

Math 111 - Fall 2016
Final Exam
December 10, 2016

Name: _____

Section: _____

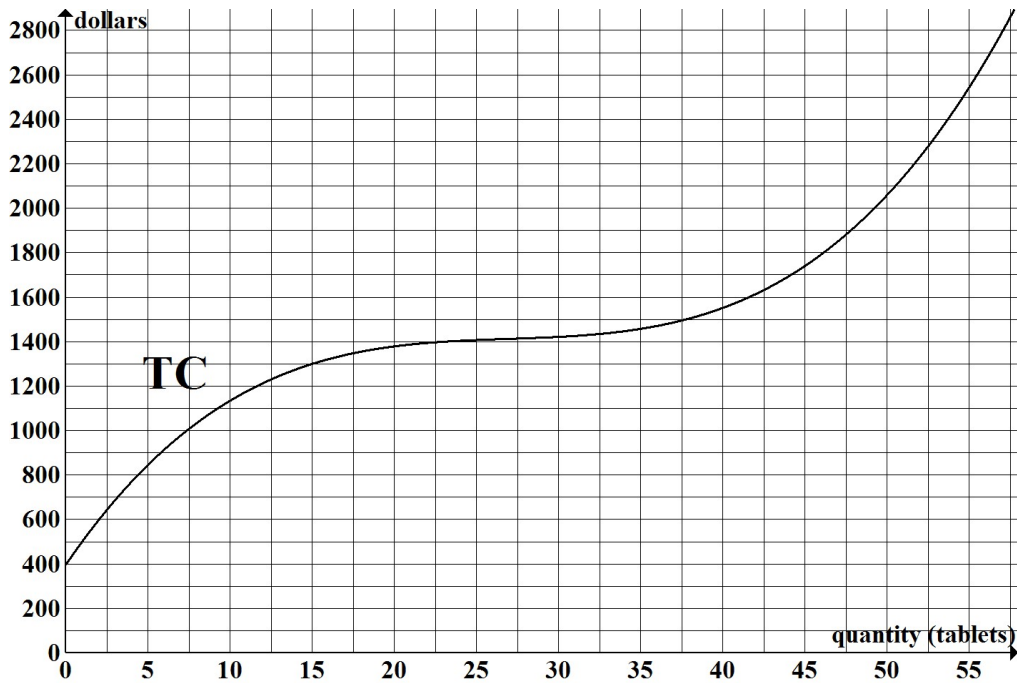
Student ID Number: _____

1	15	
2	13	
3	14	
4	15	
5	13	
6	15	
7	15	
Total	100	

- You are allowed to use a Ti-30x IIS Calculator (only this model!), a ruler, and one **hand-written** 8.5 by 11 inch page of notes. If we see a different calculator model, we will take it from you and you can get it back from us at the end of the final.
- 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 will 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 back of the page 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. Don't be tempted to copy off a classmate. Any student found engaging in academic misconduct, even if the copying is only on one part of one problem, will receive a score of 0 on the entire exam and will meet in from of the academic misconduct board.** I submitted several cases of cheating last year on the final, please don't make me do this again. Show your work and 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.
- Scores and grades will be posted on Friday at the end of final's week. You will receive an email from Dr. Loveless when the grades have been posted.

GOOD LUCK!

1. (15 pts) The graph of **total cost** for producing a certain type of tablet are given. The x -axis is in tablets and the y -axis is in dollars.



Show some calculations in every problem and label your work in the graph.
At least one line should be drawn for each part!

- (a) Find the average variable cost and average cost at $q = 15$ tablets.

$$AVC(15) = \underline{\hspace{2cm}} \text{ dollars per tablet}$$

$$AC(15) = \underline{\hspace{2cm}} \text{ dollars per tablet}$$

- (b) Find the Breakeven Price (BEP).

$$BEP = \underline{\hspace{2cm}} \text{ dollars per tablet}$$

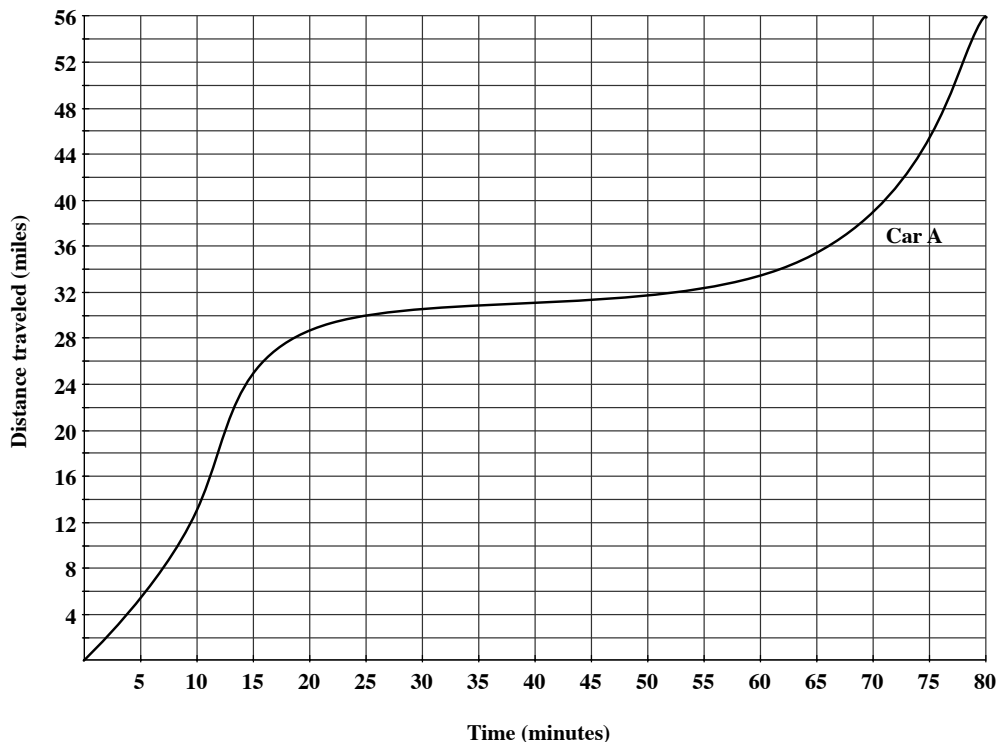
- (c) Give the longest interval of quantities over which marginal cost is less than or equal to 20 dollars per tablet.

