

MATH 111
Final Exam
December 11, 2010

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	17	
2	15	
3	16	
4	20	
5	20	
6	12	
Total	100	

- This exam consists of this cover sheet followed by six problems on seven pages. Please check that you have a complete exam.
- Turn your cell phone OFF and put it away for the duration of the exam.
- You may not listen to headphones or earbuds during the exam.
- Unless otherwise indicated, you must show your work or write a few words to justify your answers. Clearly show all calculations. The correct answer with no supporting work may result in no credit.
- On problems that require you to work with a graph, show your work clearly by marking all lines and points that you use.
- 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.
- Unless otherwise specified, you may round your **final answer** to two digits after the decimal.

GOOD LUCK!

1. (17 points) Consider the following accounts:

Account A: 9.34% annually, compounded quarterly
Account B: 9.28% annually, compounded daily ($n = 365$)
Account C: 9.25% annually, compounded continuously

- (a) Which account has the highest APY?

ANSWER: Account _____

- (b) How long does it take \$5000 to be increased by 40% in Account A?

ANSWER: _____ years

- (c) What is the percentage change in the balance of Account C over any five-month period?

ANSWER: _____%

- (d) What is the future value of \$1, three years after it is placed in Account B?

ANSWER: \$ _____

- (e) What is the present value of \$10,000 to be received from Account A fifteen years from now?

ANSWER: \$ _____

2. (15 points) A bacteria colony triples its population every 90 minutes and there are currently 7500 bacteria in the colony.

(a) What is the population 3 hours from now?

ANSWER: _____ bacteria

(Round your answer to the nearest whole number of bacteria.)

(b) What is the population 30 minutes from now?

ANSWER: _____ bacteria

(Round your answer to the nearest whole number of bacteria.)

(c) What is the percentage change in the population over any one-hour period?

ANSWER: _____%

(d) How long does it take for the population to **quadruple**? Give your answer in minutes.

ANSWER: _____ minutes

3. (16 points) You sell Things on a sliding price scale. The total revenue (in **hundreds of dollars**) for selling q **hundred Things** is

$$TR(q) = -0.01q^2 + q.$$

- (a) What is the maximum value of total revenue?

ANSWER: _____ hundred dollars

- (b) Compute the average revenue for selling 14 hundred Things.

ANSWER: _____ dollars per Thing

- (c) Give the largest interval on which total revenue is at least 17 hundred dollars. (If no such interval exists, write “none” in the first blank.)

ANSWER: from $q =$ _____ to $q =$ _____ hundred Things

- (d) Compute the marginal revenue at $q = 4$ hundred Things. Give units with your answer.

ANSWER: $MR(4) =$ _____ UNITS: _____

4. (20 points) The total revenue and total cost (both in **hundreds of dollars**) for selling q **hundred** Objects are

$$TR(q) = -0.25q^2 + 10q \text{ and } TC(q) = 0.56q^2 + 5.6q + 4.$$

- (a) Find all quantities at which profit is 0.

ANSWER: (list all) _____ hundred Objects

- (b) What is the maximum possible profit on an order of Objects?

