Calculus II, Spring 2005
Lab 1

Math 131-01
January 18

Warm-up Exercises: *Here are a few warm-up exercises to review differentiation and anti-differentiation. These exercises are not to be turned in. (On the other hand, some of them might appear on quizzes. . . .) Try to solve all of these problems, but save some time to work on the problems that you have to hand in.*

1. Compute the following derivatives

a) $\dfrac{d}{dx}\tan(e^x)$ **b)** $\dfrac{d}{dt}\left(\dfrac{e^{2t}-e^{-2t}}{3t^3+\frac{1}{2}t+7}\right)$ **c)** $\dfrac{d}{dx}\left(x\sin(x^{17})\right)^{17}$

2. Compute the following indefinite integrals. For parts c and d, you have to rewrite the function before you will be able to do the integration.

a) $\displaystyle\int x^{1/2}\,dx$ **b)** $\displaystyle\int \sin(t)-\cos(t)\,dt$ **c)** $\displaystyle\int \frac{1+x}{x\sqrt{x}}\,dx$ **d)** $\displaystyle\int z(1+z)^2\,dz$

Exercises to hand in: *Please hand in your responses to the following exercises at the end of lab. You can work on these problems in a group and turn in a single solution for the entire group. For this first lab, the grading will be pretty generous.*

3. The values of a function $f(x)$ are measured for certain values of x. The results are shown in the following table.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
$f(x)$	2.7	2.9	2.85	2.75	2.6	2.4	2.1	1.6	0.8

a) Given the data in this table, what is your best estimate for the value of $f'(2)$? *Explain your reasoning.* What are some other possible answers that might be given to this question, and why is yours better?

b) Given the data in the table, what is your best estimate for the value of $f''(2)$? *Explain your reasoning.*

4. If $F(x)$ and $G(x)$ are both anti-derivatives of the same function $f(x)$, then $G(x) = F(x)+C$ for some constant C, right? Let $f(x)=\frac{1}{x^2}$, for $x\neq 0$. Consider the following two functions:

$$F(x) = -\tfrac{1}{x},\ \text{for } x\neq 0 \qquad\qquad G(x)=\begin{cases}-\frac{1}{x}+1 & \text{for } x>0\\ -\frac{1}{x}+2 & \text{for } x<0\end{cases}$$

Show that $F'(x)=G'(x)=f(x)$ for all $x\neq 0$, but that $G(x)$ is not equal to $F(x)$ plus any (single) constant. How can this be explained? (Look carefully at the definition of anti-derivative in the textbook!) Find **all** functions $H(x)$ that satisfy $H'(x)=f(x)$.