Math 131 Day 42

1. **The final exam is cumulative**. The material listed below constitutes 90 to 95% of the material on the exam:

   a) Riemann Sums: Drawing upper and lower sums, determining the formula for a simple Riemann sum and computing its limit as $n \to \infty$;

   b) antidifferentiation techniques including substitution, parts (including parts twice), partial fractions (including repeated factors), trig substitutions, low powers of trig functions functions (e.g., $\cos^2 x$, $\sin^2 x$, $\tan^2 x$, $\sec^2 x$). You should be able to do integrals such as $\int \cos^9(4x)\sin^4(4x)\,dx$ by splitting off an odd power. I will give you the reduction formulas for high powers of trig functions, e.g. $\int \cos^n x\,dx = \frac{1}{n}\cos^{n-1} x\sin x + \frac{n-1}{n}\int \cos^{n-2} x\,dx$;

   c) relating the graphs of $f(x)$ and $F(x) = \int f(x)\,dx$

   d) applications: area between curves, volumes (including revolutions around the y axis), average value, work, and arc length

   e) L'Hopital's rule including indeterminate forms such as 1^∞, ∞^0, $0\cdot\infty$;

   f) improper integrals of types: e.g. $\int_a^\infty f(x)\,dx$ or $\int_{-\infty}^a f(x)\,dx$ or $\int_a^b f(x)\,dx$ where f is not defined at one of a or b. Know the p-power theorem for $\int_1^\infty \frac{1}{x^p}\,dx$

   g) sequences: finding limits, KNOW key limits

   h) series: convergent (divergent) series, partial sums, telescoping, integral test, n-th term test, geometric series test, direct comparison, limit comparison, ratio test, root test, alternating series, absolute and conditional convergence, absolute convergence test, ratio test extension;

   i) power series: finding the radius and interval of convergence;

   j) Taylor polynomials and Taylor series.

   k) **Final Exam: Monday, May 13, 2013 1:30–4:30 PM.**

Review Session, Office Hours, Practice Problems

1. a) Review Session Thursday at 10:00–12:00 pm in Gulick 206A. Try the practice problems and test.

   b) My Office Hours: Wednesday: 1:30–3:00. Friday 10:30–12:00. Other times by appointment.

   c) Practice: Review the previous practice tests, exams, and labs. There are hundreds of solved problems on line.

2. **Math Intern Hours for next week:** Dave Brown is working this upcoming Sunday and Monday as normal and then taking Tuesday the last day of classes off. Then his schedule will be:

   1) Wed 5/8 3-9

   2) Thur 5/9 2-5 6-9

   3) Fri 5/10 12-6

   4) Sat 5/11 12-6

   5) Sun 5/12 12-6

   6) Mon 5/13 12-6

3. Having trouble with a particular topic? Review the online notes.

4. **Do the online practice problems**. The answers are posted.

5. **Do the online Practice Exam**. It is a bit longer than the actual exam will be. Try this after you have practiced. The answers will be posted after the Review Session.

6. **Extra Credit**: See the Day 41 handout (which is also on line).

Math 131 Day 42: Integral Quick Check

	Integral	Technique	Intuition/Reasoning
1	$\displaystyle\int \frac{x}{x^2 - 4}\ dx$		
2	$\displaystyle\int \frac{x^2 - 4}{x}\ dx$		
3	$\displaystyle\int \frac{x^2}{x^6 + 1}\ dx$		
4	$\displaystyle\int xe^x\ dx$		
5	$\displaystyle\int \frac{e^{\sqrt{x}}}{\sqrt{x}}\ dx$		
6	$\displaystyle\int x\cos x\ dx$		
7	$\displaystyle\int e^x \cos x\ dx$		
8	$\displaystyle\int x\sec^2 x\ dx$		
9	$\displaystyle\int_{-\pi}^{\pi} x^2 \sin^7 x\ dx$		
10	$\displaystyle\int x\ln x\ dx$		
11	$\displaystyle\int \ln x\ dx$		
12	$\displaystyle\int \tan x\ dx$		
13	$\displaystyle\int x\tan\left(x^2 + 1\right)\ dx$		
14	$\displaystyle\int \frac{4}{(4 - x^2)^{3/2}}\ dx$		
15	$\displaystyle\int \frac{-4x + 4}{(x - 2)^2 x}\ dx$		
16	$\displaystyle\int \frac{4x + 8}{x^2 + 4x + 5}\ dx$		

	Integral	Technique	Intuition/Reasoning
1	$\int \dfrac{4}{x^2 - 4}\ dx$		
2	$\int \dfrac{x}{x^2 - 4}\ dx$		
3	$\int \dfrac{4}{x^2 + 4}\ dx$		
4	$\int x\sqrt{4 - x^2}\ dx$		
5	$\int \dfrac{\sqrt{x^2 - 1}}{x}\ dx$		
6	$\int \dfrac{1}{\sqrt{1 - x^2}}\ dx$		
7	$\int \sin^3 x \cos^{4/5} x\ dx$		
8	$\int \sin^3 x \cos^5 x\ dx$		
9	$\int \sin^2 x \cos^4 x\ dx$		
10	$\int \sec^2 x \tan^{-5} x\ dx$		
11	$\int \sec^4 x \tan^5 x\ dx$		