MATH 112
Exam I
April 24, 2008

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	16	
3	8	
4	10	
Total	50	

- Please check that your exam contains 4 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.
- If you use a guess-and-check method when an algebraic method is available, you may not receive full credit.
- Put your name on your sheet of notes and turn it in with the exam.

GOOD LUCK!

1. (16 points) The Total Revenue and Total Cost (both in **thousands of dollars**) for selling q **thousand Items** are given by the functions:

$$TR(q) = -25q^2 + 1250q \qquad TC(q) = q^3 - 60q^2 + 601q + 10.$$

(a) Use the derivative rules to write out the formulas for Marginal Revenue and Marginal Cost.

$MR(q) =$_____

$MC(q) =$_____

(b) Determine the quantity that maximizes profit.

ANSWER: $q =$_____thousand Items

(c) Give the longest possible interval of quantities for which MR is at least \$100 but no more than \$250.

ANSWER: from $q =$_____to $q =$_____thousand Items

(d) For what quantity is Total Revenue greatest?

ANSWER: $q =$_____thousand Items

(e) Give the longest interval on which Marginal Cost is decreasing.

ANSWER: from $q =$_____to $q =$_____thousand Items

2. (16 points) Suppose the distance vs. time function for a car is given by

$$D(t) = -3t^2 + 150t.$$

(Distance is measured in feet, time in seconds.)

(a) Write out the formula for the **average speed** of the car from time $t = 5$ to time $t = 5+h$. Simplify your answer as much as possible.

ANSWER: _____

(b) Use the derivative rules to find a formula for the car's **instantaneous speed** at time t.

ANSWER: _____

(c) The car's **average trip speed** at time t is $\frac{D(t)}{t}$. Compute the car's average trip speed at the instant its instantaneous speed is 87 feet per second.

ANSWER: _____feet per second

(This problem continues on the next page.)

There is a second car whose distance vs. time is given by the function $E(t)$. We don't have a formula for $E(t)$, but we know that

$$E(m+h) - E(m) = \frac{10h}{(m+h+1)(m+1)}.$$

(d) Find an interval, starting at $t = 1$, over which the second car travels exactly 4 feet.

ANSWER: from $t = 1$ to $t =$_____

(e) Find the formula for $E'(m)$.

ANSWER: $E'(m) =$_____

3. (8 points) Use the derivative rules to compute the derivative of each of the following functions.

   (a) $y = \dfrac{5}{\sqrt[3]{x}} - \sqrt{x}$

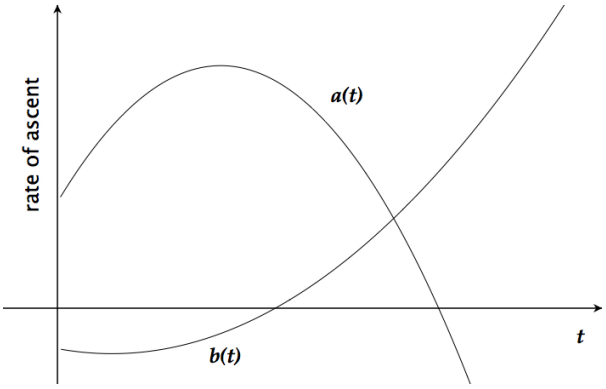
   (b) $s = t^4\left(3 - \dfrac{1}{2t} + \dfrac{7}{4t^4}\right)$

4. (10 points)

Two balloons, A and B, are rising and falling. The graphs at right show the **rate of ascent** of the two balloons. The **rate of ascent** functions are:

$$a(t) = -t^2 + 6t + 7$$

$$b(t) = \frac{1}{3}(t^2 - 2t - 8).$$



(a) When is balloon A rising the fastest?

ANSWER: $t =$_____

(b) When is balloon A at its highest altitude?

ANSWER: $t =$_____

(c) When is balloon B at a higher altitude: at $t = 3$ or $t = 4$? Explain.
ANSWER: (circle one) $t = 3$ $t = 4$
EXPLANATION: