Math 111 - Fall 2014
Final Exam
December 6, 2014

Name: _____

Section: _____

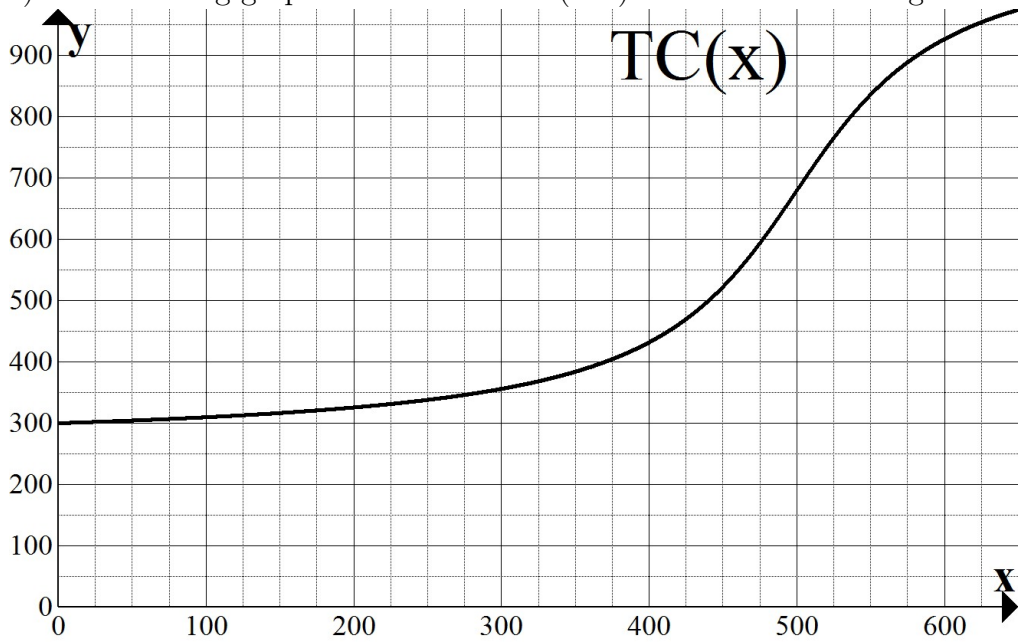
Student ID Number: _____

1	14	
2	13	
3	11	
4	10	
5	10	
6	9	
7	10	
8	11	
9	12	
Total	100	

- You are allowed to use a scientific calculator (no graphing calculator and no calculator with calculus abilities) and one hand-written 8.5 by 11 inch page of notes.
- Check that your exam contains all the problems listed above.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit.
- If you use a guess-and-check, or calculator, method when an algebraic method is available, you may not receive full credit.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question. We will only clarify the wording of a question, we cannot and will not comment on your work. So don't raise your hand fishing for answers.
- There may be multiple versions of the exam. Any student found engaging in academic misconduct will receive a score of 0 on this exam. Keep your eyes down and on your paper. If we see your eyes wandering we will warn you only once before taking your exam from you.
- You have 2 hours and 50 minutes to complete the exam.

GOOD LUCK!

1. (14 points) The following graph shows total cost (TC) in **dollars** for selling x **Things**.



For each part, clearly explain your work in a sentence and label your work in the graph.

(a) Estimate the following values using the graph and the definitions:

i. The fixed costs: $FC =$ _____ dollars

ii. The variable cost at $x = 450$: $VC(450) =$ _____ dollars

iii. The average variable cost at $x = 450$: $AVC(450) =$ _____ dollars/Thing

(b) Find the breakeven price (BEP).

$BEP =$ _____ dollars per Thing

(c) If the market selling price is below BEP, what does that tell you? (On the lines provided write one brief sentence/phrase answering this question)

