Math 121, D. Benedetto

What you need to know for Exam 2

You should know Sections 7.3–7.5, 7.8, and 11.1–11.7. The test will not explicitly cover the material from earlier sections, but of course it will still be assumed that you know how to deal with exponentials, logarithms, inverse trig functions, L'Hôpital's rule, substitution, and so on. The following is a list of most of the topics covered. **THIS IS NOT A COMPREHENSIVE LIST, BUT MERELY AN AID.** Remember, no calculators in any exams.

- 7.3: Mainly what will be covered from this section is Completing the Square.

- 7.4: Partial Fractions. Proper Cases only. deg(numer) < deg(denom)). Break the proper Rational Function fraction into the correct pieces (using factorization of the denominator), and solve for $A, B, \ldots$. Then integrate the resulting pieces (usually, but not always, ln's and arctan's). Be familiar with all the common partial fractions decompositions.

- 7.5: Integration Strategy. This section reminds you how to approach integrating most integrals we've seen, which of course could come up in any improper integral.

- 7.8: Improper Integrals. Be able to recognize improper integrals of either type I or II, and know how to compute them by turning them into limits of integrals. Note: We did not cover the more complex *split* cases. You may need L'H Rule to finish the Improper Limit.

- 11.1: Sequences. Know what sequences are, and be able to compute their limits (or determine that they diverge). Remind yourself how to use L'H Rule, or the Squeeze Law.

- 11.2: Series. Know what series are, and don't confuse them with sequences. Mainly learn Geometric series and the nth Term Divergence Test.

- 11.3: Integral Test. Know the integral test and be able to use it. If asked, make sure you explicitly check all the requirements before applying it. Also know the p-Test.

- 11.4: Comparison Tests. Know the Comparison Test and the Limit Comparison Test. Choose the comparison (testing) series wisely, and make sure to check the requirements before invoking either test. Analyze the comparison series with fine detail. Be clear on your conclusion about the original series.

- 11.5: Alternating Series Test. Know the definition of an alternating series, know how to recognize one, and know the Alternating Series Test. Know that if the terms do **not** go to 0, then you cannot use AST; but you can use the divergence test in that case.

- 11.6: Absolute Convergence Test, Ratio Test, (**NOT** Root Test). Know these tests. Know the definition of Absolute Convergence, Conditional Convergence, and Divergence. Know that if you are asked whether a series converges absolutely, it does not necessarily mean that you use either the Ratio (or Root) Test. The Ratio Test works great for series involving factorials and/or constants raised to the power n, even if there are other polynomials multiplied in.

- 11.7: Strategy for Testing Series. The main theme: get used to using the Tests to decide convergence/divergence of a series even if the problem doesn't tell you which test to use.

- How to use Partial Fractions Decomposition (PFD) Algebra to decompose Proper Rational Functions in integration. What are the Decompositions for the Two main cases:

  - Denominator factors into two distinct Linear factors
  - Denominator factors into one Linear factor and one Quadratic Irreducible factor

- How to use Complete-the-Square algebra to prepare for a-rules or Trig Sub integrals.

- How to choose between PFD and Complete the Square algebra in integrals.

- How to compute Improper Integrals for both Type I and Type II Improper integrals. Make sure to set-up the limit ASAP. Make sure to finish the Limit carefully.

- How to recognize or spot the Type II Improper Integrals with Vertical Asymptotes.

- How to finish the Improper Integral limits, using L'Hôpital's Rule for Indeterminate pieces.

- How to review all previous integration techniques as new techniques may reduce to previous cases, like a-rules, *split-split*, u-subs, IBP, . . . and Trig and Inverse Trig values . . .

- How to compute Sequence Limits, including the relevant L'Hôpital's Rule (using the Related Function in x), Factorial Algebra or *divides-by-algebra* for Rational Functions.

- How to distingush between an Infinite Sequence and an Infinite Series.

- How to choose/analyze/justify any of the 9 Convergence Test for Infinite Series. What are their possible conclusions? Study the Plan of Attack Handout.

- How to use the nth Term Divergence Test? How to finish the conclusions of the Integral Test?

- How to compute the Sum of a Geometric Series. How to use Arithmetic of Series.

- How to tell the difference between Convergence, Divergence, Absolute Convergence, and Conditional Convergence for Series.

- How/when to apply Absolute Convergence Test versus Alternating Series Test.

- How to approach the different Convergence questions? Converge/Diverge versus Absolute/Conditional Convergence?

- How to use the Absolute and Conditional Convergence *Charts*.

- How to create Series that satisfy a certain description by a specific convergence test. Example: *Create a series that Diverges by the nTDT and which requires a L'H Rule finish.*

- How to be efficient in writing your convergence of series answers. Be explicit about 3 things:

  - Make a clear Declaration of your final convergence conclusion
  - State your Convergence Test(s) used
  - Write the reasons or show all of the condition(s) checked for each Convergence Test. Justify all details.