## Final Exam

Calculus I; Fall 2009

## Part I

Part I consists of 10 questions, each worth 5 points. Clearly show your work for each of the problems listed.

In 1-4, find 
$$y'$$
 if:

$$(1) \ y = x^2 \sin(x)$$

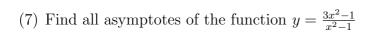
(2) 
$$y = \frac{\ln(x)}{2x+1}$$

(3) 
$$y = (\tan(x))^{30}$$

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

(5) Find the critical points of 
$$y = f(x) = x(x+1)^3$$

(6) Find all local/absolute maxima/minima of the function  $y = 2x^4 - x$ . Make sure to state both x and y values. (Do **not** simplify these numbers!)



(8) Find all x-values where  $y = x \ln(x)$  is **increasing** 

(9) Find the most general form for the  ${\bf anti-}$  derivative of y=x(3x+2)

(10) Use calculus to find two positive numbers whose product is 4 and whose sum is minimal

## Part II

Part II consists of 6 problems; the number of points for each part are indicated by [x pts]. You must show the relevant steps (as we did in class) and justify your answer to earn credit. Simplify your answer when possible.

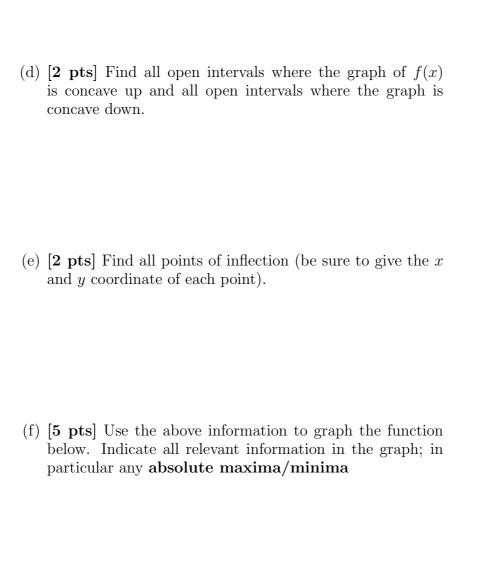
(1) [10 pts] Use implicit differentiation to find the derivative if  $y^5 = x^2y - x^3$ 

(2) **[6 pts]** Find the linearization of the function  $y = f(x) = \sqrt[4]{x}$  at x = 16.

(a) [2 pts] Find the x and y intercepts of the function.

(b) [2 pts] Find the open intervals where f(x) is increasing and the open intervals where f(x) is decreasing,

(c) [2 pts] Find the local maximum and local minimum values of f(x). (Be sure to give the x and y coordinate of each of them).



(5) [5 pts] If  $y = \frac{(x-1)^2}{(x+1)^3}$  find the absolute maximum and minimum of f(x) on the interval [0, 5]. (Include the appropriate y values but do not simplify.)

(6) [10 pts] An advertising executive wants to design a can (= cylinder) which is most visible. He decides that this means that the can must have maximal surface area. The can must have a volume of  $100 \text{ cm}^3$ . Using calculus you must either state the dimensions the can with maximal surface area or show such a can does not exist. [Given a can of radius r and height h its volume  $V = \pi r^2 h$  and its surface area  $S = 2\pi r h + 2\pi r^2$ .]