_____

_____

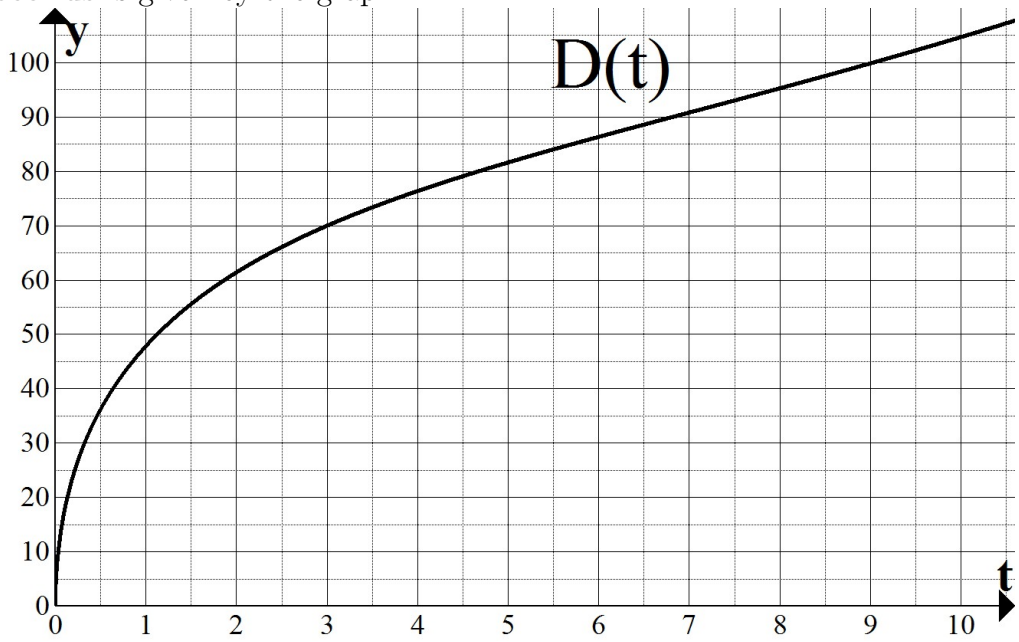
(d) Find the range of quantities over which **marginal cost** is at least 2.50 dollars per Thing.

$x =$ _____ to $x =$ _____ Things

(e) Suppose the market selling price is fixed at 2 dollars per Thing.
Find the quantity at which profit is zero.

$x =$ _____ Things

2. (13 points) Your sister goes for a bike ride. The distance, $D(t)$, in **yards** traveled by your sister after t **seconds** is given by the graph:



For each part, clearly explain your work in a sentence and label your work in the graph.

(a) Find the average speed over the 3-second interval starting at $t = 1$ second. (Give the units)

Average Speed = _____ UNITS = _____

(b) Find a time when the average trip speed is 15 yards/second.

t = _____ seconds

(c) Find a 6-second interval over which your sister travels 30 yards.

t = _____ to t = _____ seconds

(d) You decide to go for a bike ride as well. You start at the same time and place, but you travel at a constant speed of 10 yards/second. Find the time when your sister is farthest ahead of you and estimate the distance between you at this time.

t = _____ seconds

Distance ahead = _____ yards

3. (11 points) You sell Things.
The total cost for selling x Things is $TC(x) = 14x + 2000$ dollars.
The selling price per Thing is $p = -12x + 600$ dollars/Thing.

(a) Give the formulas for total revenue, $TR(x)$.

$TR(x) =$ _____

(b) Compute the marginal revenue and marginal cost at $x = 3$ Things.

$MR(3) =$ _____ dollars/Thing
$MC(3) =$ _____ dollars/Thing

(c) Find the largest interval over which Total Revenue is greater than or equal to \$1200.
(Round answers to the nearest Things)

$x =$ _____ to $x =$ _____ Things

(d) What selling price leads to the largest possible profit?

$p =$ _____ dollars/Thing

4. (10 pts) The average cost of producing x **thousand** items is given by

$$AC(x) = 0.01x^2 - 0.9x + 80 + \frac{20}{x} \quad \text{and} \quad MC(x) = 0.03x^2 - 1.8x + 80,$$

where $AC(x)$ and $MC(x)$ are in dollars/item.

In addition, the selling price per item is a constant $p = 84$ dollars/item.

(a) Give the formulas/values for all the following:

i. Average Variable Cost: $AVC(x) =$ _____ dollars/item

ii. Total Revenue: $TR(x) =$ _____ thousand dollars

iii. Marginal Revenue: $MR(x) =$ _____ dollars/item

(b) Find the minimum value of the marginal cost function.

minimum MC value = _____ dollars/item

(c) Find the quantity at which profit is maximized.

$x =$ _____ thousand items

5. (10 points) Your company makes two kinds of smoothie mixes: Veri-Tasty and Yum-Drink.

