NAME: _____ Student ID #: _____

QUIZ SECTION:_____

# Math 111
# Midterm I

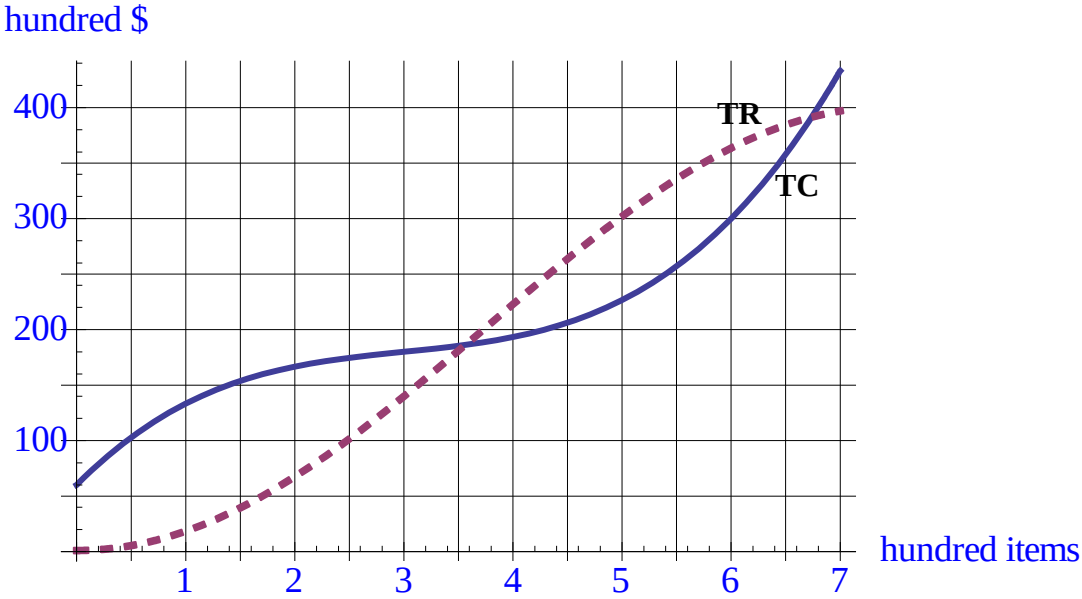
January 27, 2011

| | | |
|---|---|---|
| **Problem 1** | **14** | |
| **Problem 2** | **16** | |
| **Problem 3** | **12** | |
| **Problem 4** | **8** | |
| **Total:** | **50** | |

- This exam is 50 minutes long. You may use a calculator, a ruler, and one double-sided sheet of notes.
- Your exam should contain 4 problems on 3 pages (not including this one). **Check that your test is complete!**
- Unless otherwise instructed, you **must indicate how you get your answers**. Answers with no justification may result in little or no credit, even if they are correct.
- On problems in which you use a graph**, carefully draw all lines you use, label them,** and mark the points you used. If you guess and check when a better method was taught in this class, you may not receive full credit.
- Write your **final answer in the indicated spaces**.
- If you need more room, use the backs of pages and indicate to the reader that you have done so.
- There are multiple versions of this test. Cheating will not be tolerated.
- Raise your hand if you have a question.

GOOD LUCK!

**1.** (**14 points**) The solid line graph below shows the total cost **(TC),** and the dotted line graph shows the total revenue (**TR),** in hundreds of dollars, for producing and selling $q$ hundred Items.




a) (6 pts) Estimate the Average Cost and the Marginal Cost at 2 hundred Items.

ANSWER: AC(2) = _____ $/item

MC(2) = _____ $/item

b) (2 pts) Give an interval of values of q, if any exists, over which the Marginal Revenue and the Marginal Cost are both decreasing.

