Math 205 Quiz 7
October 13, 2016

Name: ANSWERS

Instructions: No calculators! Answer all problems in the space provided! Do your rough work on scrap paper.

1. Let $f(x)$ and $g(x)$ be differentiable functions of x, c a constant. Complete the following formulas. (You may use $f'$and g' as shorthand):

   (a) $\frac{d}{dx}(cf(x)) =$ $cf'(x)$ (b) $\frac{d}{dx}(x^n) =$ nx^{n-1} (c) $\frac{d}{dx}e^x =$ e^x

   (d) $\frac{d}{dx}(a^x) =$ $a^x \ln a$ (e) $\frac{d}{dx}\ln x =$ $\frac{1}{x}$ (f) $\frac{d}{dx}(f(x) \pm g(x)) =$ $f' \pm g'$

2. Define $f'(x) =$ $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$ (using limits)

3. Use limits to find the derivative of $f(x) = 2 - x - x^2$ by doing the following:
   (a) The expression you get, no simplifying, when you plug the function into the definition: $\lim_{h\to 0} \frac{2-(x+h)-(x+h)^2-(2-x-x^2)}{h}$

   (b) The expression, just before taking the limit as $h \to 0$: $\lim_{h\to 0}(-2x-1-h)$ (c) Final answer: $-2x-1$

4. For problem 3 above, find the equation of the tangent line at $(0,2)$: $y-2=-(x-0)$

5. Find the following derivatives:

   (a) $\frac{d}{dx}\left(2+\frac{3}{x^2}\right) =$ $-6/x^3$ (b) $\frac{d}{dx}\frac{4x^4-3x^2+2x+3}{2x^2} =$ $4x - \frac{1}{x^2} - \frac{3}{x^3}$

   (c) $\frac{d}{dx}(\sqrt{x} + \ln x) =$ $\frac{1}{2\sqrt{x}} + \frac{1}{x}$ (d) $\frac{d}{dx}3^x =$ $3^x \ln 3$

6. Complete the table:

Function (assume all are continuous everywhere)	The behavior it tells us about	How?
$f(x)$	Points on the graph	Plug in x into f(x), find corresponding y-value to get (x,y)
f'	f is increasing (also decreasing)	$f'(x) > 0$
$f''(x)$	The function is Concave down	$f''<0$
f'	The function is decreasing	$f'<0$
f'	There is a minimum point at x	$f'<0$ on left of x, $f'>0$ on right of x, $f'=0$ or und at x. *

Bonus:

1. Complete the following rules:
   (a) $\frac{d}{dx}(f(x) \cdot g(x)) =$ $f'g + fg'$ (b) $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) =$ $\frac{f'g - fg'}{g^2}$

   (c) $\frac{d}{dx}f(g(x)) =$ $f'(g(x)) \cdot g'(x)$

* could also use the second derivative test.