

MATH 111A
Final Exam
December 17, 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)

- (a) A business purchased for \$460,000 in 1992 was sold for \$980,000 in 2001. What is the annual rate of return for this investment?

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

- (b) Suppose the legislature approves a 5.9% tuition increase for next year and wants to increase tuition by $(r \cdot 100)\%$ per year for the following four years. What value of r will make the **total increase** 35% over five years?

ANSWER: $r =$ _____ . (Round to 2 decimal places).

- (c) Developers expect the new Segway Human Transporter to be available to consumers for \$3000 in late 2002. Assuming “late 2002” means 10 months from now, how much would you have to deposit in an account bearing 2.25% interest, compounded monthly, to afford a Segway when they become available?

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

- (d) John loans money to two friends. Both friends agree to pay 12% interest per year, compounded continuously. One friend will pay back the loan in 6 months, by giving John \$70. The other will pay back the loan in 1 year, by giving John \$100. What is the total amount of money that John loans his friends?

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

2. (15 points) You are considering putting money into one of two accounts.

Account I: 6.015% interest, compounded quarterly

Account II: 6% interest, compounded continuously

- (a) If you deposit \$10,000 in Account I, how long will it take before your balance is \$17,500?

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

- (b) Compute the Annual Percentage Yield (APY), rounded to 2 decimal places, for each account to determine which account to use.

ANSWER: APY for Account I: _____ %

APY for Account II: _____ %

Which account do you choose? (circle one) Account I Account II

- (c) Suppose Account II is not available to you now, but will be available to you in 2 years. You deposit \$10,000 in Account I for 2 years and then deposit the resulting balance in Account II. How long will it take before your balance is \$17,500?

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

3. (15 points) Suppose A_1, A_2, A_3, \dots is an additive sequence with increment 3.

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

ANSWER: _____

(b) If $A_1 = 57$, find an explicit formula for A_k .

ANSWER: $A_k =$ _____

(c) Recall that $b^x \cdot b^y = b^{x+y}$. Let B_k be a sequence such that

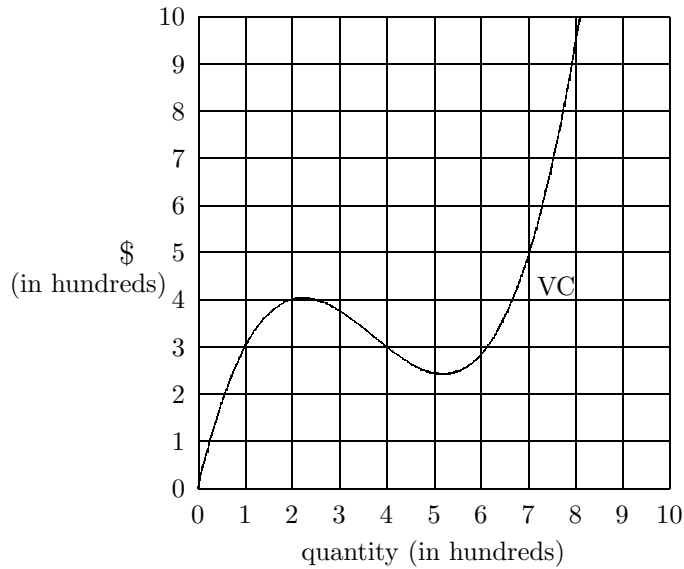
$$B_1 = 7^{A_1}, B_2 = 7^{A_2}, B_3 = 7^{A_3}, \dots$$

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 graph shows Variable Cost to produce q hubcap shams.



(a) Carefully approximate the shut down point. Show all your steps.

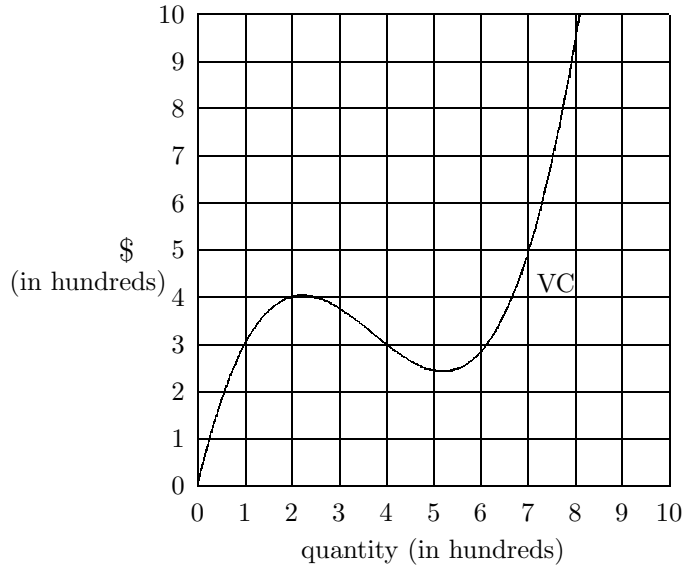
ANSWER: The shut down point is \$_____. (Round to the nearest cent.)

(b) At what quantity is Average Variable Cost equal to Marginal Cost ($AVC=MC$)? Explain your answer.

