# Math 115 - Calculus of Functions of One Variable II
## Fall 2017

**Course Description:** In Math 115, we take complex problems and break them into smaller pieces. For instance, we approximate the area of a region by subdividing it into rectangles. By breaking up a problem into smaller and smaller parts, we get better and better approximations of the true solution. In fact, sometimes we can define the *limit* of these approximations, giving us the best possible answer. Otherwise, we can understand the *error* involved in our approximation.

Over the semester, we will develop techniques for solving problems in geometry, economics, biology and physics. These techniques include integration, parameterization, Taylor series expansion and modeling via differential equations. We will also appreciate the beautiful way these ideas come together to form calculus, the mathematics of change.

**Course Objectives:** This course will help you understand
- the connection between net change and rate of change
- techniques for solving length, area and volume problems
- techniques for working with various physical, biological and economic models
- how to use Taylor series to represent functions that are otherwise hard to work with
- how to use differential equations to model many real-world situations

**Sections:**

| Section | Class Times | Room | Instructor | Email (@yale.edu) |
|---------|-------------|------|------------|-------------------|
| 01 | MWF 9:25-10:15 | LOM 205 | Brett Smith | brett.c.smith |
| 02 | MWF 9:25-10:15 | LOM 215 | Michael Landry | michael.landry |
| 03 | MWF 11:35-12:25 | LOM 201 | Lam Pham | lam.pham |
| 04 | MWF 11:35-12:25 | LOM 206 | Asher Auel | asher.auel |
| 05 | TTh 9:00-10:15 | LOM 206 | Ross Berkowitz | ross.berkowitz |
| 06 | TTh 9:00-10:15 | LOM 205 | Ian Adelstein | ian.adelstein |
| 07 | TTh 11:35-12:50 | LOM 214 | Sarah Vigliotta | sarah.vigliotta |
| 08 | TTh 11:35-12:50 | YK220 100 | Aaron Clark | TBA |
| 09 | TTh 11:35-12:50 | YK212 106 | Sudesh Kalyanswamy | sudesh.kalyanswamy |
| 10 | TTh 2:30-3:45 | GR109 ROSENFELD | Sarah Vigliotta | sarah.vigliotta |

**Textbook:** *Calculus: Early Transcendentals* (8$^{\text{th}}$ ed.) by James Stewart. The Yale Bookstore has a special version for Math 115 which contains only the sections used in our course. This should be the cheapest way to purchase the book. Be sure to obtain the correct edition. Earlier editions differ in sections and exercises.

**Resources:**
- **Office Hours**: Each instructor will hold weekly office hours. Office hours are a great opportunity to ask questions and gain a deeper understanding of the material. They also give you and your instructor the opportunity to get to know each other.
- **Prep Videos**: Before each class, you will watch a short video (or two) and work on related prep-problems. The work you put in before class will prepare you to engage more meaningfully during class, and your responses to the prep-problems will help your instructor tailor class to the needs of you and your classmates.

- **Course Websites**: We will have two sites on Canvas, an umbrella site that provides information relevant to all sections and a section site that provides specific information for your section. Be sure to check each site frequently.
- **Peer Tutors**: These are undergraduate students who have been through a second semester calculus class and can help you understand the material. The peer tutors will have office hours and are also available to schedule individual meetings. Look on the Canvas umbrella site for a schedule of the peer tutors' office hours.
- **Residential College Tutors**: Each residential college has math and science tutors scheduled. You can attend any tutors' hours, even those outside of your own college. See

    http://science.yalecollege.yale.edu/residential-college-math-science-tutors

    for more details.
- **Private Tutors**: If you feel that you would benefit from a private tutor, please speak with your instructor.

**Active Learning**:

*"The only way to learn mathematics is to do mathematics."* - Paul Halmos

Paul Halmos was a Hungarian mathematician. A quick search online for quotes by him will turn up many quotes echoing the sentiment above. In this course, during class, you and your classmates, along with your instructor, will engage with the material through tough problems. Doing so within the classroom will help to provide a support system as you work with the mathematics. As such, we will encourage questions, discovery and most of all mistakes! As Halmos suggests, we learn by doing.

