MATH 2250

Midterm Exam I
September 21, 2015

NAME (please print legibly): _____

Your University ID Number: _____

Please complete all questions in the space provided. You may use the backs of the pages for extra space, or ask me for more paper if needed. This exam will be graded on:

- Correctness of computations.

- Correctness of procedure.

- Clarity of explanation of procedure.

A correct answer obtained using an incorrect or poorly explained procedure will not be graded for full credit. Please feel free to write as much as you like. Work carefully, and try to complete the problems you find easier before going back to the harder ones.

Your signature above indicates that **you understand the academic honesty policies of the University of Georgia** and **consent to photography and video recording for academic honesty purposes during the exam period**.

Good luck!

QUESTION	VALUE	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
TOTAL	90	

1. (10 points) Find the limit
$$\lim_{x \to -1} \frac{x^2 - 1}{x + 1}$$
using algebra. (You may use L'Hôspital's rule, if you know it, for half credit.)

ANSWER: _____

2. (10 points) Give the definition of the derivative as a limit. Use this definition to find the derivative of the function

$$f(x) = x^3$$

using the **definition of the derivative as a limit**. (You can use the ordinary differentiation rules – power rule, quotient rule, etc to check your work, but not to do the problem.) Hint: Pascal's triangle.

ANSWER: _____

3. (10 points) Find the derivative of the function

$$f(x) = \cos(4x) + 3^x$$

using any method you like.

ANSWER: _____

4. (10 points) According to an auto-racing site, the engine power P (in horsepower) required to overcome the force of air resistance on a 2004 Corvette at a given speed v (in mph) is given by the simple formula

$$P(v) = \frac{0.354}{8250}v^3$$

- Find the horsepower used to overcome air resistance while driving at 150 mph.

- Compute the derivative dP/dv at 150 mph.

- Now describe in a sentence or two what this derivative means or measures (harder).

5. (10 points) Find the derivative of

$$q(x) = \ln \tan x$$

using any method you like.

ANSWER: _____

6. (10 points) Find the derivative of

$$f(x) = e^{5x} \arctan x$$

using any method you like.

ANSWER: _____

7. (10 points) Find the derivative of the function

$$\frac{\cos x}{\sin x}$$

using the quotient rule for derivatives. (Since this function is $\cot x$, you can use the derivative formula for $\cot$ to *check* your work, but you must use the quotient rule above, and show all your steps, for full credit.)

ANSWER: _____

8. (10 points) Suppose that x and y obey the equation

$$x^3 + 4xy + y^3 = 4$$

Find $\frac{dy}{dx}$.

ANSWER: _____

9. (10 points) A certain function $f(x)$ has

$$f(5) = 3 \quad \text{and} \quad f'(5) = 7.$$

Find the derivative of the inverse function $f^{-1}(x)$ at $x = 3$. Hint: If you're stuck, you can always write $f(f^{-1}(x)) = x$ and differentiate both sides.

ANSWER: _____