Mathematics 134 – Calculus 2 with Fundamentals
Information on Final Examination
May 3, 2018

General Information

- The final examination for this class will be given during the scheduled period 8:00am to 10:30am on Thursday, May 10.
- Like the midterms, this one will be given *in our regular classroom*, Swords 302.
- The final will be similar in format to the midterm exams but perhaps two times as long. I expect that if you are well prepared and you work steadily, then you should be able to finish the exam in about 1.75 hours. However, you will have the full 2.5 hour period to work on the exam if you need that much time.
- As on the midterms, you may use a calculator. Tables for the trigonometric reduction formulas, normal curve areas, and time value of money formulas will be provided.
- No cell-phones, computers, or other electronic devices beyond a basic calculator may be used during the exam. Please do not bring them with you; they will be subject to confiscation for the period of the exam if you use them.
- Tori will run a final exam review session on Wednesday, May 9, 8 to 10pm.
- I will also be available for office hours the last day of classes and during the reading period as follows:
  - Monday, May 7: 10am to 12 noon and 2pm to 3pm (but not after that because of Honors presentations in the deparment)
  - Tuesday, May 8: 8am to 10am (sorry, but that is the *only* time I can be available due to multiple other things going on that day in the department and otherwise)
  - Wednesday, May 9: 10am to 12 noon as usual (I won't be available in the afternoon due to a long meeting with Public Affairs about redesigning our department web site.)

What Will Be Covered

- This will be a *comprehensive* final – it will cover all the topics we have studied this semester, with somewhere around 25% each devoted to the material on each of the midterm exams (but of course topics from earlier in the semester might appear in parts of questions about things we did later).
- See the review sheets for the four midterms for a detailed breakdown of the topics we studied earlier. Those review sheets are now reposted on the course homepage if you need another copy of any of them.

Philosophical Comments and Suggestions on How to Prepare

- The reason we give final exams in almost all mathematics classes is to encourage students to "put whole courses together" in their minds. Also, preparing for the final should help to make the ideas "stick" so you will have the material at your disposal to use in later courses. *This is especially important if you are preparing to continue to MATH 241 or other advanced mathematics courses – everything is based on material from this semester's course and it will be difficult or impossible to do well in that course unless you have the material from this one under good control.*

- It may not be necessary to say this, but here goes anyway: *You should take this exam seriously* – it is worth 20% of your course average and it can pull your course grade up *or down* depending on how you do.

- Get started reviewing early and do some work on this *every day* between now and the date of the final. Don't try to "cram" at the end. The fact that you reviewed just recently to prepare for Exam 4 should actually *help you here*(!)

- Review videos and your class notes in addition to the text, especially for topics where you lost points on the midterms. There are a lot of worked-out examples and discussions of all of the topics we have covered there.

- Look over the midterm exams with the solutions. Go over your corrected problem sets. If there were questions where you lost a lot of points, be sure you understand why what you did was not correct, and how to solve those questions.

- Be sure you actually do enough practice problems so that you have the facility to solve exam-type questions in a limited amount of time. *Even if you have saved solutions for practice problems from the midterms*, it is going to be much more beneficial to do practice problems starting "from scratch" rather than just reading old solutions. Remember, the goal of the course is to get you to be able to develop solutions to these problems yourselves, not just to understand solutions that someone else (that includes you, one or more months ago!) has written down. Another analogy – as most of you know from your study of languages, it's much easier to understand another language passively than it is to actually use a language actively yourself (for instance, to form your own complete, grammatically correct sentences). The goal of this course is to make you reasonably proficient "calculus speakers" and there's no substitute for active practice on those skills.

