MATH 2250

Midterm Exam I

September 27, 2016

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.

- Clarity of explanation of procedure.

- Correctness 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. 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 derivative

$$\frac{\mathrm{d}}{\mathrm{d}x}(\cos(1 - 2x))^4$$

ANSWER: ―――――――――――

2. (10 points) Find the derivative

$$\frac{\mathrm{d}}{\mathrm{d}x}\ln(\sin^2 x)$$

ANSWER: ―――――――――――

3. (10 points) Find the derivative

$$\frac{\mathrm{d}}{\mathrm{d}x}\arcsin(x^2)$$

ANSWER: ―――――――――――

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4. (10 points) Use the definition of the derivative as a limit to find the derivative

$$\frac{\mathrm{d}}{\mathrm{d}x}1/x$$

Note: You should check your answer using our usual methods, but you won't get credit for evaluating the derivative without doing the limit.

ANSWER: _____

5. (10 points) Use implicit differentiation to find $\frac{dy}{dx}$ knowing

$$x^2 + xy + y^2 - 5x = 2$$

ANSWER: _____

6. (10 points) Suppose you know the following information about $f(x)$:

x	f(x)	f'(x)	f''(x)
2	3.44	7.44	-11.96
3	6.44	-7.74	-100.46

Estimate $f(2.1)$ as accurately as you can. (Bonus credit: Estimate in more than two ways!)

ANSWER: _____

7. (10 points) Use logarithmic differentiation to compute

$$\frac{\mathrm{d}}{\mathrm{d}x} \frac{2(x^2 + 1)}{\sqrt{\cos 2x}}$$

Note: Half credit for doing the problem (correctly) without logarithmic differentiation (but I promise that's much harder!).

ANSWER: _____

8. (10 points) If two resistors of resistance R_1 and R_2 are connected in parallel, the overall resistance is given by

$$R = \frac{1}{R_1} + \frac{1}{R_2}.$$

At a particular time, $R_1 = 75$, $R_2 = 50$, $\frac{d}{dt}R_1 = 1/2$ and $\frac{d}{dt}R_2 = -5$. Find R and $\frac{d}{dt}R$.

ANSWER: _____

9. (10 points) We know that

$$\frac{\mathrm{d}}{\mathrm{d}x} f(x)g(x) = f'(x)g(x) + f(x)g'(x)$$

Find formulas for the second derivative

$$\frac{d^2}{dx^2} f(x)g(x)$$

and the third derivative

$$\frac{d^3}{dx^3} f(x)g(x).$$

ANSWER: _____

Extra credit: Generalize! What is the formula for $\frac{d^n}{dx^n}f(x)g(x)$ and why?