Math 1a. Introduction to Calculus
Review Guide for Midterm I

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Midterm Details

The first midterm will primarily cover Chapter 2, but you will also be responsible for any precalculus material that is needed in this chapter. The midterm exam will be on Wednesday, October 26 at 5–7 PM in Science B. There will also be a course-wide review session on Thursday, October 20 at 7–9 PM in Science D. We plan to videotape the review session. You should be able to access the video by clicking on Lecture Videos at the course website.

Studying and Reviewing

- You can find copies of old midterms as well as solutions by clicking on Previous Exams at the course website.
- You should also try working some of the problems in the Chapter 2 review section (pp. 175–178). We will post solutions to these problems on the course website on the Exams page.
- Be sure to take advantage of the TF office hours, CA sections, and the MQC in Loker Commons.

Topics for Midterm I

- To understand how the tangent line as a limit of secant lines (Section 2.1).
- To understand the concepts of average and instantaneous velocity, described in numerical, graphical, and physical terms (Section 2.1).
- To understand the concept of local linearity (Section 2.1).
- To be able to approximate the slope of a tangent line using the slopes of secant lines (Section 2.1).
- To understand the idea of a limit (both finite and infinite) from descriptive, graphical, and numerical points of view.[1] (Section 2.2).

[1] We will not emphasize the ϵ-δ definition of a limit.

- To understand and be able to calculate one-sided limits (Section 2.2).
- To understand the disadvantages and advantages of trying to find limits numerically and graphically and why guessing the limit does not always work (Section 2.2).
- To understand that $\lim_{x\to a} f(x)$ may not be equal to $f(a)$ (Section 2.2). .
- To understand and be able to compute limits algebraically (Section 2.3). .
- To understand and be able to evaluate limits from a graphical point of view (Section 2.3).
- To know and be familiar with examples where limits do not exist (Section 2.3).
- To be able to compute limits when the limit laws do not apply such as in the case of the Squeeze Theorem (Section 2.3).
- To understand the geometric and mathematical definitions of continuity (Section 2.4).
- To understand discontinuity and be familiar with different examples of discontinuous functions (Section 2.4).
- To understand and be able to apply the Intermediate Value Theorem (Section 2.4).
- To understand and be able to apply the geometric and limit definitions of asymptotes, particularly as they pertain to rational functions (Section 2.5).
- To understand and be able to compute infinite limits (Section 2.5).
- To understand the idea that the slope of a tangent line is the limit of the slope of secant lines and to be able to compute such limits (Section 2.6).
- To understand and be able to compute the instantaneous rate of change as the limit of average rates of change (Section 2.6).
- To understand the definition of the derivative at $x = a$,

$$f'(a) = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} = \lim_{x\to a} \frac{f(x) - f(a)}{x - a}.$$

  (Section 2.7).
- To understand and be able to compute the equation of a tangent line with f' notation (Section 2.7).
- To understand and be able to apply the derivative as an approximate rate of change when working with discrete data (Section 2.7).
- To understand and be able to use the units associated with $f'(x)$ (Section 2.7).
- To understand the concept of a differentiable function, interpreted graphically, algebraically, and descriptively (Section 2.8).
- To understand and be able to obtain the derivative function f' by first considering the derivative at a point x, and then treating x as a variable (Section 2.8).
- To understand how a function can fail to be differentiable (Section 2.8).
- To understand and be able to sketch the derivative function from the graph of the original function (Section 2.9).
- To understand and be able use the first derivative to determine if a function is increasing or decreasing (Section 2.9).
- To understand and be able use the second derivative to determine concavity and points of inflection (Section 2.9).
- To understand the geometric description of concavity and the relationship between concavity and the increasing/decreasing behavior of the first derivative (Section 2.9).