

Logistics:

- It covers material from Chapter 2, but you are expected to know all the prerequisite material that was reviewed in Chapter 1 as well.
- The exam is one hour in length.
- No books, notes, internet resources.
- All exams for all sections of Calculus I will be graded by all three instructors together.
- There is an extra-credit question.
- You cannot re-do a midterm.
- You may not turn in a midterm late.
- If you are taking the midterm in person, you may not use your cell phone. If you are taking the midterm remotely, you may only use your cell phone for calling into zoom and for scanning your exam at the end.

Things to Keep in Mind:

- *All* of the problems should be familiar to any student who attended class, did the homework, and took the quizzes.
- **Be a good test taker.** If you are stuck on a problem, leave it and come back. Pay attention to the time and make sure you get to every problem. Attack each problem under the assumption that you have the tools to solve it. If time permits, check every problem by working it a different way or by checking the plausibility of your answer.
- **Be active, not passive,** when reviewing for this (and all) midterms. It is better to work problems and/or take a practice test, then to read the book, read over your notes, or look over solutions to quizzes/tests/homework.
- Don't skip Recitation. It will be an active review. Focus on your weak areas.
- Is there any good thing about preparing for and taking a Midterm?

Topic Review

Chapter 2

1. Identify all of the following given a picture of the graph of $f(x)$.
 - domain, range, regions where the function is (or isn't) continuous, points where the derivative of the function fails to exist.
 - limits of various kinds (infinite, one-sided, two-sided)
 - values of the function (Given x , find y . Given y , find x .)
2. Evaluate limits algebraically:
 - Recall the various types: one-sided, two-sided, infinite, at infinity;
 - Recall various strategies: get a common denominator, factor and cancel, rationalize, divide by the highest power of x in the denominator, and more;
 - But *when* to use these tricks?

Example: Let

$$f(x) = \frac{x^2 - 1}{2x^2 + 3x + 1}.$$

- (a) Find the limit of $f(x)$ as $x \rightarrow 1$, $x \rightarrow -1$, $x \rightarrow -1/2^+$, $x \rightarrow -1/2$, $x \rightarrow \infty$, $x \rightarrow -\infty$.
 - (b) What is the limit of $(x + 1)e^{f(x)}$ as $x \rightarrow 0$?
3. Understand the relationship between limits and asymptotes. Know the (formal Calculus) definition of horizontal and vertical asymptotes.
 4. Know the (formal Calculus) *definition of continuity* and *how to use it to show a function is or is not continuous at a point*.

Example: Use the definition to show that

$$f(x) = \begin{cases} x & x \leq 10 \\ 2x + 10 \cos((x - 1)\pi) & x > 10 \end{cases}$$

is continuous at $x = 10$.

5. Know *how to find the derivative* of $f(x)$ at $x = a$ *using the definition*.

Example: Find the derivative of $f(x) = 2\sqrt{x}$ at $x = 9$ using the definition.
6. Know how to *interpret* the derivative of $f(x)$ at $x = a$.
 - as the slope of the tangent line to the graph of $f(x)$ at $x = a$
 - as instantaneous rate of change of f with respect to x at $x = a$.

Chapter 1

1. Know how to graph the catalog of essential functions (as discussed in section 1.2) and transformations of these (as discussed in section 1.3).

Example: Graph $f(x) = \pi + e^{x+1}$

2. Know how to find the domain and range of functions and how to solve equations. Good example problems: Section 1.5 # 51-54, Review Problems (page 70) #5-8, 25-26.

Example: Find the domain of the function $f(x) = \frac{x^2}{2+3\ln(x)}$.