MATH 2200/2300H

Midterm Exam II
October 25, 2004

NAME (please print legibly): ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Your University ID Number: ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Please complete all 10 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	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
TOTAL	100	

1. (10 points) Given the information

x	2	6	8	10	12
$f(x)$	10	6	12	2	8
$g(x)$	8	6	10	12	2
$f'(x)$	2	4	3	1	7
$g'(x)$	5	2	4	6	3

compute the derivatives given below. You might need to use the product, quotient or chain rule.

1. $h(x) = f(g(x))$. Find $h'(2)$.

2. $i(x) = g(g(x))$. Find $i'(2)$.

3. $j(x) = h(x)/i(x)$. Find $j'(2)$.

2. (10 points) Please compute the derivative of $f(x) = \sqrt{2x + x \sin x}$.

ANSWER: _____

3. (10 points) Compute the derivatives of

$$f(x) = e^x + e^{-x} \quad \text{and} \quad g(x) = e^x - e^{-x}.$$

BONUS (2pt): Use your answers to find the eighth derivative of $f(x)$.

ANSWER: _____

4. (10 points) Find the maximum and minimum values of the function

$$f(x) = x^3 - 3x^2 - 24x + 10.$$

on the closed interval $[-3, 0]$.

ANSWER: _____

5. (10 points) Compute the derivative of

$$f(x) = 5^x + \ln 2x + \tan x. \tag{1}$$

ANSWER: _____

6. (10 points) Find the derivative of

$$f(x) = \cos(\sin x). \tag{2}$$

ANSWER: _____

5

7. (10 points) Given the equation $\cos(xy) + y^5 = 3x$, find an expression for dy/dx in terms of x and y by implicit differentiation.

ANSWER: _____

8. (10 points) Using implicit differentiation, find the equation of the tangent line to the curve $x = \ln(xy) + 1$ at the point $(1, 1)$. Please express your answer in point-slope form, and do not be concerned if the answer seems somewhat unusual.

ANSWER: _____

9. (10 points) A certain cylinder is growing in radius at 2 cm/sec and height at 3 cm/sec. At what rate is the volume of the cylinder growing when its radius is 10 cm and its height is 4 cm? Please express your answer in terms of π.

ANSWER: _____

10. (10 points) The Earth is moving along an elliptical orbit described by the equation

$$\frac{x^2}{9} + \frac{y^2}{16} = 2.$$

At $t = 0$, an alien spaceship is floating at the point $(0,0)$, while the Earth is at $(3,4)$. The x-coordinate of the Earth is increasing at 2 miles/sec at this time.

What is the rate of change of the distance between the spaceship and the Earth at this time? Use related rates.

ANSWER: _____