

NAME (*please print*): _____

Honor Code Reaffirmation: _____

“I have adhered to the UGA Honor Code in completing this assignment.”

SIGNATURE: _____

Please write your answers clearly to all problems, showing all work carefully explaining your answers. You are not allowed to use any notes, review sheets or calculators during the exam. You have exactly 75 minutes to complete the exam. Good Luck!

Problem Number	Possible Points	Points Earned:
1	20	
2	20	
3	20	
4	20	
5	20	
Total:	100	

(20) 1. Please differentiate each of the following functions (with respect to x), being sure to show all work:

a) $x^2 + 3 \cos(x)$

b) $e^{2x} \cot(5x)$

c) $\frac{\pi}{\sqrt[3]{2x^5+9}}$

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

- (20) 2. Please find the equation of the tangent line to the graph $(x + y)^3 = x^3 + y^3$ at the point $P = (-1, 1)$, being sure to show all work.

- (20) 3. A conical water tower (with point pointing down) has a top radius of 20 meters and height of 30 meters. From the time it is completely filled, the water starts to run out of the bottom at the rate of 1 cubic meter per day. How quickly is the water level falling when the water level is at 10 meters from the bottom of the tank?

(Please draw a reasonable picture labelling all important quantities with either variables or constants, and be sure to show all necessary work to justify your conclusion!)

- (20) 4. Suppose the function $f(x) = e^x \sin(x)$ is defined on the closed interval $[0, \pi]$. In the following problem you will be asked to find the absolute extrema of $f(x)$.

(Please be sure to carefully justify all reasoning, and show all work!)

(a) What are the critical numbers for $f(x)$?

(b) What are the absolute extrema of $f(x)$?

(20) 5. a) Please precisely state the theorem from class that ensures that a function has a global maximum and minimum.

b) Please give an example of a function that does not have a global maximum, and carefully explain why your example does not satisfy the conditions of this theorem.