MATH 112
Exam II
Spring 2015

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 | 12 | |
|---|----|---|
| 2 | 10 | |
| 3 | 12 | |
| 4 | 16 | |
| Total | 50 | |

- Check that your exam contains 4 problems.

- You are allowed to use a scientific (non-graphing) calculator, a ruler, and one sheet of hand-written notes. All other sources are forbidden.

- Do not use scratch paper. If you need more room, use the back of the page and indicate to the grader you have done so.

- Turn your cell phone OFF and put it away for the duration of the exam.

- You may not listen to headphones or earbuds during the exam.

- 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.

- When rounding is necessary, you may round your final answer to two digits after the decimal.

- There are multiple versions of the exam, you have signed an honor statement, and cheating is a hassle for everyone involved. DO NOT CHEAT.

- Put your name on your sheet of notes and turn it in with the exam.

GOOD LUCK!

1. (12 points)

   (a) Compute $\dfrac{dy}{dx}$. DO NOT SIMPLIFY.

   $$y = \frac{\ln(4x)}{5x^2} + e^{x(3x+1)^4}$$

   $$\frac{dy}{dx} =$$

   (b) Evaluate the integral.

   i. $\displaystyle \int \left( \frac{e^{6x}}{6} + \frac{3x^4 + 10}{x^5} \right) dx$

   ii. $\displaystyle \int_1^5 \left( \frac{12}{t^2} + 2t \right) dt$

2. (10 points) Mick sells Items and knows that the total cost (in dollars) for selling $q$ Items is given by

$$TC(q) = 874.8 + 0.3q^2.$$

Recall that **average cost** is given by $AC(q) = \frac{TC(q)}{q}$.

(a) Find the critical value of $AC(q)$.

ANSWER: $q =$ _____ Items

(b) Use the Second Derivative Test to determine whether the critical value you found in part (a) gives a local maximum or a local minimum of average cost.

ANSWER: (circle one)    local maximum    local minimum    cannot determine

(c) Mick knows that, when $q$ Items are sold, marginal revenue is

$$MR(q) = 8e^{0.04q} \text{ dollars per Item.}$$

Find the total revenue if 30 Items are sold.

ANSWER: $_____

3. (12 points) Bianca sells Things and knows that, when $q$ **hundred** Things are produced and sold, marginal revenue and marginal cost (both in dollars per Thing) are given by:

$$MR(q) = 25 - 4q \text{ and } MC(q) = 2 + 6q.$$

In addition, when Bianca sells 3 hundred Things, her profit is 18 hundred dollars.

(a) Find the formulas for Bianca's total revenue and variable cost at $q$ hundred Things.
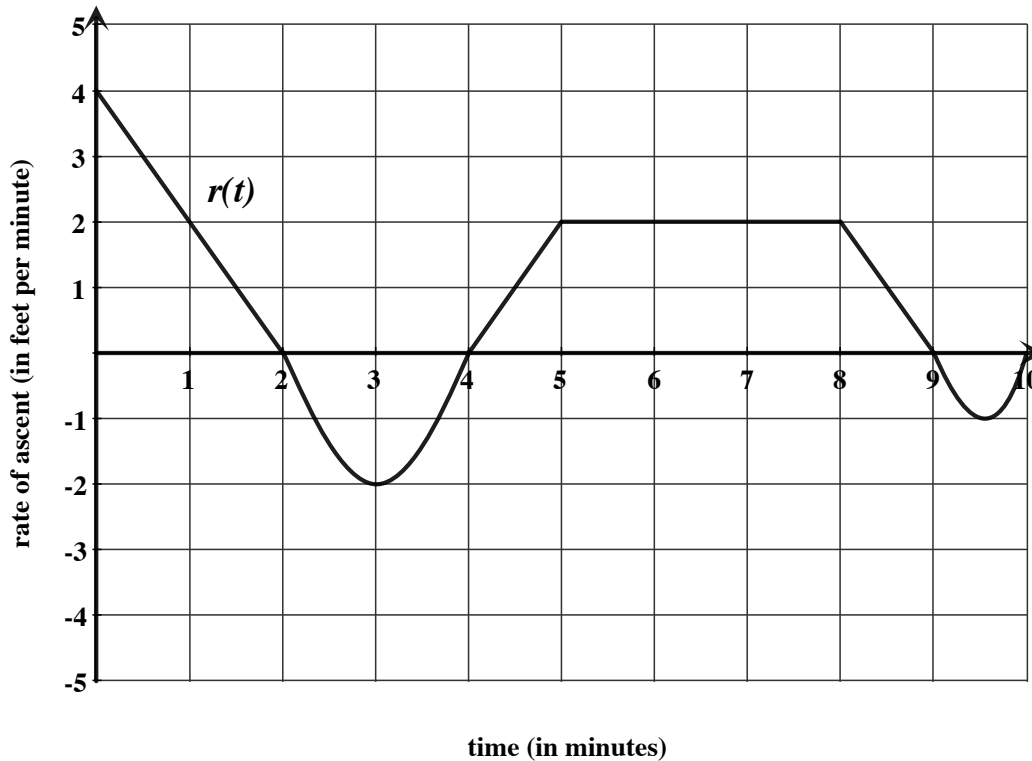
ANSWER: $TR(q) =$_____

$VC(q) =$_____

(b) Find Bianca's fixed cost.

ANSWER: _____hundred dollars

(c) Find the maximum possible profit for selling Things.

ANSWER: _____hundred dollars

4. (16 points) The altitude, in feet, of a hot-air balloon at time $t$ minutes is given by a function $A(t)$. The graph below shows the balloon's **rate of ascent** at time $t$. The rate of ascent is given by the function $r(t)$.



**time (in minutes)**

FOR THIS PROBLEM, YOU ARE NOT REQUIRED TO SHOW ANY WORK. JUST GIVE ANSWERS.

(a) Give the times in the first 5 minutes at which the graph of $r(t)$ has horizontal tangents.

ANSWER: (list all) $t =$_____minutes

(b) Give the times in the first 5 minutes at which the graph of $A(t)$ has horizontal tangents.

ANSWER: (list all) $t =$_____minutes

(c) Give the time in the first 5 minutes when the balloon is at its **highest altitude**.

ANSWER: $t =$_____minutes

(d) Give the time in the first 5 minutes when the balloon is **rising the fastest**.

ANSWER: $t =$_____minutes

(e) Give two intervals during which the balloon is **falling and getting slower**.

ANSWER: from $t =$_____to $t =$_____

from $t =$_____to $t =$_____

(f) Is the graph of $A(t)$ concave up or concave down at $t = 2.5$?

ANSWER: (circle one)    concave up    concave down    cannot determine

(g) Compute $A(9) - A(4)$.

ANSWER: _____