ANSWER: from $q =$ _____ to $q =$_____ , OR: circle "none exists"

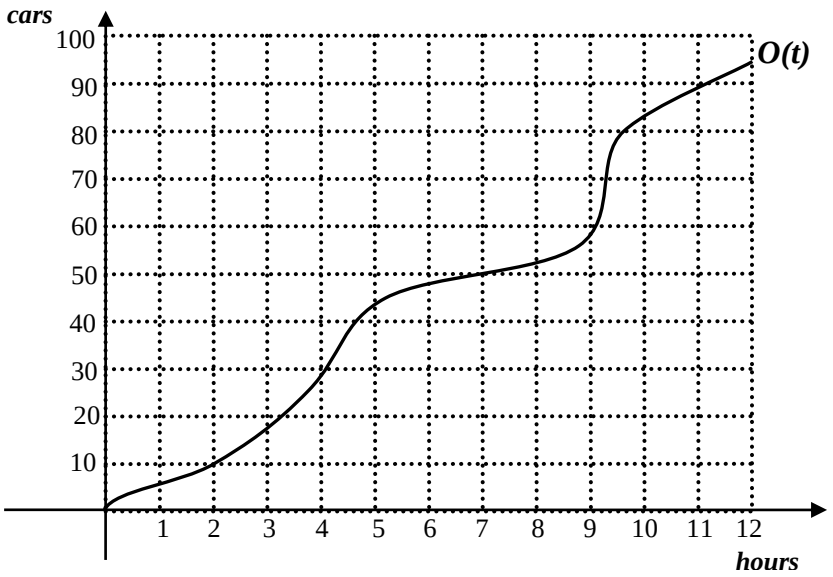
c) (2 pts) Find the longest interval of quantities which result in a profit.

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

d) (4 pts) Suppose that, instead of having the total revenue from the graph above, you are now in a market price situation, which means that every item sells for the same price $p$. Your total cost graph remains the same as in the graph above. What is the lowest market price $p$ that allows you to at least break even?

ANSWER: _____ $/item

**2** **(16 pts)** The following graph, $O(t)$, shows the total number of cars that left a parking lot over a 12 hour period.




a) (4 pts) Find a three hour time interval during which 15 cars left the parking lot.

ANSWER: $t =$ _____ to $t =$ _____ hours.

b) (4 pts) Estimate the **highest** overall average rate at which cars leave this lot. Include correct units for your answer.

ANSWER: _____ units:_____

c) Suppose that cars enter this parking lot at a constant rate of 8 cars per hour.

i. (2 pts) Draw the graph of the total number of cars that entered the lot up to time $t$ hours. Label it $I(t)$.

ii. (3 pts) Suppose that there are 20 cars parked in this lot initially (at $t = 0$ hours).
How many cars are inside the parking lot at 5 hours? Make sure to explain your answer.

ANSWER: _____ cars

iii. (3 pts) At what time during the 12 hour period shown above will there be the most cars inside the lot?

ANSWER: at $t =$ _____ hours

**3** (**12 points**) You produce and sell bottles of Love Potion #9. The table below shows your average cost (AC), marginal cost (MC), and marginal revenue (MR), in dollars per Item, for quantities between 0 and 12 bottles.

| $q$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AC: | ---- | 14.8 | 8.05 | 5.6 | 4.3 | 3.6 | 3.31 | 3.3 | 3.38 | 3.5 | 3.55 | 3.55 | 3.43 |
| MC: | 3 | 1.8 | 1.3 | 0.7 | 0.5 | 0.65 | 1.9 | 3.2 | 4 | 4.5 | 4 | 3.5 | 2.1 |
| MR: | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | -1 | -2 |

a) What is the total cost of producing 4 bottles?

ANSWER: $TC(4) =$ _____ dollars

b) List the longest interval of quantities over which your total revenue TR is increasing.

ANSWER: from $q$ = _____ to $q$ = _____ bottles

c) What number of bottles should you produce and sell in order to maximize your profit?

ANSWER: $q =$ _____ bottles

d) What is the change in profit if the order size increases from 8 to 9 bottles?

ANSWER: Profit increases / decreases (circle one) by _____ dollars

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**4** (**8 pts=2+4+2**) A Car and a Bus start from the same place and drive on a straight road in the same direction. Use $C(t)$ and $B(t)$ to denote the distance (in miles) they each traveled, respectively, after $t$ minutes .
Translate the following into functional notation. There is no need to show work or justify your answers.

a) At 3 minutes, the Car was ahead of the Bus by 2 miles.

Translation:

b) The average trip speed of the Car at 3 minutes was equal to the average speed of the Bus over a 2 minute time interval starting at $t$ minutes.

Translation:

c) After $t$ minutes, the Bus reached the same place where the Car was 7 minutes earlier.

Translation: