Calculus I **Review sheet for Test 2** **March 1, 2002** **Dr. Adler**

You should be able to do the following:

1. Find the derivative of a not-too-complex function using the *definition* of the derivative. (Example: $f(x) = \frac{x+3}{x-7}$.)
2. Recognize from the graph of a function where it is and is not differentiable.
3. Use the *rules* of differentiation to find the derivative of any function that involves only addition, subtraction, multiplication, division, powers, roots, and trig functions. Example: $g(x) = \tan(x^2 + 7) \cdot \sqrt{x + \sin(x)} + 47^2$.
4. Find second and third derivatives.
5. Find an equation of the tangent line to the graph of a curve at a given point. Examples:

   (a) $y = 2\sin x + 3$ at $x = \pi/3$. (b) $x^2 + xy - y^2 = -5$ at $(-1, 2)$.

6. Be able to interpret derivatives in terms of velocity, acceleration, marginal cost, or whatever is appropriate.
7. Solve related rates problems, such as 71–73 on p. 217.
8. Find the linearization of a function and use it to estimate values of the function.
9. Use the fact that $\lim_{x\to 0}(\sin x)/x = 1$ to compute other limits. (Examples: find $\lim_{t\to 0} \frac{\sin 3t}{\tan 5t}$ and $\lim_{x\to 0} \frac{t^3}{\tan^2 2t}$.)

The above was mainly a list of concepts. See the other side of this sheet for some more sample problems.

Here are some more sample problems:

10. Find dy/dx and simplify:

    (a) $y = (4 - \sqrt{x})^{7/4}$

    (b) $y = \frac{2x}{\sqrt{x^2+1}}$

    (c) $\cos(x + y) = y$

    (d) $y = \tan^2(3x - 1)$

11. Find y'':

    (a) $y = \tan(3x + 7)$

    (b) $x^2 - y^2 = 1$

12. Find the linearization $L(x)$ of $f(x) = (x^2 + 1)^{-1}$ at $x = 1$.

13. The position of a body at time t seconds is $s = t^3 - 6t + 9$ meters. Find the body's acceleration each time the velocity is zero.

14. The volume of a sphere is given by $V = (4/3)\pi r^3$. How will a 10% increase in r affect V?

15. Use the quotient rule to prove that $\frac{d}{dx}(\cot x) = -\csc^2 x$.

16. Graph the function

$$f(x) = \begin{cases} \sqrt{x} & \text{if } 0 \le x \le 1, \\ 2x - 1 & \text{if } 1 < x \le 3, \\ 5 & \text{if } x > 3. \end{cases}$$

    (a) Is f continuous at $x = 1$?

    (b) Is f differentiable at $x = 1$?

    (c) Find f' where it exists.

17. Suppose $h(x) = f(x)g(x)$, where $f(2) = 3$, $g(2) = 5$, $g'(2) = 4$, $f'(2) = -2$, and $f'(5) = 17$. Find $h'(2)$.