Math 151
Final Exam
December 10th, 2008

Name: _____

1. Your exam contains 8 questions and 7 pages; Please make sure you have a complete exam.
2. The entire exam is worth 100 points. Point values vary and these are indicated on each problem. You have 2 hours for this exam.
3. Make sure to **ALWAYS SHOW YOUR WORK**; you will not receive any partial credit unless all work is clearly shown. If in doubt, ask for clarification. **Note:** To evaluate limits, proof by graph or table of values does not suffice for full credit.
4. If you need extra space, use the back of the exam and clearly indicate this.
5. You are allowed two 8.5×11 sheets of handwritten notes (both sides) and a calculator.
6. Leave answers in exact form (as simplified as possible).
7. Put a $\boxed{\text{box around your final answer}}$ where applicable.

Problem	Total Points	Score
1	19	
2	10	
3	7	
4	12	
5	6	
6	19	
7	15	
8	12	
Total	100	

1. (19 pts.) Find the following. **You do not need to simplify your answers.**

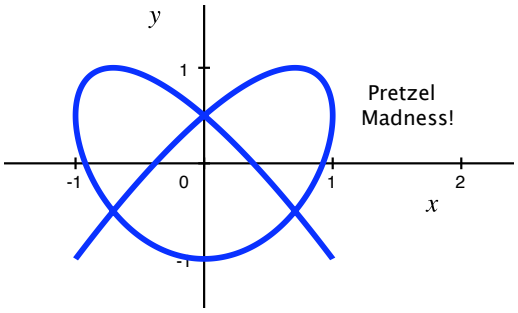
(a) (7 pts.) Find $g'(x)$ for $g(x) = \tan(5x^2 \cdot \ln x) + 3\ln(2)$.

(b) (7 pts.) Find $\dfrac{dy}{dt}$ for $y = (\arcsin t)^{3t}$.

(c) (5 pts.) Find the 53rd derivative of $f(x) = xe^x + 4$.

2. (10 pts.) The following curve is given by the parametric equations $x(t) = \sin(3t)$ $y(t) = -\cos(4t)$ for $-\frac{\pi}{2} \leq t \leq \frac{\pi}{2}$.

Find an **equation** of the tangent line at $t = \frac{\pi}{12}$.



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3. (7 pts.) A raccoon is moving along a straight line. The position of the raccoon at 2 seconds is 10 feet. The velocity of the raccoon is given by $v = 2t^3 - t^2$ in feet/second at t seconds.

Estimate the **position** of the raccoon at 2.1 seconds using **linear approximation** at $a = 2$ seconds.

4. (12 pts.) An object is dropped from the top of the Space Needle.* A small dog is lying **60 meters from the base** of the Space Needle and watching the object fall straight down to the ground.

   What is the **rate of change of the observer's angle of elevation** (the angle between the dog's line of sight and the ground) at the moment for which the object is 80 meters above the ground and traveling 40 meters/second towards the ground? (Include units in your answer.)

*It is illegal to drop objects from the top of the Space Needle and I am not promoting illegal behavior through my fictitious scenarios.

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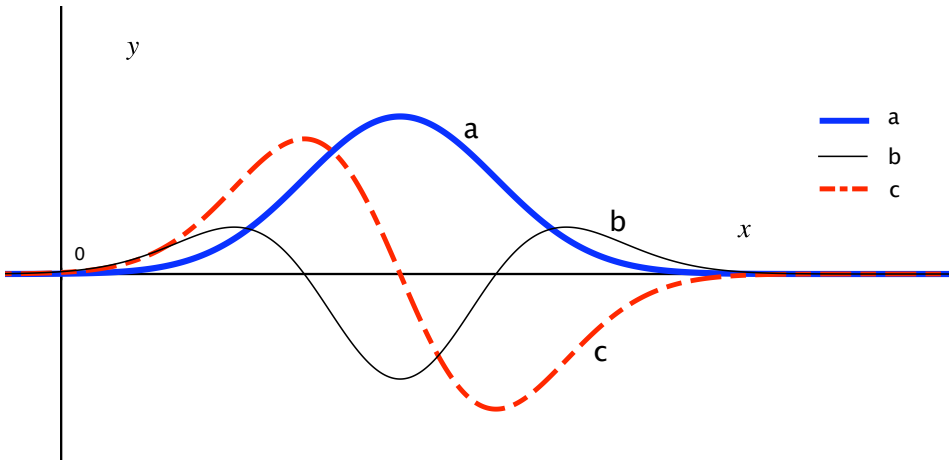
5. (6 pts.) The figure below shows the graphs of $f(x)$, $f'(x)$, and $f''(x)$. Identify each curve.



$f(x)$: _____

$f'(x)$: _____

$f''(x)$: _____

6. (19 pts.) Evaluate the following limits. **Justify** your answers. If the limit is infinite, determine if it is $+\infty$ or $-\infty$.

(a) (7 pts.) $\lim_{t\to 2} \dfrac{t^5 - 32}{t^2 - 4}$

(b) (6 pts.) $\lim_{x\to -1} \dfrac{\ln(x^2+2)}{e^{x+1}}$ (To clarify: The exponent of e is $x+1$.)

(c) (6 pts.) $\lim_{x\to 3^-} \dfrac{2x+1}{x(x-3)^2}$

7. (15 pts.) $F(x) = \dfrac{3x^3}{e^{2x}}$

(a) (10 pts.) Find the critical number(s) of $F(x)$ and identify each number as the location of a local maximum, local minimum, or neither by using the 1st or 2nd derivative test.

(b) (5 pts.) If the domain of $F(x)$ is restricted to $[0, 3]$, what are the **global** maximum and minimum **values** of $F(x)$ on this domain?

8. (12 pts.) Consider the function $h(x) = \dfrac{4e^x+6}{e^x-2}$.

(a) (5 pts.) For what x-values is $h(x)$ **discontinuous**?

(b) (7 pts.) Find **equations** of the horizontal and vertical asymptotes of $h(x)$ (if any exist). Be sure to show your work or explain your reasoning.