MATH 111D
Final Exam
December 19, 2001

Name _____

Student ID #_____

Section _____

1	20	
2	15	
3	15	
4	20	
5	15	
6	15	
Total	100	

- You are allowed to use a calculator, a ruler, and one sheet of handwritten notes.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit.
- If you use a trial and error method when an algebraic method is available, you will not receive full 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.
- Raise your hand if you have a question.
- You have 1 hour and 50 minutes to complete the exam.

GOOD LUCK!

1. (20 points) You have some cash to deposit in a bank account paying 8.5% interest, compounded continuously.

   (a) What's the Annual Percentage Yield for this account?

   ANSWER: _____% (Round to 2 decimal places.)

   (b) How much would you have to deposit in order to have a $1300 balance in 18 months?

   ANSWER: $_____ (Round to the nearest cent.)

   (c) If you deposit $1200 initially, how long would it take to have a balance of $1500?

   ANSWER: _____ years (Round to 2 decimal places.)

2. (15 points)

(a) A collector purchased a Bee Gees lunchbox for \$2 at a J-Mart going-out-of-business sale in 1986. In 2001, the collector sold the lunchbox on e-bay for \$63. What is the annual rate of return on this investment?

ANSWER: _____% (Round to 2 decimal places.)

(b) Suppose you currently pay \$$R$ in rent each year. (That is, R=(monthly rent payment)$\times$12.) Your landlord tells you that he intends to raise rent once a year by 5.12% for the next several years. How many years will it take until you triple your current rent payment?

ANSWER: _____ years (Round to the nearest year.)

(c) You deposit \$700 in an account paying 7% interest, compounded 7 times per year. After 7 years, you take the balance and deposit it in an account paying 4% interest, compounded monthly, for three more years. What is your balance after a **total** of 10 years?

ANSWER: \$ _____ (Round to the nearest cent.)

3. (15 points) Suppose $A_1,\ A_2,\ A_3, ...$ is an multiplicative sequence with multiplier 3.

(a) Write an equation that shows the relationship between A_{10} and A_8.

ANSWER: _____

(b) If $A_1 = 12$, find an explicit formula for A_k.

ANSWER: $A_k =$_____

(c) Recall that $\log_b(x \cdot y) = \log_b x + \log_b y$. Let B_k be a sequence such that

$$B_1 = log_{10}(A_1),\ B_2 = \log_{10}(A_2),\ B_3 = \log_1 0(A_3), ...$$

Determine whether B_k is an additive or a multiplicative sequence. If it's additive, find its increment. If it's multiplicative, find its multiplier.

ANSWER: B_k is (circle one): additive multiplicative

Its (circle one) increment multiplier is _____.

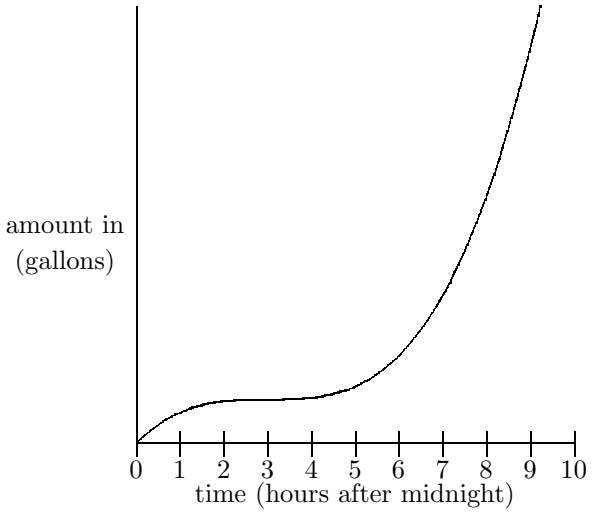
4. (20 points) The amount of water that has flowed into a tank t hours after midnight is given by the formula

$$I(t) = \frac{1}{27}t^3 - \frac{1}{9}t^2 + \frac{1}{3}t.$$

(a) Find a time t at which the overall average rate of in-flow, $I(t)/t$, is $\frac{7}{3}$ gallons per hour.

ANSWER: t=_____ hours

(b) On the graph below, draw a line whose slope is equal to the incremental rate of in-flow from 1:00 a.m. to 6:30 a.m. and use the formula for $I(t)$ to compute this rate of in-flow.



