Math 111 Final Exam *Name* _____
August 19, 2011

Honor Statement

"I affirm that my work upholds the highest standards of honesty and integrity, and that I have neither given nor received any unauthorized assistance on this exam."

Signature _____

1	13
2	12
3	13
4	12
total	50

- Your test should have 4 problems on 4 pages (not including this one). Make sure that it does!
- If you can't solve part (a) of a problem, but need the answer to solve part (b), then write down *how* you would solve (b) if you did know the answer for (a).
- Cell phones and any electronic items that aren't calculators must be turned off and put away.
- **Important:** Always show your work, unless the problem says not to. Otherwise, you may not receive credit, even if your answer is correct. For graph problems, draw and label all lines you use. If you use your calculator to do the quadratic formula, you must indicate this.
- The good news: all problems can be solved algebraically or graphically.
- The bad news: as a result, you will not receive full credit for guess-and-check.
- You're allowed:
  - one double-sided $8\frac{1}{2}'' \times 11''$ sheet of notes
  - a ruler
  - a calculator
- Raise your hand if you have a question or can't understand a problem.
- If you'd like to pick up your final after grading, check the class website at the beginning of fall quarter.

1. *Note:* Each part of this problem is completely unrelated to the other parts. So, you can do them in any order.

(a) Claire has an investment earning 3% annually, compounded continuously. What is the APY for her investment?

APY = _____

(b) Your savings account earns 2% annually, compounded monthly. What's the present value of $1500 in 20 years?

PV = _____

(c) 10 years ago, Thurgood and Menander invested the same amount of money into two different accounts:

- Thurgood's account earns 2% annually, compounded annually;
- Menander's account earns 1.5% annually, compounded annually.

If Thurgood's account has $20 now, how much does Menander have?

Menander's balance:_____

2. You've been keeping a tab on the temperature inside and outside your room.

Let $I(t)$ stand for the inside temperature and $O(t)$ the outside temperature, where t is hours since midnight. You found the following equations for $I(t)$ and $O(t)$:

$$I(t) = -\frac{1}{4}t^2 + 8t + 16$$
$$O(t) = -\frac{1}{2}t^2 + 12t + 8$$

(a) At what time(s) are the inside and outside temperatures equal?

at $t =$ _____

(b) When is the temperature difference $O(t) - I(t)$ greatest?

at $t =$ _____

(c) Translate the following statements into functional notation. You don't have to check if they're true or not.

- "It's always three degrees colder inside than it is outside."

translation: _____

- "The inside temperature after t hours is the same as the outside temperature three hours earlier."

translation: _____

3. More interest problems:

(a) The flu has just begun to spread through campus. Every 2 days, the number of infected people doubles. What is the percentage increase in the number of infections over any 5-day period?

percentage increase: _____%

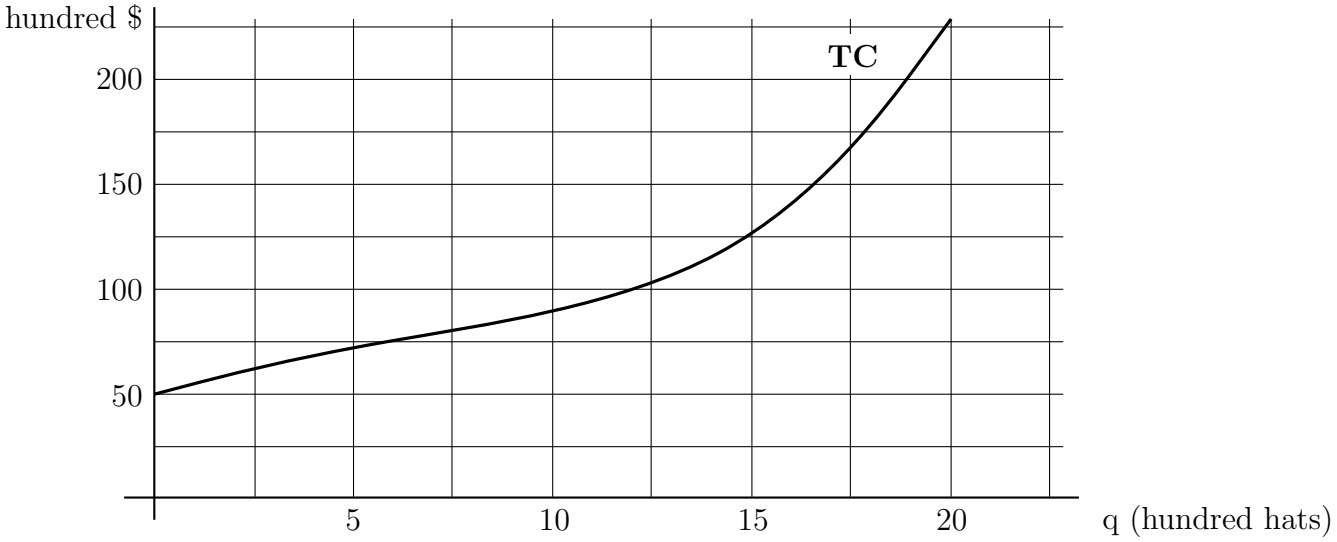
(b) You put \$50 in an account. It's compounded continuously, but you don't remember the APR. In $1\frac{1}{2}$ years you have \$60 in the account. At what time does your balance to reach \$100?

_____ years

(c) You put \$100 into Account U, which pays 1% interest, compounded continuously. Five years later, you move all your money to Account Q, which is compounded monthly. After another five years, you have \$125. What is Account Q's APR?

APR = _____

4. You produce and sell rubber hats. Here's the graph of your total cost:
(Note that q is measured in hundreds.)



(a) What is the cost of producing the 1500$^{\text{th}}$ hat? *(careful with the units!)*

cost is \$ _____

(b) Draw the VC graph. At what quantity q is *average variable cost* equal to \$7.50/hat?

q = _____

(c) Find the longest range of quantities where average cost is decreasing.
Be sure to explain how you found your answer.

from q =_____ to q =_____