Some Tips for Final Exam | Friday, April 13, 2012
Math 116-017 | GSI: Rafe Kinsey

Here's a *non-exhaustive* list of some tips that came to mind about the material in chapters 9-10. Please see the exam 1 tips and exam 2 tips (available on section webpage in the handouts section) for the earlier material, as well as for general tips on studying. **Note that the final exam is cumulative; a lot of it will be on material that was also on the earlier exams.**

**Room**: Chem 1800 (note new location), 8am-10am, Thursday, April 19.

**Extra OH**: We have review sessions today (4/13) and next Tuesday (4/17) in class, and I have office hours after class both days. If necessary, I can also hold extra office hours (probably one of Monday/Sunday, and on Wednesday). We'll figure out a good time in class.

**On grades, getting exams back, etc.** The plan is for us to grade the exams later that day on Thursday. You will most likely be able to check your score on the exam on http://instruct.math.lsa.umich.edu by sometime Thursday evening. I'm going to be out of town for a conference Friday-Sunday. Assuming the overall scale is available, I will submit your overall grades (including any possible bumps up or down as well as any deductions for gateway) to the course coordinator by Friday morning, and so they should be available on Wolverine Access sometime Friday or Saturday. If you want to pick up your exam before that grade is officially posted, they will be available Friday afternoon at the office of the course coordinator, Fernando Carreon, EH 3847; he'll be there from 1pm until late afternoon. Otherwise, if you want to pick up your final exams after Friday, you can send me an email to pick them up at some point the following week (or in the fall, if you've already left town for the summer). Please note that I will have only sporadic internet access Friday-Sunday, so I will probably not respond to emails over the weekend until Monday.

## General Comments

- See the general tips from the previous exam review sheets for studying hints.
- This exam will be approximately 50% material from chapters 9-10 and 50% material from earlier.
- You will be given a formula sheet for the exam, listing some Taylor series. (Thus you do not need to write these on your index card.) You can see precisely what it will be; it's posted on the course website. Note that you are allowed only **one** index card (and one calculator).
- On the course website, there will be a review sheet that you might want to consult.
- You might want to consult the problem bank website
  http://dhsp.math.lsa.umich.edu/ mconger/dhsp/116exams/116exam3shop.html
  for more practice problems.
- If you are asked down to write a series, you can either[1] write it in summation notation (e.g. $\sum_{n=0}^{\infty} \frac{x^n}{n!}$) or you can write it just with *ellipses*, but if you do this, you **must** include at least the first two terms (sometimes it's a good idea to include the first three terms or more[2]), the general term (i.e., a term with $ns$), and appropriate ellipses. For example

$$1 + x + x^2/2! + \cdots + x^n/n! + \cdots \text{ is good}$$

$$1 + x + x^2/2! + \cdots \text{ won't give you full credit, since there is no general term}$$

[1]Unless you are specifically told to write it in a certain form, in which you case you need to write it in that form.

[2]In the example below, it would be silly to include just $1 + x$, since that's not enough information. Also, you can see that it's much more helpful to write 2! than 2, since that gives the idea of the general pattern.

## Series and Sequences

- An important skill is being able to figure out what the general $n$th term of a sequence is.
- For geometric series: be very careful about when things are $n-1$, when they are $n$, when they are $n+1$. Remember the formula for the finite geometric series is subtle. For applications (e.g., those problems about bank accounts, or drug injections), it's a good idea to write out the first few terms explicitly, then figure out the general term. Be careful about things like whether it starts at 0 or at 1.
- To show whether a series converges, you have to be careful to (a) cite which test you are using by name; and (b) show that you have satisfied all the criteria for that test.
- Remember: the limit comparison test is often an easier choice than the comparison or integral tests.
- Be **very careful** about your notation/language when you say something converges. There's a difference between saying $\sum 1/n^2$ converges and saying $1/n^2$ converges.
- Remember the difference between absolute and conditional convergence. This is a good topic for true/false questions.
- To figure out convergence for power series, use the ratio test. Note: the remarkable fact is that the interval of convergence (except possibly for endpoints) is *symmetric* around the center.
- To test the endpoints for power series, you just plug those in and check. E.g., if the radius of convergence is 4 and the center is 1, then you plug $x = 5$ and $x = -3$ into the power series, and see whether those series converge.
- In general be careful about parentheses, especially for factoring things, ratio test, etc.
- When you use the $p$ test, you **must** mention which value of $p$ it is. (E.g., say "$\sum \frac{1}{n^2}$ converges because of the $p$ test ($p = 2$)" or something like that.)

## Taylor Series

- There are a few common examples of Taylor series: $e^x, \sin x, \cos x, (1+x)^p, \frac{1}{1-x}$ around $x = 0$ and $\log x$ around $x = 1$. A lot of the other Taylor series we work with are variations on this theme—the key is to identify which of these Taylor series it is similar to.[3] In 10.3 we saw how to figure these more complicated series in terms of these easier ones.
- Remember the basic philosophy: for $x \approx a$, the Taylor polynomials should be good approximations for the function. The closer you get to $a$, or the more terms you give of the Taylor series, the better the approximation should be.
- One type of problem has you expand something in terms of a ratio of things. E.g., $\frac{mM}{m+M}$ being expanded in terms $m/M$. The key is that this will give good approximations if $m/M$ is small. You'll want to adjust things so it becomes like one of the standard functions (so like $1/(1-y)$, where $y = \pm m/M$).

Good luck!

[3]Note, this technique can be used in both directions. You can get a function similar to one of those functions, and use the Taylor series; or you can get a Taylor series similar to one of the Taylor series you know (e.g., perhaps like $\sum x^n$ except that it's the derivative) and use this to figure out what function it represents.