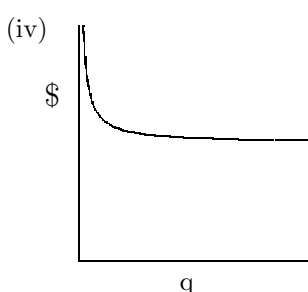
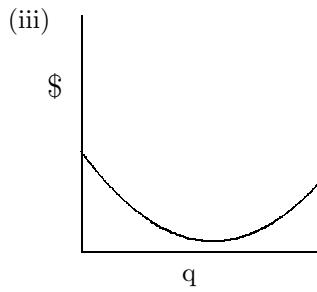
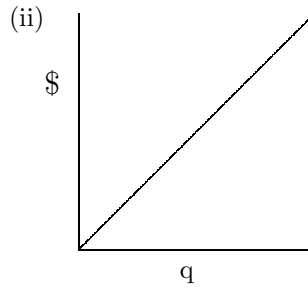
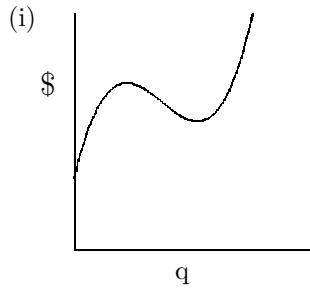
ANSWER: $AVC=MC$ when $q =$ _____ hubcap shams.

EXPLANATION:

(c) Suppose fixed costs are \$300. Sketch a graph of Total Cost on the axes below.

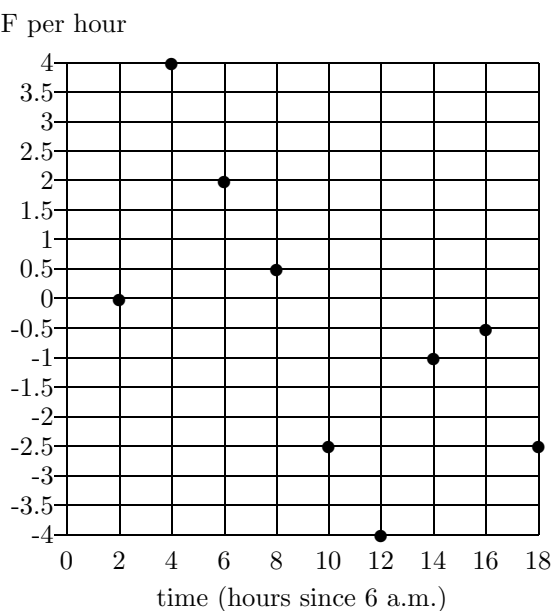


(d) Which of the following could be the graph of Average Variable Cost vs. quantity? Justify your answer.



ANSWER: I choose _____ because:

5. (15 points) One morning, beginning at 6 a.m., I record the temperature every 2 hours until midnight. The graph shows the *incremental rate of change* of the temperature in $^{\circ}\text{F}$ per hour over each two-hour period. For example, the height of the dot at $t = 4$ is obtained by taking the **total change** in temperature from 8 a.m. to 10 a.m. and dividing by 2.



- (a) What is the total change in temperature between 8 a.m. and 10 a.m.?

ANSWER: _____ $^{\circ}\text{F}$

- (b) Let $P(t)$ be the temperature t hours after 6 a.m. Find $P(8) - P(4)$.

ANSWER: $P(8) - P(4) =$ _____.

- (c) At what time did I record the highest temperature? Explain your answer.

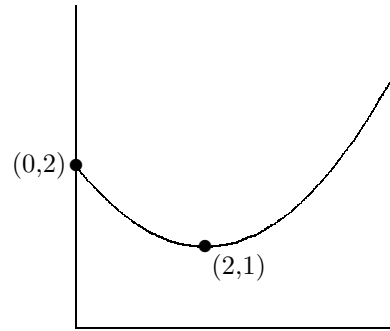
ANSWER: I recorded the highest temperature at _____.

EXPLANATION:

6. (15 points) The parabola to the right has a formula that looks like

$$f(x) = ax^2 - x + c.$$

The vertex is at the point $(2, 1)$.



- (a) Find a and c and write the formula for $f(x)$.

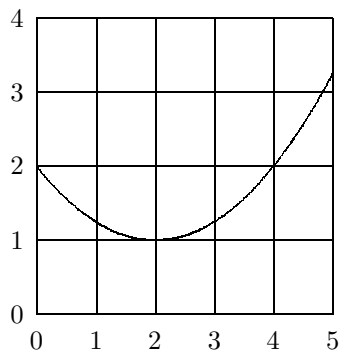
ANSWER: $a = \underline{\hspace{2cm}}$, $c = \underline{\hspace{2cm}}$, $f(x) = (\quad)x^2 - x + (\quad)$

If you are unable to complete part (a), make a guess for the formula for $f(x)$ and use your guess to complete parts (b) and (c).

- (b) On the graph below, draw a line whose slope is equal to

$$\frac{f(2.5) - f(2)}{0.5},$$

and compute this slope using the formula for $f(x)$.



ANSWER: slope = $\underline{\hspace{4cm}}$

- (c) Write out a formula for $f(3 + h)$ and put it in the indicated form.

ANSWER: $f(3 + h) = (\quad)h^2 + (\quad)h + (\quad)$.