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 n^{th} 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.

Some things you don't need to know

- Sections 7.4/7.5: Long division of polynomials. I won't give you any integrals that require inverse hyperbolic functions. (Granted, I might give you something like $1/(x^2 - 1)$; you are free to use $\tanh^{-1}$ for that, but personally, I think partial fractions is easier to remember.)
- Section 7.8: Comparison Test for integrals (near the end of the section).
- Section 11.3–11.6: Proofs of the various convergence tests.
- Section 11.3: The stuff about estimating sums.
- Section 11.4 and 11.5: The stuff about estimating sums or remainders.
- Section 11.6: Root test or Rarrangements.

Tips

- For integrals: practice, practice, practice. Do the review packet and search the answer keys on-line. Take the practice tests. Come ask me for advice on problems you were unable to do or unsure of. On the test itself, be prepared to mess around and to try several different things on any given integeral. If you can't figure out how to do a given integral (or other problem), skip it and come back to it later. But try not to just stare; keep trying to come up with different strategies and keep writing stuff down.
- Improper Integrals: **Recognizing them**: a ∞ or $-\infty$ in the limits of integration is a dead giveaway, but also look to see whether the integrand has a vertical asymptote at either endpoint. **Computing them:** Compute the integral on each piece by taking a limit as t approaches the bad endpoint. The limit sign is important; **don't** leave it off.
- For sequences: know all the methods; but remember, if you want to use L'Hôpital, you must step aside and use the related function and convert from the integer-only variable n to the real variable x.
- Make sure not to confuse a sequence with a series.
- Don't make up an n^{th} *term convergence test*.
- For series: try not to misuse a convergence test. If the limit of the terms is zero, the Div. test is **inconclusive**. (It does **not** say that the series converges, for example.) If you get stuck using a convergence test, you need to try something else. If you're really stuck, write down (briefly) what failed and why. Once you see it on paper, that might give you an idea of what will work; or if it doesn't, you may at least get some partial credit. Study the overview sheet I made with all the convergence tests listed. **MEMORIZE THEM!**
- If you're asked for the **sum** of a series, in our class that pretty much means that you must be dealing with a geometric series, or the sum of two such things.
- Train being efficient in writing your convergence of series answers. Be explicit about 3 things, 1. your convergence conclusion or declaration, 2. your test used (or type of series), **and** 3. write the reasons or show all of the conditions checked. Leave no details out.