Math 1210-2
Tuesday Nov. 13

Review Session tomorrow (Wed) night,
7:00-8:30 pm. WEB 103

Carnival tomorrow 4:15 - 5:30?
show up at or near student center
in LCB/JWB basement.
Apparently 250 people have signed up!

§4.3 - 4.4.

Prove FTC1, Monday notes,
pages 2-4

<u>FTC1</u>: $\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$

<u>FTC2</u> $\int_a^b f(x)\,dx = F(b) - F(a)$ if F is any antiderivative of f.

<u>Exercise 1</u> Combine FTC1 and FTC2 to compute the following derivatives, without first actually calculating the definite integral. When possible, check your answer by calculating the definite integral, then differentiating.

1a) $D_x \int_0^x \sin t\,dt$

1b) $D_x \int_{2x}^{3x} t^2\,dt$

1c) $D_x \int_1^{\cos x} \frac{1}{t}\,dt$

Note: for $a<b$, FTC2 says $\int_a^b f(t)dt = F(b) - F(a)$.

In order to be consistent with this fact, we define

$$\int_a^a f(t) = 0, \quad \int_b^a f(t)dt = -\int_a^b f(t)dt$$
$$= F(a) - F(b), \text{ i.e. } F(x)\Big]_b^a.$$

(we secretly used this fact in Exercise 1)

Exercise 2 Find

$$\int_2^0 \frac{t}{\sqrt{3t^2+1}}\,dt$$

Substitution in Definite Integrals

Recall (?!!)

$$* \int f(g(x))\,g'(x)dx = F(g(x)) + C$$

($F'(u) = f(u)$), Chain rule backwards!

which we work out in actual problems using $u = g(x)$, $du = g'(x)dx$ substitution, i.e. $* = \int f(u)du = F(u) + C = F(g(x)) + C$.

Thus also

$$\int_a^b f(g(x))g'(x)\,dx = F(g(b)) - F(g(a)) = \int_{g(a)}^{g(b)} f(u)\,du$$

, i.e. if you convert x-limits into corresponding u-limits you can compute the definite integral without reconverting u to $g(x)$

Exercise 3 Rework Exercise 2, by converting the x-limits into u-limits.

Review Sheet for Exam 3

Problem Sessions:

Wed Nov. 14 7–8:30 pm, WEB 103

Thurs Nov. 15 9:40–10:30 am JWB 335 (here, the usual problem session.)

Exam is this Friday, Nov 16.

Chapter 3 (Except 3.7, Newton's method). Chapters 3.1–4.4

Max-min problems

3.1 Extreme values and critical points

3.2 Monotonicity & concavity

3.3 local extrema, 1^{st} & 2^{nd} derivative tests

3.4 Practical max-min problems:

- Express fcn to be extremized in terms of 1 or more variables
- Use constraint equations to find a function of just 1 variable which you wish to extremize on some interval domain
- Use Calc. to find extreme value.

Graphing with Calculus

3.5 (also 3.1–3.3).

inc/dec

CU/CD (& inflection pts)

intercepts

asymptotes

limits related to asymptotes

sample points

plot!

Mean Value Theorem (for derivatives)

3.6 : Statement of theorem, testing theorem for given $f(x)$ and interval $[a,b]$.

Antiderivatives

3.8 : sum rule, constant multiple rule, power rule; trig fcns substitution using differentials (chain rule in reverse)

3.9 solving 1^{st} order differential equations by antidifferentiation. Separable DE's.

Chapter 4.1–4.4

The definite integral and Riemann sums

4.1–4.2 Computing Riemann sums, summation notation

Taking the limit as $\Delta x \to 0$ in special cases, ($\Delta x = \frac{b-a}{n}$, $n \to \infty$) providing you're given "magic formulas"

Interpret definite integrals as signed area

Computing definite integrals (and their derivatives), using FTC2, FTC1:

4.3–4.4. Theorem statements. Integral ~~properties~~

how to compute definite integrals via antidifferentiation

substitution in definite integrals

derivatives of integral expressions (FTC1 + chain rule)

applications to area, or net change as an integral of rate of change

Topic	quiz	class	webworks	text
3.1–3.3		10/16 #1, 10/5 #2,3,5, 10/15 #2, 10/16 #4,5, (10/22 #1)	6 #1,2,3,4,	p211 #8
3.4	10/26 #1	10/5 #1,4, 10/22 #2, 10/23 #1	6 #9-15	p211-212 #40, 42, 43
Graphing (3.5)	11/2 #1,2	10/24 #1,2,3, 10/25 #18	6 #5,6,7,8; 7 #1-4	p211 #20, 21, 22, 29, 38, 44; p ~~146~~ 183 #17
Mean Value Theorem (3.6)	11/9 #1	10/26 #1,2,3	7 #5-7	p212 #45
Antiderivatives (3.8, 3.9)	11/9 #2	10/31 #1,2,3, 11/2 #3,4,5	7 #12-25	p212 #54, 59, 61, 65, 73
4.1–4.2		11/6 #1,2,3,6, 11/7 #1,3, 11/12 #1,	8 #1-6, 8, 9; 8 #7	p271-272 #13, 20, 21, 22
4.3–4.4		11/7 #4, 11/9 #1,2, 11/12 #1,2,3, 11/13 #1,2,3	8 #10-24	p272 #3, 7, 9, [illegible], 15, 23, 28