

MATH 112  
Exam II  
May 19, 2009

Name \_\_\_\_\_

Student ID # \_\_\_\_\_

Section \_\_\_\_\_

HONOR STATEMENT

“I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam.”

SIGNATURE: \_\_\_\_\_

1	16	
2	15	
3	19	
Total	50	

- Please check that your exam contains 3 problems.
- Please turn your cell phone OFF and put it away for the duration of the exam.
- Unless otherwise indicated, you must show your work. Clearly label lines and points that you are using and show all calculations. The correct answer with no supporting work may result in no credit.
- You are expected to use the methods of this course to answer all questions on this exam. If you use a guess-and-check method or read a value from a graph on your calculator when an algebraic method is available, you may not receive full credit.

GOOD LUCK!

1. (16 points) Compute the indicated derivative. DO NOT SIMPLIFY.

(a)  $f(t) = t^5(2t + 1)^3$

$$f'(t) =$$

(b)  $v = \frac{\ln(u^2 - 4u)}{e^{(3u^2+u)}}$

$$\frac{dv}{du} =$$

(c)  $h(m, p) = 9e^{(mp+m^2p^2)}$

$$h_m(m, p) =$$

(d)  $w = x^3y^2 - \ln(xy) + \frac{1}{(y^2 + 1)^5}$

$$\frac{\partial w}{\partial y} =$$

2. (15 points) Betty produces two flavors of lip balm: Original and Strawberry. She must rent space by the hour in a lab to make her balm. She finds that each tin of Original flavor takes 2 hours and each tin of Strawberry takes 3 hours to produce. She can afford to rent the lab for at most 45 hours. She knows from previous experience that she will sell a total (both flavors combined) of at most 21 tins of lip balm. Each tin of the Original earns \$2.50 in profit, while each tin of the Strawberry earns \$3.00 in profit.

Let  $x$  be the number of tins of the Original flavor and  $y$  be the number of tins of the Strawberry Betty sells. Find the values of  $x$  and  $y$  that maximize profit subject to the given constraints.

Use the method of linear programming and show all your work.

ANSWER:  $x =$  \_\_\_\_\_,  $y =$  \_\_\_\_\_

3. (19 points) Let  $f(x)$  be the function

$$f(x) = 5x^4 - 21x^3 + 24x^2 + 9x.$$

Define two new functions:

$$D(x) = \frac{f(x)}{x} = \text{the slope of a diagonal to } f(x)$$

and

$$T(x) = \text{the slope of a tangent to } f(x).$$

(a) Write out formulas for:

- $D(x) =$  \_\_\_\_\_
- $D'(x) =$  \_\_\_\_\_
- $D''(x) =$  \_\_\_\_\_
- $T(x) =$  \_\_\_\_\_
- $T'(x) =$  \_\_\_\_\_
- $T''(x) =$  \_\_\_\_\_

(b) Find all values of  $x$  at which the function  $D(x)$  has a horizontal tangent line.

ANSWER:  $x =$  \_\_\_\_\_ (list all)

(c) Apply the Second Derivative Test to the values you found in part (b) and state whether each critical number gives a local maximum or local minimum of  $D(x)$ .

(d) Find the largest and smallest values of  $T''(x)$  on the interval from  $x = 2$  to  $x = 5$ .

ANSWER: largest = \_\_\_\_\_, smallest = \_\_\_\_\_