

MATH 112  
Exam I - Version 1  
April 22, 2004

Name \_\_\_\_\_

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

Section \_\_\_\_\_

1	16	
2	16	
3	18	
Total	50	

- You are allowed to use a calculator, a ruler, and one sheet of handwritten notes.
- Please check that your exam contains three problems on three pages.
- Please turn your cell phone OFF and put it away for the duration of the exam.
- Unless otherwise indicated, you must show your work. The correct answer with no supporting work may result in no credit.
- Write your answers in the specified locations.
- If you need more room, use the backs of the pages and indicate to the reader that you have done so. If you still need more paper, please ask for some.
- When rounding is necessary, round your **final answer** to two digits after the decimal.
- Raise your hand if you have a question.
- Put your name on your sheet of notes and turn it in with the exam.
- You have 50 minutes to complete the exam.

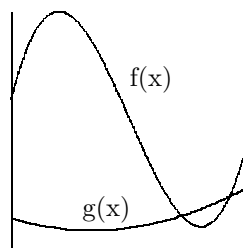
GOOD LUCK!

1. (16 points)

The graphs of  $f(x)$  and  $g(x)$  are given at right.  
Their formulas are

$$f(x) = 2x^3 - 30x^2 + 96x + 150 \text{ and}$$

$$g(x) = x^2 - 6.8x + 30.$$



(a) Use the derivative rules to compute  $f'(x)$  and  $g'(x)$ .

$$\text{ANSWER: } f'(x) = \underline{\hspace{10cm}}$$

$$g'(x) = \underline{\hspace{10cm}}$$

(b) Compute and simplify  $\frac{g(a+h) - g(a)}{h}$ .

$$\text{ANSWER: } \frac{g(a+h) - g(a)}{h} = \underline{\hspace{10cm}}$$

(c) Give the longest interval of values of  $x$  over which  $g(x)$  is increasing and  $f(x)$  is decreasing. (As always, show all work.)

$$\text{ANSWER: from } x = \underline{\hspace{10cm}} \text{ to } x = \underline{\hspace{10cm}}$$

(d) For what value of  $x$  is  $f'(x)$  smallest?

$$\text{ANSWER: } x = \underline{\hspace{10cm}}$$

2. (16 points) You sell *Items*. Your profit for selling  $q$  thousand Items is given by a function  $P(q)$ , measured in thousands of dollars. We do not have the formula for profit, but we do know a formula for the *change in profit* that comes from increasing quantity from  $q_1$  to  $q_2$  thousand Items:

$$P(q_2) - P(q_1) = \frac{3}{32}(q_2 - q_1)(16 - q_2 - q_1).$$

- (a) Find the increase in profit that comes from changing quantity from 2 thousand Items to 4 thousand Items.

ANSWER: \_\_\_\_\_ thousand dollars

- (b) Compute the value of  $\frac{P(8) - P(3)}{5}$ .

ANSWER:  $\frac{P(8) - P(3)}{5} =$  \_\_\_\_\_

- (c) Write out a formula for  $\frac{P(q+h) - P(q)}{h}$ .

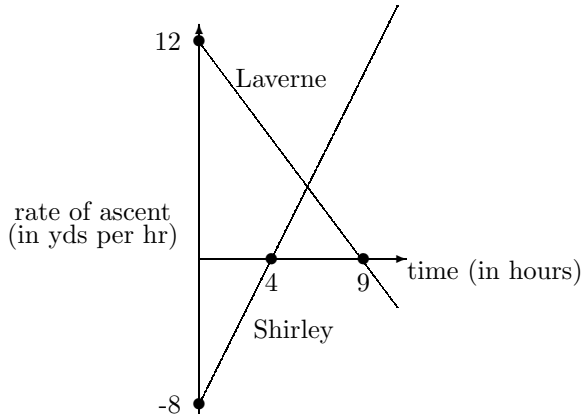
ANSWER:  $\frac{P(q+h) - P(q)}{h} =$  \_\_\_\_\_

- (d) For what quantity is  $P'(q) = 1.2$ ?

ANSWER:  $q =$  \_\_\_\_\_

3. (18 points)

Laverne and Shirley are each in a hot-air balloon. At  $t = 0$ , the balloons are both 125 yards above the ground. The graphs at right give the balloons' *rate of ascent* at time  $t$ .



(a) Use the graphs to answer the following questions.

i. Is the distance between the balloons greater at  $t = 3$  or at  $t = 4$ ?

ANSWER: (circle one)  $t = 3$   $t = 4$

ii. Give a four-hour interval during which both balloons are rising.

ANSWER: from  $t =$  \_\_\_\_\_ to  $t =$  \_\_\_\_\_

iii. At what time is Laverne's balloon at its maximum height?

ANSWER:  $t =$  \_\_\_\_\_

(b) Use the points labeled on the graph to find linear formulas for each balloon's rate of ascent.

ANSWER: Laverne: \_\_\_\_\_

Shirley: \_\_\_\_\_

(c) At what time in the first seven hours is the distance between the balloons the greatest?

ANSWER:  $t =$  \_\_\_\_\_ hours

(d) Suppose Shirley's altitude at time  $t$  is given by the function  $S(t)$ . What is the value of  $S'(10)$ ?

ANSWER:  $S'(10) =$  \_\_\_\_\_