Midterm Exam 2
Math 1
October 30th, 2013

Name: _____

Please circle your instructor's name below

Infeld Petit

Please read the following instructions before starting the exam:

- This exam is closed book, with no calculators, notes, or book allowed. You may not give or receive any help during the exam, though you may ask the instructors for clarification if necessary.
- Be sure to show all work whenever possible. Even if your final answer is incorrect, we can assign an appropriate amount of partial credit if we can see how you arrived at your answer.
- Please circle or otherwise indicate your final answer, if possible.
- The test has a total of 9 questions, worth a total of 100 points. Point values are indicated for each question.
- You will have two hours from the start of the exam to complete it.
- Good luck!

HONOR STATEMENT: I have neither given nor received help on this exam, and I attest that all the answers are my own work.

SIGNATURE:_____

This page is for grading purposes only

Problem	Points
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

1. **Multiple choice.** Circle the correct answer to each question. [2 points each, no partial credit].

The derivative of $\cos(x)\sin(x)$ is:

- $\sin^2(x) - \cos^2(x)$
- $\cos^2(x) - \sin^2(x)$
- 0
- 1

If $y = \arcsin(x)$, then $\frac{dy}{dx}$ is:

- $\frac{1}{\sin(y)}$
- $\frac{1}{\cos(y)}$
- $\frac{1}{\sin(x)}$
- $\frac{1}{\cos(x)}$

What easy condition can you check to show that the continuous function $f(x) = 4x^3 - 6x^2 + 3x - 2$ has a zero in $[1, 2]$?

- $f(1)$ and $f'(1)$ have different signs.
- $f'(x)$ has a zero in $[1, 2]$.
- $f(1)$ and $f(2)$ have different signs.
- $f(1)$ and $f(2)$ must be equal.

The function $f(x)$ such that $\lim_{x\to 1} f(x) = f(1)$, $\lim_{x\to 1^-} f'(x) = 2$, $\lim_{x\to 1^+} f'(x) = 3$ is

- Non-differentiable at $x = 1$.
- Non-differentiable and discontinuous at $x = 1$.
- Differentiable at $x = 1$
- Continuous, but non-differentiable, at $x = 1$

What's the derivative of $f(x) = 7^x$?

- $\frac{1}{\ln(7)} 7^x$
- $\ln(7) \cdot 7^x$
- 7^x
- $\log_7(e) \cdot 7^x$

2. Find the derivatives of the following functions: [4 points each]

- $f(x) = 4x^7 + 8x^3 - 2$

- $f(x) = xe^x$

- $f(x) = \sin(3x)$

- $f(x) = \frac{x^2 - x}{\cos(x)}$

- $f(x) = (x^3 - 5x^2)3^x$

3. Find the value of c that makes the following function continuous on its domain: [10 points]

$$f(x) = \begin{cases} \frac{x-c}{x^2-c^2} & x \neq c \\ \pi & x = c \end{cases}$$

4. Compute these derivatives of $f(x)$ using the limit definition of the derivative, DO NOT USE THE POWER RULE: [10 points]

   - $f(x) = x^2$

   - $f(x) = \frac{1}{x}$

5. Find the equation of the tangent line to the implicitely defined function

$$y \sin(2x) = x \cos(2y)$$

at the point $(\pi/2, \pi/4)$. [10 points]

6. Compute the following limits: [5 points each]

- $\lim_{x \to -\infty} \frac{x^2}{\sqrt{x^4+1}}$

- $\lim_{x \to +\infty} \frac{(2x^2+1)^2}{(x-1)^2(x^2+x)}$

7. • State the formula for the chain rule. [5 points]

• Use the chain rule and any other differentiation rules you find appropriate to find $f'(x)$, where $f(x) = \frac{\tan(3x)}{x^2-2}$.: [5 points]

8. • Find the domain and range of $f(x) = \ln(x^2 - 9)$ and write them in interval notation. [5 points]

• Compute the derivative $f'(x)$. [5 points]

9. Find the equation of the tangent line to $y = \frac{e^x}{x}$ at the point $(\ln(3), \frac{3}{\ln(3)})$: [10 points]