in an E.

**Half-way Mastered Outcomes:** If you get credit once for an outcome, it will count as half a point toward your total number of outcomes mastered. So credit once each on two different content outcomes will add together to a whole point, even though neither outcome is considered “mastered”. Remember that the requirements listed above are minimums, so a score of 24.5 in the General Outcomes Mastered column results in a C+ (assuming you have at least 7 Fundamental Outcomes; at least 190 Homework points; and at least 350 Participation points).

**Examples:**

Some examples of using this grading scheme are shown below:

<table>
<thead>
<tr>
<th>Student</th>
<th>Fundamental Outcomes Mastered</th>
<th>General Outcomes Mastered</th>
<th>Homework</th>
<th>Participation</th>
<th>Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela Davis</td>
<td>8</td>
<td>28.5</td>
<td>280</td>
<td>700</td>
<td>A−</td>
</tr>
<tr>
<td>Leonard Bernstein</td>
<td>7</td>
<td>26</td>
<td>340</td>
<td>650</td>
<td>C+</td>
</tr>
<tr>
<td>Thomas Friedman</td>
<td>8</td>
<td>20.5</td>
<td>250</td>
<td>490</td>
<td>D</td>
</tr>
</tbody>
</table>

[More on grading →]
Grading Details:

- **Mastery Grading:**
  This style of grading is designed to hold you accountable for learning the content of the course. If you get something wrong, you get to try again until you get it right. (Pretty awesome, huh?) But it also means you can’t just let things go without really learning them. Here’s how it works:
  
  Our course has a list of Content Outcomes – these are mathematical facts and skills that comprise the content we are learning in this class. (Content outcomes include things like “Find the equation of a tangent line to a curve at a given point.” and “Find the derivative of a function from the limit definition of derivative.” – see LATTE for a complete list.)

  Every Friday you will have an opportunity to demonstrate mastery of the content we have covered so far in the course. Your work will be held to a high standard (essentially a B+/A- level), but graded only on a credit/no-credit basis. If you earn credit for a particular outcome on two different Fridays, you have mastered that outcome and no longer need to do those problems on subsequent Fridays.

  If you do not earn credit on a particular outcome, it does not count against you. But this means you need to review the problem, study/practice that concept or skill further, and come back to try again the next week.

  With this grading structure, you can be confident at every point in the semester that you have strong skills in all the outcomes you mastered, and you will know exactly which skills and ideas need more work.

- **We will *not* provide make-ups for Friday Assessments**, since there are so many opportunities during the semester to attempt the outcomes and missing an opportunity doesn’t count against you. (But do not miss Fridays unless you absolutely have to – getting behind on your outcomes can make it difficult to catch up.)

  The **Final Exam** time scheduled by the registrar will be used as one last Friday Assessment.

- **Participation:** This score will be computed from:
  - 12 Perusall reading assignments, each worth 20 points;
  - 12 Team Quizzes, each worth 20 points
  - 12 Friday Assessment Reviews, each worth 20 points;

  for a total of 720 possible points.

- **Homework:** There will be 12 homework assignments, each worth 30 points for a total of 360 possible points. For each assignment, you earn 10 points for completing the assignment and we will grade 10 of the questions, each worth 2 points.

- **No Late Work:** We understand that life sometimes gets in the way of our studies, or prevents us from completing an assignment or attending class. Our minimum required scores for Homework and Participation already take this into account. So if you miss an occasional class or an assignment we won’t accept late work (for logistical reasons) but it shouldn’t adversely affect your grade. Please communicate with me and (when appropriate) your team. We’ll work together to make sure you don’t fall too far behind.

If you have questions about how this course is graded, please do not hesitate to reach out to your instructor!
Resources to Help you Succeed

Homework Teams:

Subject to change depending on group availability. I will set up a regular schedule to meet with each of you in small groups (Homework Teams). Depending on scheduling, these may or may not be the same as your in-class teams. Each Homework Team will have a designated hour that they meet every week. During that time, you should check your homework answers with each other and discuss any discrepancies. I will join your team meeting for the last 20-30 minutes to review any questions with you that you have not settled yourselves. This will provide timely feedback on your homework and make sure that you are all progressing in your learning.

Practice Assessments:

We will provide Practice Assessments for each Content Outcome to help you prepare for the Friday Assessments. Complete solutions will also be provided. These practice assessments are optional (but strongly recommended!) and are for your use only. They have no effect on your grade.

Tutoring:

The department provides some additional tutoring at no cost. The tutors are math graduate students or advanced undergrads. Please take advantage of this excellent resource! Visit your course LATTE page to schedule an appointment or find drop-in tutoring hours.

Other Course Information

Calculators:

Calculators are not allowed during quizzes or Friday Assessments. You should have access to a scientific calculator for homework (you can use a free online one), but you do not need a graphing calculator.

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.).

Accommodations:

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, please talk with me and present your letter of accommodation as soon as you can. I want to support you.

In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability or requesting accommodations, please contact Student Accessibility Support (SAS) at 781.736.3470 or access@brandeis.edu

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/srscs/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.
Necessary Equipment and Available Resources:

Success in this online course will require a webcam with a microphone and internet access. If you need assistance with acquiring any of these items, contact emergencyfunds@brandeis.edu. You will be required to have your camera ON and your mic OFF during class. All classes will be recorded.

Many resources are available to help with the academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the links on the Support at Brandeis page https://www.brandeis.edu/support/undergraduate-students/browse.html to find out more about the resources that the University provides to help you and your classmates achieve success.

Timely communication:

Use your Brandeis email to reach out to me. I am usually able to respond quickly to most messages, within 24 hours, although during the weekends and over holidays it could take me longer. If I reach out to you, with a query or comment or in response to an email from you, I would appreciate it if you would acknowledge receipt of my message and/or respond within 24 hours, unless it is during weekend or over a holiday. Note that we will use your Brandeis email address, so you need to check it regularly.

All course announcements can be found in the Course News & Announcements page on Latte.

Time zones:

All times listed on this syllabus will be given in Eastern time, but on November 1 Daylight Savings Time will end in the US, which may change your local time at which class and assessments meet. It is your responsibility to adjust accordingly. I will remind everyone often as that time approaches.

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, rtorrey@brandeis.edu.

About Me: Becci Torrey

My name is Becci. I was born in Chicago and have lived in New York, Washington, D.C., Vermont, London, and now Massachusetts. I work on math education at the collegiate level. I’m always happy to talk about it and I’m always looking for ways to improve your learning experience. When I’m not working on teaching, I’m dancing salsa (though, like everything else, this is now done at home with online classes). I am really looking forward to working with you this semester!