Math Xb Spring 2006
Midterm 1 Review Guide

1 Topics

Midterm 1 will cover chapters 17 to 20 (omitting §20.7) and sections 21.1, 21.2, and 21.3 in our textbook, *Calculus: An Integrated Approach to Functions and Their Rates of Change*. In particular, you will be responsible for the following topics.

Chapter 17: Implicit Differentiation and Its Applications

You should be able

- To use logarithmic differentiation to find the derivatives of functions of the form $f(x)^{g(x)}$
- To use implicit differentiation to find $\frac{dy}{dx}$ given an equation involving x and y
- To find the slope of a tangent line to a given curve (described by an equation involving x and y) at a given point
- To find the points on a curve (described by an equation involving x and y) at which the tangent line has a given slope
- To understand how to use a geometric relationship between two or more variables that depend on time to find a relationship between the rates of change of those variables

Chapter 18: Geometric Sums and Series

You should be able

- To recognize a finite geometric sum and identify its common ratio
- To express a geometric sum in closed form
- To determine if a given geometric series converges or diverges
- To find the sum of a given convergent geometric series
- To express a geometric sum or series using summation notation
- To analyze a geometric sum or series expressed in summation notation
- To be able to use geometric sums and series to solve problems in a variety of contexts

Chapters 19 & 20: Trigonometry

You should be able

- To understand sine and cosine as functions of arc length on the unit circle
- To approximate sine, cosine, and tangent values given a calibrated unit circle
- To be familiar with the graphs of the sine, cosine, and tangent functions
- To understand the periodicity of the sine and cosine functions
- To identify the balance value, amplitude, and period of a sinusoidal function given its formula or graph
- To use trig functions to model other functions
- To understand the interpretation of $\tan x$ as the slope of a certain line.

- To understand the relationship between angles and arc length.
- To take advantage of circle symmetry when finding trig function values.
- To understand the relationship between sine, cosine, and tangent and right triangles.
- To know the sine, cosine, and tangent values of $\frac{\pi}{6}$, $\frac{\pi}{4}$, and $\frac{\pi}{3}$.
- To "solve" triangles, that is, to determine all angles and sides of a triangle from some given information.
- To understand the inverse trig functions $\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$ and their domains and ranges.
- To simplify expressions involving inverse trig functions by using triangles
- To solve equations involving trig functions on both restricted and unrestricted domains
- To be able to apply the Law of Cosines and the Law of Sines.
- To know the identities listed on the Trig Identities Handout.

Chapter 21: Differentiation of Trig Functions

You should

- Know the derivatives of the six trigonometric functions, and be able to find derivatives of more complex functions that involve trigonometric functions. *Problems: §21.2 # 1,3,4,5,7,9,15*
- Be able to solve word problems involving trigonometry. These include related rates, optimization, curve-sketching, and other problems. You need to be able to look at a problem and determine what kind of problem it is so that you can decide what strategy to use. Look at the problems in §21.3 and try to classify all of the problems without solving them, then look at how we have classified the problems below.[1] *Problems: §21.3 #1–18 and 23.*

2 Some Suggestions for Preparing for the Exam

1. Go over your old homework problems, and pay special attention to the problems that you skipped or answered incorrectly. For each problem, ask yourself:
   - How did I solve this problem?
   - How did I decide how to solve this problem? (In other words, if the problem was on the midterm exam, what clues in the problem would help you know how to solve it?)

   If you get stumped answering either question, do the problem again.
2. Review workshops and in-class worksheets, asking yourself the same questions.
3. Review the topics in the outline above, asking yourself if you understand each subject, and testing yourself with problems. For any topics where you run into difficulty, look at notes for the corresponding class, go back and read the book, do more problems, and/or ask someone for help.
4. Set aside a couple of hours to do the practice midterm exam. Once you are done, review the solutions, and discuss anything you missed with a TF, a CA, or a friend in the course.

Suggested Exercises

Review the problems that were assigned as homework, making sure that you understand how to do any problems that you skipped or missed. Additional problems from Chapters 17–20 are suggested below.

Chapter 17

- §17.1 #4
- §17.2 #1, 5

[1] (This list only covers problems #1–18 and 23) Related rates problems: 8, 13, 15, 18, 23 ; Optimization: 1, 2, 9, 11, 12, 14, 16, 17, ; Curve Sketching: 1, 2, 3, 4, 5, 6, 16 ; Other: 7, 10

- §17.3 #2, 4, 5, 7, 10
- §17.4 #1, 6, 8, 10, 13

Chapter 18

- §18.1 #1, 4, 11, 12, 18, 24, 27, 32
- §18.2 #3, 4, 6, 8, 11
- §18.4 #7, 8, 11, 20
- §18.5 #6, 8, 12, 13, 26

Chapters 19 & 20

- §19.1 #1, 2, 5
- §19.2 #4, 5, 7, 14, 15
- §19.3 #2, 4, 6, 12
- §19.4 #1, 5, 8, 10
- §20.1 #2, 3, 5
- §20.2 #2, 5, 7, 9
- §20.3 #4, 5, 8, 9, 10, 12, 13
- §20.4 #3, 4, 9, 10, 12, 22
- §20.5 #5, 6
- §20.6 #4, 5, 6, 9