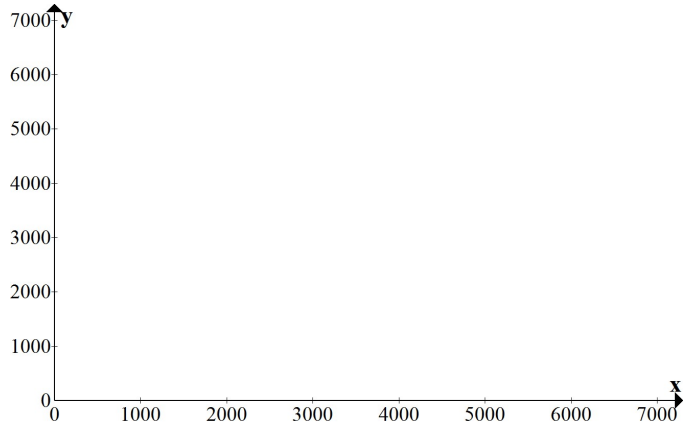
   Each pound of Veri-Tasty brings in \$3 dollars in profit and you have enough supplies to make at most 4000 pounds of Veri-Tasty.

   Each pound of Yum-Drink brings in \$2.50 dollars in profit and you have enough supplies to make at most 5000 pounds of Yum-Drink.

   In total, you can produce and package at most 7000 pounds of mixes.

   Let x = the pounds of Veri-Tasty mix and y = pounds of Yum-Drink mix.

   (a) Give the constraints, then sketch and shade the feasible region.
   You **must** label all x-intercepts, y-intercepts, and **intersection points** for full credit.



   (b) How much of each type of mix should you produce to give maximum profit?
   Also give the value of maximum profit? (Show your work)

$x =$ _____ pounds of Veri-Tasty

$y =$ _____ pounds of Yum-Drink

Max Profit = _____ dollars

6. (9 pts) The demand function for a product is given by $\dfrac{173-4p}{q}=1$, where p is the price per item, in dollars/item, and q in the number of items.

   The supply function is **linear**. Suppliers produce 10 items if the price is 25 dollars/item and produce 20 items if the price is 40 dollars/item.

   (a) Find the supply curve. (Write your answer in the form $p=mq+b$).

   $p=$ _____

   (b) Find the price and quantity that correspond to market equilibrium.

   $q=$ _____ items

   $p=$ _____ dollars/item

   (c) Does a market price of \$47 per item correspond to a shortage or surplus?

   Circle one: Shortage or Surplus

7. (10 pts)

(a) Bill bought a $3000, 9-month certificate of deposit (CD) that will earn 8% annual simple interest. Three months before the CD was due to mature, Bill needed his CD money, so a friend agreed to lend him money and receive the value of the CD when it matured.

i. Find the value of the CD when it matures.

_____ dollars

ii. If their agreement allowed the friend to earn a 10% annual simple interest return on his loan to Bill, how much did Bill receive from his friend?
(Round to the nearest cent)

_____ dollars

(b) Your boss offers you two salary options.
Option 1: Start with a salary of $40,000 for the first year on the job and you get raises of $2,500 at the end of each year.
Option 2: Start with a salary of $40,000 for the first year on the job and you get 5% raises (compounded) each year.

Which option will give the larger salary for the tenth year on the job?
(You must show your computations)

Circle one: Option 1 or Option 2

8. (11 points) (Round final answers to two digits after the decimal point).

(a) You invests $5000 into an account that has a 6.2% annual rate, compounded continuously. How much total interest do you earn in 4 years?

_____ dollars

(b) You invest $1000 into an account that pays interest compounded semi-annually. The value in 8 years is $1650, what is the semi-annual interest rate?

_____ %

(c) You invest $615 into an account paying 7.3%, compounded monthly. How long does it take to double your investment?

_____ years

9. (12 points) (Round final answers to two digits after the decimal point).

(a) Fred wants to make regular payments to save up \$150,000 by the time his daughter, Pebbles, turns 18 years old. His account earns 5% interest, compounded quarterly. How much must he deposit into the account at the end of each quarter after Pebbles is born to reach his goal?

_____ dollars

(b) What amount must be set aside now to generate payments of \$40,000 at the beginning of each year for the next 14 years if the account gets 5.5%, compounded annually?

_____ dollars

(c) When Pebbles graduates from college, her student loans total \$24,000.
These loans are at 3%, compounded monthly and are to paid off with payments at the end of each month for the next 10 years. How much are the monthly payments?

_____ dollars