NAME: _____

Math 180 Hour Exam Two

1. Differentiate with respect to x. Do not simplify your answers. [18 points]

   (a) $\dfrac{\sin(2x)}{\cos(3x)}$, (b) $\sqrt{x^2-7x+1}$, (c) $\arctan(3x^3)$

2. The table below gives values for f and g and their derivatives. [18 points]

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	3	-2	8	4
1	-1	2	5	-3
2	5	3	1	5

   (a) Find $\dfrac{d}{dx}\left(\dfrac{f(x)}{g(x)}\right)$ at $x=1$,

   (b) Find $\dfrac{d}{dx}f(g(x))$ at $x=2$,

   (c) Find $\dfrac{d}{dx}\ln(3f(x))$ at $x=0$.

3. Suppose x and y are related by the equation $xy^3+\tan(y)+x^3=27$. [16 points]

   (a) Find $\dfrac{dy}{dx}$ in terms of x and y.

   (b) Let f be a function where $y=f(x)$ satisfies this equation and where $f(3)=0$. Use the linearization of f to approximate $f(3.1)$.

4. Suppose that a function $f(x)$ is defined and is decreasing and concave down for all x. Also $f(3)=5$ and $f'(3)=-2$. [16 points]

   (a) Using the given properties of f, find an integer n with $|f(2)-n|<1$.

   (b) If $f(r)=0$, find an integer k with $|r-k|<2$.

5. Suppose b is a positive real number, and consider the function [16 points]

$$f(x)=3e^{-x^2/b}.$$

   (a) Find the x-coordinates of the inflection points of $f(x)$.

   (b) Is the graph of $f(x)$ concave up or down for x near 0?

6. Find the point (x,y) on the line $y=\frac{3}{4}x$ closest to the point $(4,0)$. [16 points]