Mathematics 134 – Intensive Calculus for Science 2
Exam 1 – Things To Know
February 10, 2006

General Information

As announced in the course syllabus, the first full-period midterm exam of the semester will be given in class on Friday, February 17. The format will be similar to that of the midterm exams last semester. The exam will cover the material since the start of the semester (Quizzes 1,2,3), including the following material from Chapters 5, 6, and section 1 of Chapter 7.

1) Riemann sums and the definite integral
2) Applications to computing areas, average values, total change of a function
3) The Fundamental Theorem of Calculus: If $F(x)$ is an antiderivative of a continuous function $f(x)$ on $[a, b]$, then

$$\int_a^b f(x)\ dx = F(b) - F(a)$$

Also know the second part of the fundamental theorem: If f is continuous on $a \leq x \leq b$, then $F(x) = \int_a^x f(t)\ dt$ is differentiable and

$$\frac{d}{dx}\int_a^x f(t)\ dt = f(x)$$

4) Antiderivatives graphically and numerically
5) The power, sum, and constant multiple rules for antiderivatives
6) Differential equations $\frac{dy}{dx} = f(x)$
7) Integrals by substitution

There will be a review for the exam in class on Wednesday or Thursday next week (February 15 or 16). Rosie Arcuri will be available on Thursday evening at the usual time for other, "last minute" questions.

Sample Exam

I. This is the graph

$$y = f(x) = \begin{cases} 1 & \text{if } -2 \leq x \leq -1 \\ -x & \text{if } -1 < x \leq 0 \\ \sqrt{4 - x^2} & \text{if } 0 < x \leq 2 \end{cases}$$

(made up of straight line segments and a quarter circle):

A) (15) Use left- and right-hand sums with $\Delta x = 1$ to estimate $\int_{-2}^{2} f(x)\, dx$.

B) (10) Using the relation between the integral and area, find the *exact* value of $\int_{-5}^{5} f(x)\, dx$.

C) (10) Let F be an antiderivative of f with $F(-2) = 1$. Use the Fundamental Theorem of Calculus to find the values $F(0)$ and $F(2)$.

D) (5) F is the same antiderivative of f as in part C. Is $y = F(x)$ concave up or down for $0 < x \leq 2$? Explain how you can tell.

II. Compute each of the following integrals.

A) (10) $\int \sqrt[3]{x} - \frac{4}{x} + \cos(x)\, dx$

B) (15) $\int x \sin(12 - 3x^2)\, dx$

C) (15) $\int_0^2 \frac{t^2}{7+2t^3}\, dt$

III. The temperature $Q(t)$ of a cup of coffee is changing at the rate

$$\frac{dQ}{dt} = -3.5e^{-.05t} \tag{1}$$

degrees Celsius per minute t minutes after it is poured. the temperature at time $t = 0$ was $Q(0) = 90$.

A) (15) Solve the differential equation (1) with the initial condition $Q(0) = 90$ to find a formula for $Q(t)$.

B) (5) What was the *average temperature* of the coffee between $t = 0$ and $t = 5$?

Look over Problem Sets 1,2,3, the last three quizzes, and see the Review Problems from the ends of Chapters 5,6,7 in the text for additional practice problems.