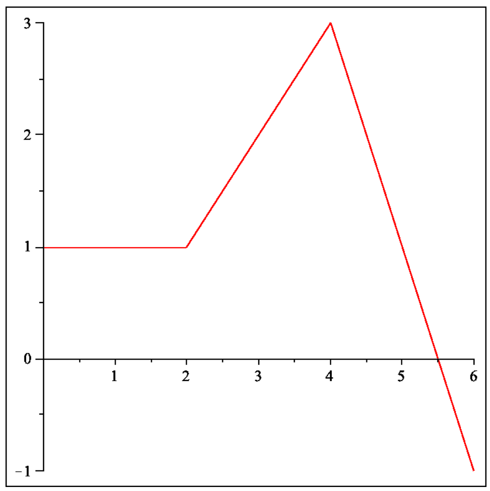
- The following is (a slightly edited version of) the final I gave in Calculus 2 in spring 2014. It's a good guide for what our exam will look like, but of course, but a few different topics, different types of questions, etc. might also appear. *For instance, you should be prepared to solve separable differential equations as well and there will be a question about the "time value of money" concepts from the last weeks of our course like VII B.*

- Your knowledge of the trig substitution and partial fractions methods will be tested with questions like the ones from the midterms – i.e. I will ask you about each step of the method separately rather than asking you to work out integrals "start to finish." The integrals in question II below are not set up that way, so this part of your exam will look somewhat different.

Sample Final Exam

I.

(A) Let $f(x) = \begin{cases} 1 & \text{if } 0 \le x \le 2 \\ x-1 & \text{if } 2 < x \le 4 \\ 11-2x & \text{if } 4 < x \le 6 \end{cases}$. whose graph is shown here:



Let $F(x) = \int_{-1}^{x} f(t)\,dt$ (there's a part of the graph with $x < 0$ that you're not seeing). Complete the following table of values for $F(x)$:

x	0	1	2	3	4	5	6
$F(x)$	3						

(B) (10) Compute the derivative of the function $g(x) = \displaystyle\int_0^{2x} \frac{\cos(t)}{t^2}\,dt$.

II. Compute the following integrals.

(A) $\displaystyle\int \frac{x^4 - 3\pi^3 + \sqrt{x}}{x^{2/3}}\,dx$

(B) $\displaystyle\int x^3 e^{x^2}\,dx$ (use integration by parts)

(C) $\displaystyle\int \frac{\csc^2(5x)\,dx}{\cot(5x)+7}$

(D) $\int_1^e x^5 \ln(x)\, dx$.

(E) $\int \frac{1}{\sqrt{16+x^2}}\, dx$

(F) $\int \frac{1}{(x^2+1)(x+1)}\, dx$

III.

(A) Use a right-hand Riemann sum with $n = 4$ (that is, the R_4 approximation) to approximate the value of the integral

$$\int_1^3 \sqrt{1+9x^4}\, dx.$$

(B) Given: The graph of the function in the integral is increasing on the interval $[1, 3]$. Check the appropriate box:

The R_4 approximation is a overestimate □/underestimate □.

IV. A region R in the plane is bounded by the graphs $y = 9 - x^2$, $y = 2x$, $x = 0$ and $x = 1$.

(A) Compute the area of the region R.

(B) Compute the volume of the solid obtained by rotating R about the x-axis.

(C) Set up integral(s) to compute the volume of the solid obtained by rotating R about the y-axis. *You do not need to compute the value.*

V. The daily solar radiation x per square meter (in units of hundreds of calories) in Florida in October has a probability density function $f(x) = c(x-2)(6-x)$ if $2 \le x \le 6$, and zero otherwise. Find the value of c, and then compute the probability that the daily solar radiation is > 4 hundred calories per square meter.

VI. An avian flu epidemic has broken out in Birdsburgh, a large city with total population 10 million. Let N be the number, in millions, of people who have been infected, as a function of time t in weeks. The Birdsburgh Public Health Department determines that the rate of change of N is proportional to the product of the number of infected people (N) and the number of people not yet infected.

(A) Write the statement above as a differential equation, calling the constant of proportionality k.

(B) The function $N(t) = \frac{10}{1+9999e^{-t}}$ should be a solution of your differential equation from part A. What is the value of k?

(C) If the epidemic proceeds according the function given in part B, how many weeks will pass before the number of infected people reaches 1 million?

VII.

(A) Find the sum of the finite geometric series with alternating signs:

$$3 - \frac{3}{2} + \frac{3}{2^2} - \frac{3}{2^3} + \cdots + \frac{3}{2^6}$$

What happens if you continue adding terms of the same form indefinitely? That is, what is the sum

$$\sum_{k=0}^{\infty} \frac{(-1)^k 3}{2^k}?$$

(B) What would be the monthly payment on a $500,000 30-year fixed-rate mortgage at 3.5% annual interest.