MATH 211, Section C | Review for the FINAL | 12/4/2002

Professor John Beachy

The Final Exam is scheduled for **Friday, December 13, 8:00–9:50 AM, in DU 148**. (See the university schedule for mass exams.) Please bring a valid picture I.D.

Some general suggestions for reviewing

1. Review from the textbook
   Briefly review each section: review the shaded boxes and be sure you understand the examples
   Work some odd numbered problems that you choose from the original assignment sheet
   Read the review sheets for the hour exams, and go back to the text if you don't understand something
2. Review your quizzes and hour tests (most have solutions on the class homepage)
3. Test yourself on some of the exams posted on the class review page

Sections 5.1–5.5

In the earlier chapters we learned how to find the rate of growth of a function (its derivative) when we were given a formula for the function. In this chapter, the situation is reversed: Suppose that we know the formula for the rate of growth of a function. Can we find a formula for the function?

We use the notation $\int f(x)\,dx$ for the general *antiderivative* of $f(x)$, and so

$$\int f(x)\,dx = F(x) + C \qquad \text{means} \qquad F'(x) = f(x)\ .$$

With this notation (also called an *indefinite integral*), each of the differentiation formulas has a corresponding integration formula. The rules "the derivative of a sum is the sum of the derivatives" and "the derivative of a constant times a function is the constant times the derivative" give us these helpful rules.

$$\int [f(x) + g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx \qquad\qquad \int kf(x)\,dx = k\int f(x)\,dx \quad (k \text{ any constant})$$

The basic differentiation formulas $\frac{d}{dx}\,x^n = nx^{n-1}$ $\frac{d}{dx}\,e^x = e^x$ $\frac{d}{dx}\,\ln x = \frac{1}{x}$ give us these formulas.

$$\int u^n\,du = \frac{u^{n+1}}{n+1} + C \quad (n \neq -1) \qquad\qquad \int e^u\,du = e^u + C \qquad\qquad \int \frac{1}{u}\,du = \ln|u| + C$$

The chain rule $\frac{d}{dx}\,f(u(x)) = f'(u(x))\,u'(x)$ leads to $\int f(u(x))\,u'(x)\,dx = F(u(x)) + C$, where $F(x)$ is any antiderivative of $f(x)$. The technique of substitution (in section 5.5) is a way to make it easier to recognize functions that fit this pattern. By choosing a function $u(x)$ and substituting for it, together with letting $du = u'(x)\,dx$, the goal is to reduce a complicated integral to one of the three general formulas given above. (In this course, we don't try to use either the product rule or quotient rule in reverse.)

The author makes this definition: $\int_a^b f(x)\,dx = F(b) - F(a)$, where $F(x)$ is any antiderivative of $f(x)$. You should think of this *definite integral* as an averaging process:

$\int_a^b f(x)\,dx$ equals the width $(b-a)$ of the interval multiplied by the average height of the function $f(x)$ on $[a, b]$.

This is useful in finding the area below a curve, or in finding a total output when you know the rate of output. (See the author's definition of the average value of a function, on page 394.) You need to know how to approximate a definite integral, as in Exercises 1 and 2 on page 396 (a problem on the final exam would have fewer subdivisions since you can't use a calculator).