

# MATH 2250

## Midterm Exam I

September 26, 2005

**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. 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	7	
3	3	
4	10	
5	10	
6	10	
7	10	
8	7	
9	3	
10	10	
11	0	
<b>TOTAL</b>	<b>80</b>	

**1. (10 points)** Three-way matching. Match the names of the derivative rules in the left column with the functions in the middle column and the derivatives in the right-hand column so that each rule is matched with its definition. **Draw lines from one column to the next to indicate your choices.**

a. Chain Rule	$\frac{d}{dx} \frac{f(x)}{g(x)}$	$= f'(x)g(x) + g'(x)f(x).$
b. Product Rule	$\frac{d}{dx} f(g(x))$	$= \frac{f'(x)g(x) - g'(x)f(x)}{(g(x))^2}$
c. Quotient Rule	$\frac{d}{dx} f(x)g(x)$	$= f'(g(x))g'(x).$

**2. (7 points)** Use the **definition of the derivative as a limit** to find the derivative of

$$f(x) = \sqrt{3x + 2}.$$

You will receive **no credit on this problem** for doing the derivative using the ordinary differentiation laws. (But see Problem 3.)

**3. (3 points)** Use **any method** to find the derivative of

$$f(x) = \sqrt{3x + 2}.$$

Your answer here should agree with your answer in Question 2.

ANSWER: \_\_\_\_\_

**4. (10 points)** Find the derivative of

$$f(x) = \frac{7x^2 + 4}{5x^2 + 3}.$$

Please do *not* simplify your answer.

ANSWER: \_\_\_\_\_

**5. (10 points)** Find the derivative of

$$f(x) = 10^x \sin(3x + 2).$$

Please do *not* simplify your answer.

ANSWER: \_\_\_\_\_

**6. (10 points)** Find the derivative of

$$f(x) = \arctan(10x^4 + 5x).$$

Please do *not* simplify your answer.

ANSWER: \_\_\_\_\_

**7. (10 points)** Use implicit differentiation to find  $\frac{dy}{dx}$  assuming that

$$2xy + y^2 = x + y.$$

Please do *not* simplify your answer.

ANSWER: \_\_\_\_\_

**8. (7 points)** It is true that

$$\sin(\pi/4) = \frac{1}{\sqrt{2}} \quad \text{and} \quad \cos(\pi/4) = \frac{1}{\sqrt{2}}.$$

Use these facts to find the equation for the tangent line to  $y = \tan(x)$  through the point  $(\pi/4, 1)$ .

ANSWER: \_\_\_\_\_

**9. (3 points)** Use the tangent line that you found in Problem 8 to find an approximation to the value of  $\tan(\pi/4 + 0.1)$ . There is no need to simplify your answer.

ANSWER: \_\_\_\_\_

**10. (10 points)** Let

$$f(x) = \frac{e^{\sin x} (5x + 4)^2 \cos(x)}{\arcsin(x) \ln x}$$

Find the derivative of  $f(x)$ . **Hint:** Logarithmic differentiation could help here (but you are not required to use it). Please don't attempt to simplify your answer— in particular, if  $f(x)$  appears in your answer, you are welcome to simply write “ $f(x)$ ”, rather than copying out the definition above.

**11. (0 points) Bonus question (hard, 5 pts):** Find the derivative of

$$f(x) = \log_x \cos x.$$

There is no need to simplify your answer.