

MATH 112
Exam 1
February 3, 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: _____

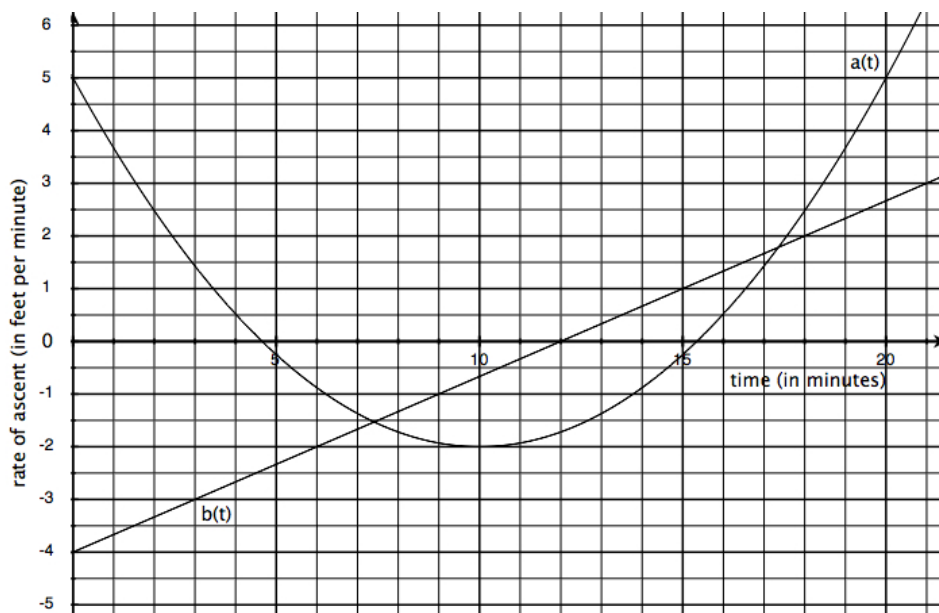
1	6	
2	14	
3	14	
4	16	
Total	50	

- 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 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. (6 points) Find $f'(x)$ if $f(x) = \frac{\sqrt{x} - 4x + 5x^2}{x^3}$.

2. (14 points) Below are the graphs of the rate of ascent of two balloons. Let $a(t)$ denote the rate of ascent of Balloon A and $b(t)$ denote the rate of ascent of Balloon B.



- (a) At $t = 0$ Balloon A and Balloon B are both 100 feet above the ground. Find the time in the first 10 minutes at which Balloon A is above Balloon B by the largest distance.

ANSWER: _____ minutes

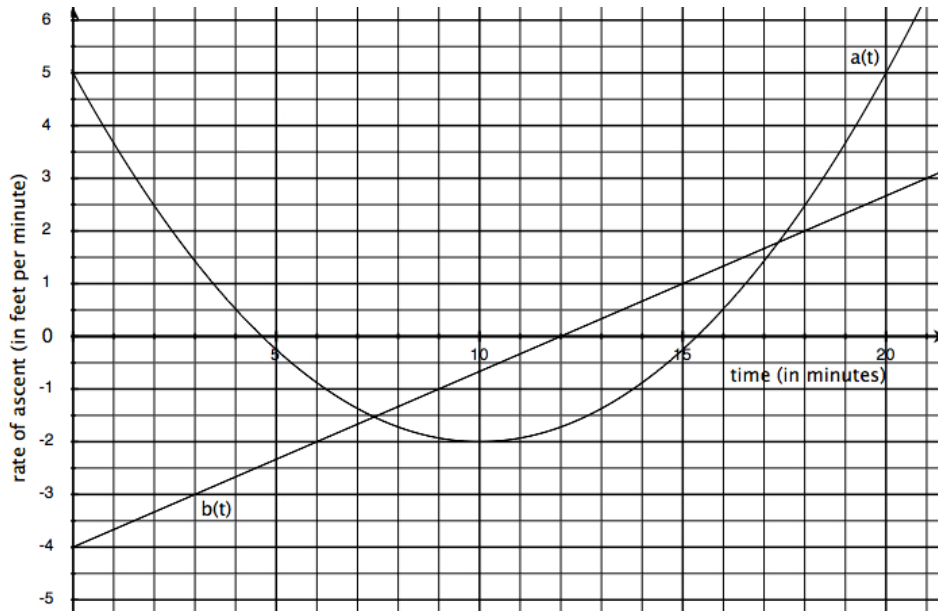
- (b) How fast and in which direction (up or down) is Balloon A moving when Balloon B is at its lowest altitude?

