Mathematics 132 – Calculus for Physical and Life Sciences 2
Exam 2 – Review Sheet
March 11, 2008

General Information

As announced in the course syllabus, the second midterm exam of the semester will be given ("main seating") at 6:00pm on Wednesday, March 26 (the first Wednesday after Easter break). The format will be similar to that of the first midterm and the exams from last semester.

- **Bring a photo ID to the exam**.
- The exam will be designed to take an hour but you will have an extra 30 minutes to work and check your solutions.
- You will be given a TI-30 scientific calculator for the exam which does NOT have graphing capabilities so be prepared to answer questions without your personal calculator. (Note: Some of you may have one of these calculators purchased for use in Chemistry courses here. That is also OK.)
- Use of cell phones, I-pods, and all other electronic devices *is not allowed* during the exam. Please leave such devices in your room or put them away in your backpack (make sure cell phones are turned off).

What will be covered

The exam will cover the material since the last exam (Problem Sets 5 and 6), namely the following material from sections 5.9, 5.10, 6.1, 6.2, 6.3, and 6.4 of Stewart:

1. Approximate integration using left- and right-hand Riemann sums, midpoint Riemann sums, trapezoidal and Simpson's rules. Know how to compute each of these with just a calculator (for a relatively small n). Also know how to determine whether your result is an under- or overestimate for the Riemann sums and the trapezoidal rules (and if it is possible to tell that). You will want to review the work we did in clas to prepare and your work on Lab 1 for much of this.
2. Improper integrals (know how to tell what makes an integral improper, how to correctly set up the limit to determine if the integral converges, and determine the value if the integral does converge).
3. Areas between curves
4. Volumes of solids with known cross-sections and solids of revolution
5. Arc length of curves
6. Average value of $f(x)$ on an interval $[a, b]$.

Important Note: Most of the problems on this exam will require you to set up and compute an integral to find the quantity that is asked for. In addition to knowing how to set up the required integral, *any* of the methods of integration tested on the first exam (i.e. basic rules, u-substitution, integration by parts, trigonometric substitution, partial fractions, or consultation of a table of integrals) might be required to evaluate the integral. In other words, this exam is *really a cumulative exam on the first two-thirds of the semester.* Especially if you did poorly on the first exam, you will need to begin your review for this exam by going back and looking at the material from sections 5.1 through 5.8 in Stewart.

There will be a review for the exam in class on Tuesday, March 25. *Please do not postpone preparing for this exam until after you return from Easter break – you will not have enough time to get ready!*

Review Problems

Section 5.9/1, 3, 11, 13, 15

Section 5.10/1, 13, 15, 19 (use parts), 21, 23, 25, 29, 31, 55

Section 6.1/1, 3, 5, 7, 9, 11, 29 (place the origin at the center of the large circle, and note that the endpoints of the arc on the smaller circle are at opposite ends of a diameter of that circle), 37

Section 6.2/1, 3, 5, 9, 21 (and evaluate), 29, 39 a (and evaluate)

Section 6.3/5, 7, 9 (look for an algebraic simplification to integrate), 17, 19 (use the table for these)

Section 6.4/1, 3, 5, 13 *Sample Exam Questions* This list is much longer than the actual exam will be (to give you some idea of the range of different questions that might be asked). Unless otherwise directed, you may use any entry of the Table of Integrals from the text that applies.

I.

(A) Use the midpoint rule, the trapezoidal rule, and Simpson's rule with $n = 4$ to estimate the value of the integral $\int_0^2 \sqrt{1+x^4}\, dx$, rounding your answers to 6 decimal places.

(B) Which of your answers in part A are overestimates and which are underestimates. Explain how you can tell.

(C) Which of the estimates in part A would you expect to have the smallest error. Explain. (Review Lab 1 to see the idea here.)

II. For each of the following integrals, say why the integral is improper, determine if the integral converges, and if so, find its value.

A) $\int_1^\infty \frac{1}{\sqrt[5]{x}}\, dx$

B) $\int_0^2 \frac{dx}{x^2-7x+6}$

C) $\int_0^\infty xe^{-3x}\,dx$

D) For which values of a is $\int_0^\infty e^{ax}\sin(x)\,dx$ convergent? Evaluate the integral for those a.

III.

(A) Let R be the region in the plane bounded by $y = 3 - x^2$ and the x-axis.

(1) Sketch the region R.

(2) Find the area of R.

(3) Find the volume of the solid generated by rotating R about the x-axis.

(B) Let R be the region in the plane bounded by $y = 3x$ and $y = x^2$.

(1) Sketch the region R.

(2) Find the area of R.

(3) Find the volume of the solid generated by rotating R about the x-axis.

(4) Find the volume of the solid generated by rotating R about the y-axis.

(C) Let R be the region in the plane bounded by $y = \cos(\pi x)$, $y = 1/2$, $x = -1/3$ and $x = 1/3$.

(1) Sketch the region R.

(2) Find the area of R.

(3) Find the volume of the solid generated by rotating R about the x-axis.

IV. The height of a monument is 20m. The horizontal cross-section of the monument at x meters from the top is an isosceles right triangle with legs $x/4$ meters. Find the volume of the monument.

V.

(A) Set up and evaluate the integral to compute the arclength of the curve $x = 3t^2$, $y = 2t^3$, $0 \le t \le 2$.

(B) Set up and evaluate the integral to compute the arclength of the curve $y = \frac{1}{6}(x^2+4)^{3/2}$, $0 \le x \le 3$. (Hint: the arclength integral simplifies to a manageable form if you are careful with the algebra.)

VI.

(A) Find the average value of $f(x) = \sqrt{1-x^2}$ on the interval $[0, 1/2]$. (Use trigonometric substitution, not the table.)

(B) Find the average value of $f(x) = x\sqrt{1+x^4}$ on the interval $[0, 2]$.