ANSWER: _____ gallons/hour (Round to 2 decimal places.)

(c) Water flows out of the tank at a constant rate of 2.5 gallons per hour. That means that $O(t)$, the amount of water that has flowed out of the tank t hours after midnight, is given by

$$O(t) = 2.5t.$$

Recall that the amount that has flowed in after t hours is

$$I(t) = \frac{1}{27}t^3 - \frac{1}{9}t^2 + \frac{1}{3}t.$$

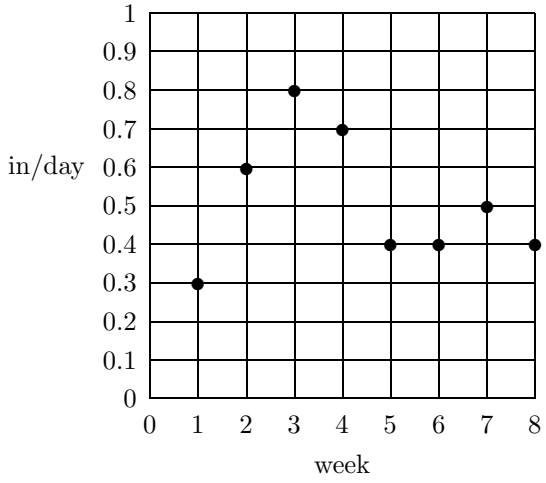
If there are 15 gallons in the tank at midnight, how many gallons are in the tank at 4 a.m.?

ANSWER: _____ gallons (Round to 2 decimal places.)

(d) Set up an equation that would allow you to find a time when the amount that has flowed in is 3 gallons more than the amount that has flowed out. **(Do not try to solve this equation.)**

ANSWER: _____

5. (15 points) Rae gets a baby dragon, name of Iggy, for her birthday. Every Sunday, Rae measures Iggy from tongue to tail and records Iggy's length. The graph shows the *incremental rate of change* of Iggy's length in inches per day over the seven-day period. For example, the height of the dot at $t = 1$ is obtained by taking the **total change** in Iggy's length over week 1 and dividing by 7 days.



(a) How many inches does Iggy grow the first week?

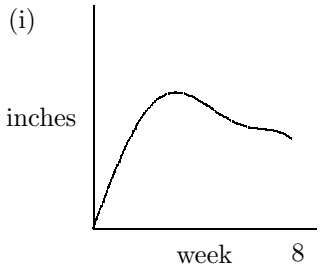
ANSWER: _____ inches

(b) Let $L(t)$ be Iggy's length in inches after t weeks. What is $L(7) - L(4)$? Clearly show all your steps.

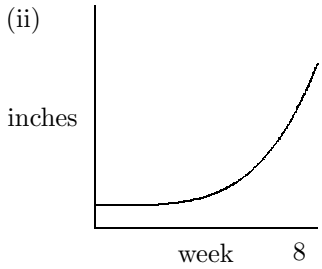
ANSWER: $L(7) - L(4) =$ _____

(c) Which of the following could be the graph of $L(t)$? Justify your answer.

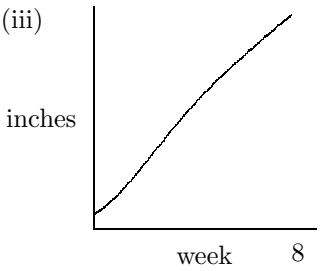
(i)



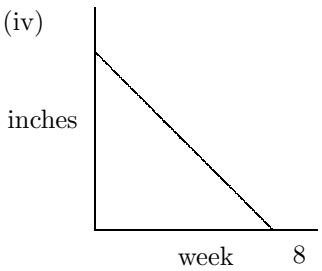
(ii)



(iii)



(iv)