To help get the most out of our time together, we warm up for each class with prep-videos and prep-problems. Each video gives a short and engaging description of a section in our book. The prep-problems are multiple-choice questions to check for understanding. You have up to six attempts to get the problems right, so it's okay to make mistakes! Your responses are fed back to your instructor so that they can see how you are doing and tailor the class to your needs. The most important part of the prep-problems is the final question:

*"Is there anything that wasn't clear in the video or that you did not understand? Was there anything you found especially interesting?"*

Your response to this question gives you the chance to tell your instructor exactly how they can help you. There is a schedule of when to complete the prep-videos and prep-problems by on the umbrella site for the course. You must complete the assigned videos and problems by 4am in the morning before class and no makeups or extensions of these assignments will be permitted. (If you do miss one of these assignments, you should still complete it! There is still value in watching these videos and doing the problems.)

**Homework:** We value the ability to communicate what you are learning in Math 115. Our weekly homework is an opportunity for you to *explain* what you understand. We will assign and collect written problem sets each week, evaluating your work for both understanding and clarity. Your first draft should probably not be your last draft, and it is often helpful to talk to others (peers, instructors, etc.) as you work on the problems. We encourage you to form study groups and attend office hours regularly. The work that you submit, however, should be in your own words. What you turn in should be **stapled with solutions written in the order in which they where assigned**. It also is not enough to just state a solution; you should explain how you got to that solution. Homework problems will be evaluated on the following scale:

3: Work is completely accurate, essentially perfect. Ideas are fully developed.
   Work is neat and easy to read. Complete sentences are used where appropriate.
2: Work is good, on the right track, but development of ideas is incomplete.
   Work is hard to read or disorganized.
1: Work is sketchy, with some correct ideas, but mostly on the wrong track.
   Work is messy or illegible.
0: Answer is completely incorrect.
   Work is minimal or non-existent. No explanations are given.

Homework will be due each week at the start of class either on Thursday or Friday depending when your section meets. **Late homework will not be accepted.** We will, however, drop your lowest homework score.

**Exams:** We will have two midterm exams and a final exam. Exam dates are as follows.
- Midterm 1: Thursday, October 5th, 7-8:30pm in TBD
  - Covers §5.1-5.5, §6.1-6.3, §7.1, §7.5, §7.7-7.8, §8.1
- Midterm 2: Thursday, November 16th, 7-8:30pm in TBD
  - Covers §10.1-§10.2, §11.1-11.11
- Final Exam: Saturday, December 16th, 9am-12:30pm in TBD
  - Cumulative

**Makeup exams will only be given with a Dean's Excuse.**

**Calculators:** You may use a calculator for assistance in checking and investigating problems for homework. However, you should not rely on them to the extent that you lose fluency with the material and do not develop your own computational skills. Use the calculator as a learning tool, not as a crutch. **Calculators will not be allowed on exams.** We will make sure that problems on the exams require only a moderate amount of calculations to allow you to spend most of your time demonstrating your mathematical knowledge.

**Grading:** Your grade for the course will be computed as follows.
- **Midterm Score**: Take the higher of
  - 40% Midterm 1 + 60% Midterm 2
  - 60% Midterm 1 + 40% Midterm 2
- **Course Score**: Take the higher of
  - 40% Final Exam + 45% Midterm Score + 15% Homework
  - 55% Final Exam + 30% Midterm Score + 15% Homework

In the computation of your letter grade for the course, your numerical score on exams is used. We do not convert your exam scores to letter grades to computer. Course numerical scores will be converted into letter grades according to the following scale:

| Grade      | A/A-   | B+/B/B- | C+/C/C- | D     | F     |
|------------|--------|---------|---------|-------|-------|
| Percentage | 100-90 | 89-80   | 79-65   | 64-50 | < 50  |