ANSWER: _____ hundred dollars

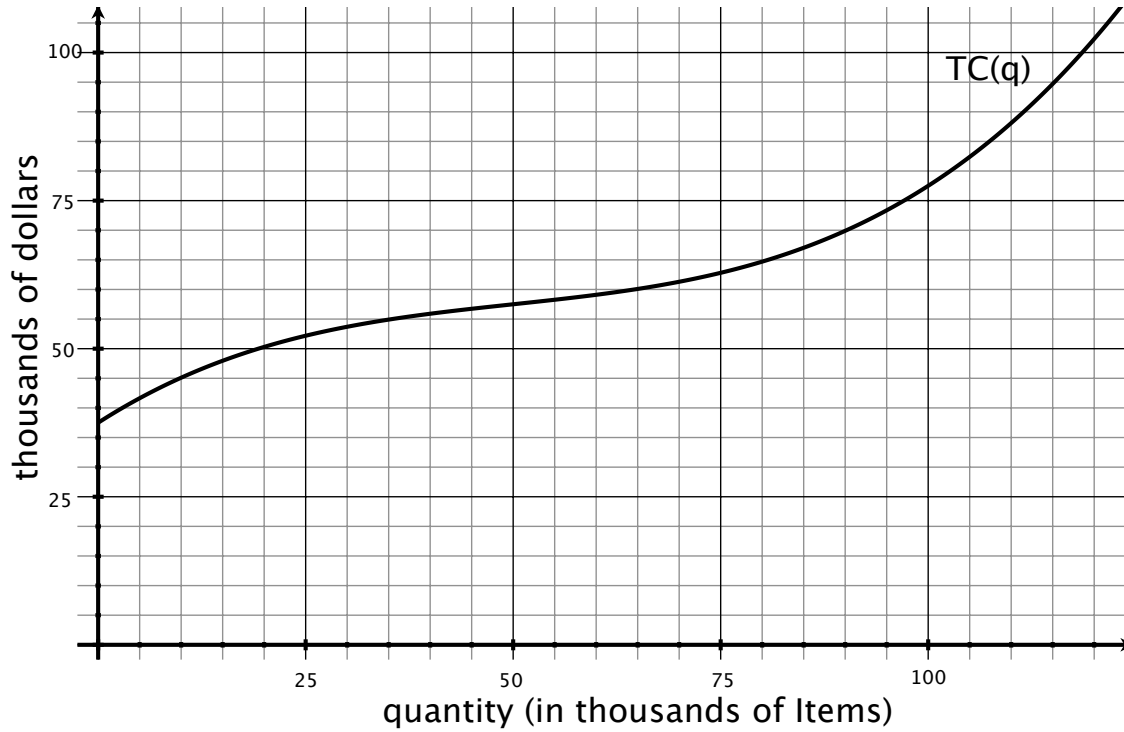
- (c) Find all quantities at which average revenue is equal to average variable cost.

ANSWER: (list all) _____ hundred Objects

- (d) Find the largest quantity at which average cost is \$10.45 per Object.

ANSWER: $q =$ _____ hundred Objects

5. (20 points) You produce and sell Items. Below is the graph of your total cost.



(a) Compute the variable cost to produce 75 thousand Items.

ANSWER: _____ thousand dollars

(b) What is the cost to produce the 25,001st Item? Give units with your answer.

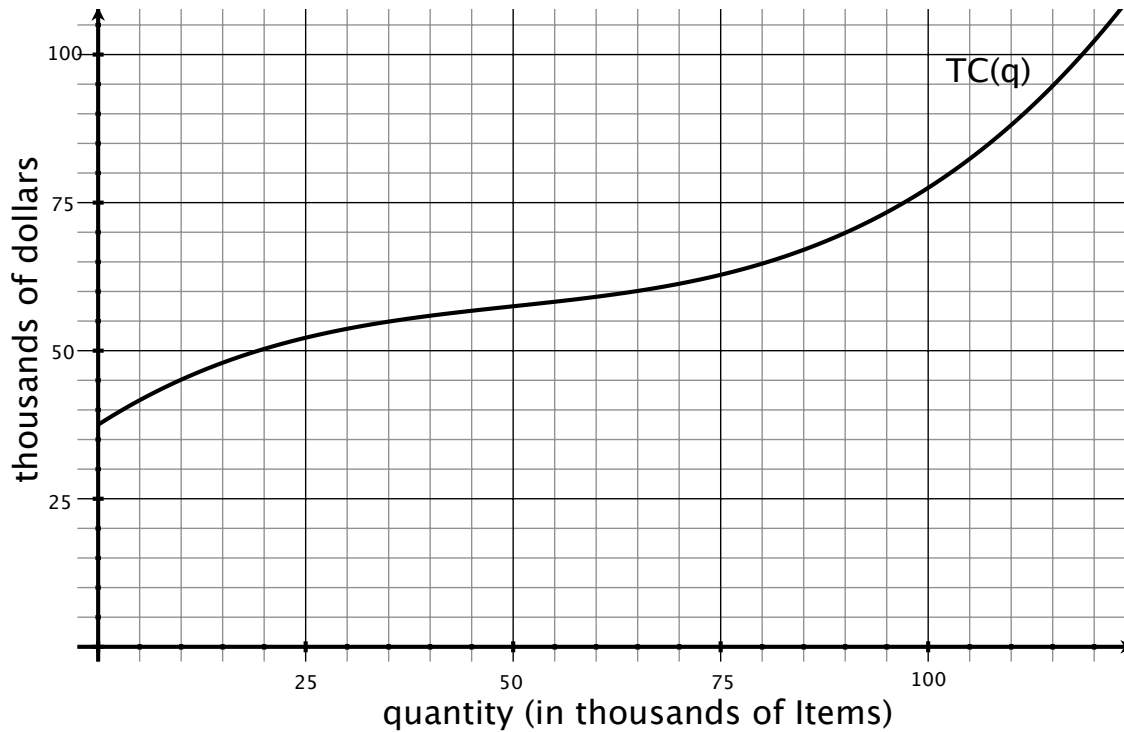
ANSWER: _____ UNITS: _____

(c) What is the breakeven price?