ANSWER: I choose _____ because

_____

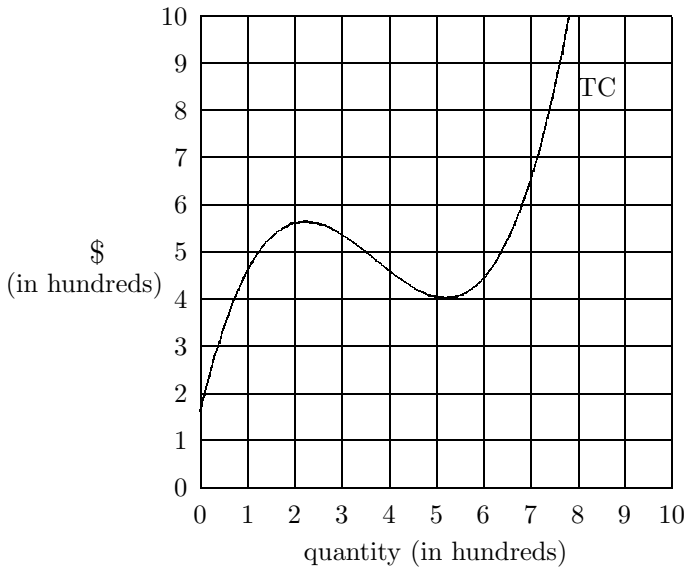
_____

_____

_____

_____

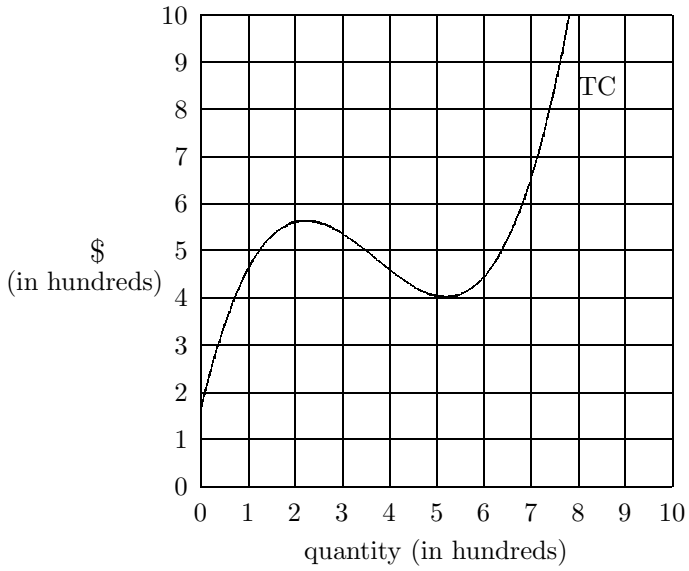
6. (15 points) You own a company that produces and sells hubcap shams. The following is a graph of Total Cost vs. quantity.



(a) Use the graph to find the break even point. Show all your steps above.

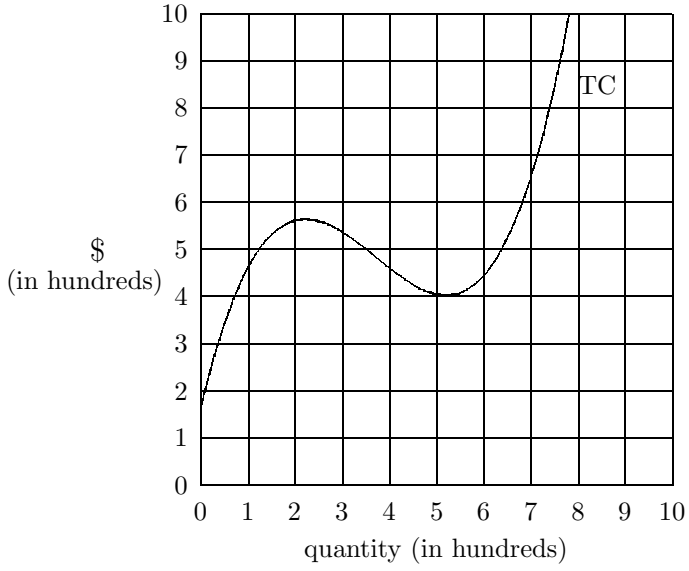
ANSWER: $_____. (Round to the nearest cent.)

(b) Suppose the shams sell for \$1 each. On the axes below, sketch the Total Revenue function and use your graph to estimate the maximum profit.



ANSWER: \$_____.

(c) Suppose you change the price per item to \$$p$. What would p have to be in order to make total revenue equal to total cost at a quantity of 300 shams? Clearly show all your steps.



ANSWER: p =\$_____. (Round to the nearest cent.)