ANSWER: _____ feet per minute;

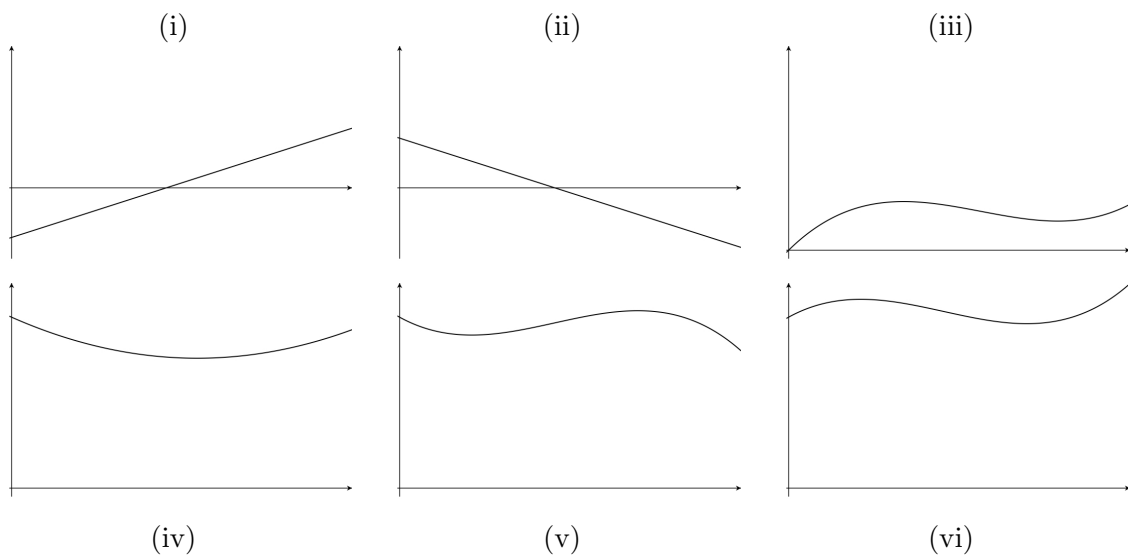
DIRECTION: (circle one) up down

(THIS PROBLEM CONTINUES ON THE NEXT PAGE.)

Here are the rate of ascent graphs again.



(c) At $t = 0$ Balloon A and Balloon B are both 100 feet above the ground. Let $A(t)$ represent Balloon A 's altitude at time t and $B(t)$ represent Balloon B 's altitude at time t . Consider the following graphs.



Which graph could be:

- the graph of $A(t)$? ANSWER: _____
- the graph of $B(t)$? ANSWER: _____
- the graph of $A(t) - B(t)$? ANSWER: _____
- the **derived graph** of Balloon A 's **rate of ascent graph**? ANSWER: _____

3. (14 points) Suppose you are not given the formula for a function $M(x)$, but you are told instead that

$$\frac{M(a+h) - M(a)}{h} = \frac{-15}{(2+5a+5h)(2+5a)}.$$

- (a) Compute the slope of the secant line through $M(x)$ at $x = 1$ and $x = 1.02$.

ANSWER: _____

- (b) Write out a formula, in terms of r , for $M(r + 0.04) - M(r)$.

ANSWER: _____

- (c) Write out the formula for $M'(a)$.

ANSWER: _____

- (d) Find a value of a that satisfies the following: The tangent line to $M(x)$ at $x = a$ is parallel to the line $y = -0.15x + 40$.

ANSWER: $a =$ _____

4. (16 points) You sell Items. The formulas for total revenue and total cost are:

$$TR(q) = -4q^2 + 70q \quad TC(q) = q^3 - 12.9q^2 + 55.72q + 7,$$

where q is measured in **thousands of Items** and TR and TC are measured in **thousands of dollars**.

- (a) Use the derivative rules to find formulas for marginal revenue and marginal cost.

ANSWER: $MR(q) =$ _____

$MC(q) =$ _____

- (b) What is the smallest value of marginal cost? Include units with your answer.

ANSWER: _____; UNITS: _____

- (c) At what value of q does the graph of total revenue have a horizontal tangent?

ANSWER: $q =$ _____ thousand Items

- (d) Find the longest interval of quantities, starting at $q = 0$, over which profit is increasing.

ANSWER: from $q = 0$ to $q =$ _____ thousand Items