

**Homework 5 - Math 141, Frank Thorne (thornef@mailbox.sc.edu)**

**Due Friday, September 23**

- (a) If  $f(x) = c$ , where  $c$  is a constant, find  $f'(x)$  using the definition. Draw a picture which explains your conclusion.
- (b) If  $f(x) = x^n$ , where  $n$  is a positive integer, explain why  $f'(x) = nx^{n-1}$ .
- (c) If  $f$  and  $g$  are two functions, draw a picture which explains why  $(f + g)' = f' + g'$  and why  $(fg)' = fg' + f'g$ . Why is it not true that  $(fg)' = f'g'$ ?
- (d) Explain why the derivative of  $e^x$  is equal to  $e^x$ . You may take for granted that  $\lim_{h \rightarrow 0} \frac{e^h - 1}{h} = 1$ .
- (e) Stewart, Ch. 3.1, 2-34, 45-46; even required, odd recommended.
- (f) Stewart, Ch. 3.1, 49. (Note: The acceleration is the derivative of the velocity.)
- (g) What is the 500th derivative of  $f(x) = x^{100}$ ? Explain why.
- (h) Stewart, Ch. 3.2, 1-18, 27-30; even required, odd recommended.
- (i) Stewart, Ch. 3.2, 31-34.
- (j) Explain why  $\frac{d}{dx}(\sin x) = \cos x$  and  $\frac{d}{dx}(\cos x) = -\sin x$ .
- (k) Find  $\frac{df}{dx}$  for the functions  $f(x) = \tan x$ ,  $f(x) = \cot x$ ,  $f(x) = \sec x$ , and  $f(x) = \csc x$ .
- (l) Find the 4th, 7th, 23rd, and 4000001th derivatives of  $\sin x$  and  $\cos x$ .
- (m) Explain why  $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$ .
- (n) Stewart, Ch. 3.3, 3-14, 21-24; even required, odd recommended.
- (o) Stewart, Ch. 3.3, 31, 35.
- (p) Stewart, Ch. 3.3, 39-44; even required, odd recommended.
- (q) Stewart, Ch. 3.3, 49.