ANSWER: _____ dollars per Item

(This problem is continued on the next page.)

Here is the graph of $TC(q)$ again:



(d) Give a value of q at which average cost is \$7 per Item.

ANSWER: $q =$ _____ thousand Items

(e) Items sell for \$1 each.

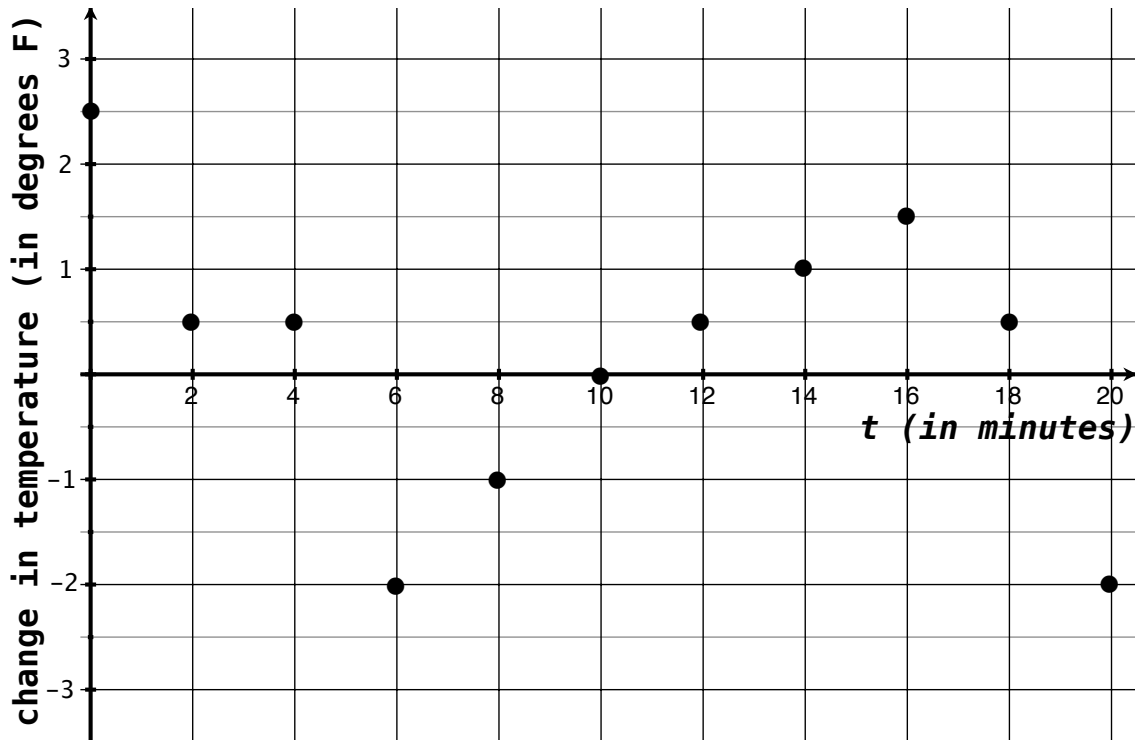
i. Draw the graph of $TR(q)$ on the axes above and name the smallest quantity at which $TR(q) = TC(q)$.

ANSWER: $q =$ _____ thousand Items

ii. What value of q yields the maximum profit?

ANSWER: $q =$ _____ thousand Items

6. (12 points) The graph below shows the **change** in temperature (in degrees Fahrenheit) during two-minute intervals beginning at time $t = 0$. That is, if temperature at time t is given by $P(t)$, then the following is the graph of $\Delta P = P(t + 2) - P(t)$.



- (a) For each of the following pairs, choose the time at which the temperature is **higher**. (Circle your choice. If the temperature is the same at both times, circle both.)

- i. $t = 0$ or $t = 2$
- ii. $t = 2$ or $t = 4$
- iii. $t = 6$ or $t = 10$
- iv. $t = 10$ or $t = 12$

- (b) Give the longest interval during which the temperature is rising.

ANSWER: from $t =$ _____ to $t =$ _____ minutes

- (c) Suppose the temperature at $t = 20$ is 67° .

- i. What was the temperature at $t = 18$?

ANSWER: _____ degrees

- ii. What will the temperature be at $t = 22$?

ANSWER: _____ degrees