Homework 4 - Math 141, Frank Thorne (thornef@mailbox.sc.edu)

Due Monday, September 24

(a) Draw a graph of a function which is not differentiable, and geometrically explain why it is not differentiable.

(b) Give an equation of a function which is not differentiable, and algebraically explain why it is not differentiable. (You can use the same function or a different function.)

(c) Give the definition of the *derivative* of a function $f(x)$ at the point $x = a$. (Please give the algebraic definition, using an equation.)

Draw a picture and explain why your equation gives the slope of the tangent line to the graph of $f(x)$ at $x = a$.

(d) Stewart, Ch. 2.8, 3, 5-8, 14.

(e) Stewart, Ch. 2.8, 19-29 (even).

(f) Stewart, Ch. 2.8, 41-43.

(g) If $f(x) = c$, where c is a constant, find $f'(x)$ using the definition. Draw a picture which explains your conclusion.

(h) Explain why the derivative of e^x is equal to e^x. You may take for granted that $\lim_{h\to 0} \frac{e^h-1}{h} = 1$.

(i) Stewart, Ch. 3.1, 2-14, 27-36, 45-46 (even).

(j) Stewart, Ch. 3.1, 49. (Note: The acceleration is the derivative of the velocity.)

(k) What is the 500th derivative of $f(x) = x^{100}$? Explain why.

(l) Stewart, Ch. 3.2, 1-18, 27-30 (even).

(m) Stewart, Ch. 3.2, 31-34 (even).

Additional problems:

(a) Stewart, Ch. 2.8, 15-16 (all), 19-29 (odd).

(b) Stewart, Ch. 3.1, 2-14, 27-36, 45-46 (odd).

(c) Stewart, Ch. 3.2, 1-18, 27-30 (odd).

(d) Stewart, Ch. 3.2, 31-34 (odd).

Bonus (1 point each):

(a) Evaluate $\lim_{x\to 1} \frac{x^{2012}-1}{x-1}$.

(b) Find the tenth derivative of $f(x) = x^2e^x$. (Hint: This is way too messy to do by brute force. Find a pattern.)