$$\text{from } q = \underline{\hspace{2cm}} \text{ to } q = \underline{\hspace{2cm}} \text{ tablets}$$

- (d) Suppose the market price is \$55.00 per tablet. Find the quantity that maximizes profit and give the value of maximum profit.

$$q = \underline{\hspace{2cm}} \text{ tablets and Profit} = \underline{\hspace{2cm}} \text{ dollars}$$

2. (13 pts) The graph gives **total distance** in miles traveled by a moving car, Car A, versus time. Let $A(t)$ represent the distance in miles traveled by Car A after t minutes.



Show some calculations in every problem and label your work in the graph.
 (At least one line should be drawn for each part!)

- (a) Find a time at which Car A's overall average trip speed is 0.75 miles per minute.

$$t = \text{_____} \text{ minutes}$$

- (b) Translate the following phrase into functional notation (using the function name $A(t)$ and appropriate values) AND compute the numerical answer:
 Find the average speed of the car over the 5-minute interval starting at $t = 10$ minutes

FUNCTIONAL NOTATION: _____

"Average speed from 10 to 15" = _____ mpm

- (c) Find a positive value of h such that $\frac{A(25+h) - A(25)}{h} = 0.2$ miles per minute.

$$h = \text{_____} \text{ minutes}$$

3. (14 pts) Consider the two functions

$$f(x) = 5x - x^2 \quad \text{and} \quad g(x) = 3x^2 - 4x + 5.$$

- (a) Find the slope of the diagonal line to $f(x)$ at $x = 3$.
(Hint: First write in functional notation, then compute).

- (b) Find and *completely simplify* $\frac{g(x+h) - g(x)}{h}$.

$$\frac{g(x+h) - g(x)}{h} = \underline{\hspace{4cm}}$$

- (c) Find all quantities at which the graphs of $f(x)$ and $g(x)$ cross.

(List solutions) $x = \underline{\hspace{4cm}}$

4. (15 pts)

(a) You sell things. The selling price per thing is a constant $p = \$7$ per thing and your average cost to produce q things is $AC(q) = 5 + \frac{3}{q}$ dollars per thing.

i. Find formulas for total revenue and total cost in terms of q .

$$TR(q) = \text{_____} \text{ dollars}$$

$$TC(q) = \text{_____} \text{ dollars}$$

ii. At what quantity is the average cost equal to \$5.10 per thing?

$$q = \text{_____} \text{ things}$$

iii. For this scenario, you should be able to tell that profit increases at a constant rate (there is no maximum profit). How much additional profit does the company make when it sells each additional item?

$$\text{'marginal profit'} = \text{_____} \text{ dollars}$$

(b) **The question below is unrelated to previous parts above.**

For a different company, the selling price is given by $p = 40 - 5x$ dollars/item for an order of x **hundred** items. In addition, you know the **total cost** is a **linear** function. The fixed cost is $FC = 10$ hundred dollars and it costs 22 hundred dollars to produce 3 hundred items. Thus, $TC(0) = 10$ and $TC(3) = 22$.

Find the quantity and selling price that maximize profit.

(Hint: First find the functions for $TR(x)$, $TC(x)$ and profit).

$$x = \text{_____} \text{ hundred items}$$

$$p = \text{_____} \text{ dollars/item}$$

5. (13 pts) The two parts below are unrelated.

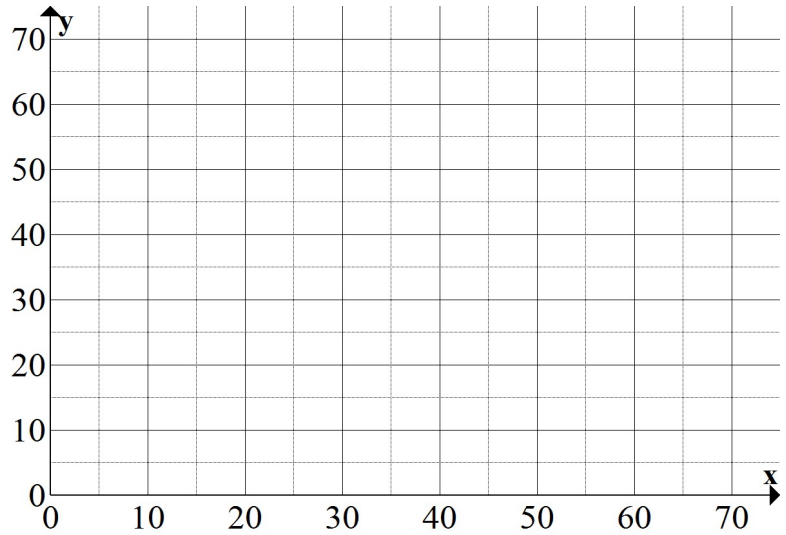
- (a) Grover invests \$3,000 in a bank account that pays simple interest. After 5 years, the account has earned \$1,215 in total interest. What is the annual interest rate on the account?

_____ %

- (b) Shade the feasible region corresponding to the constraints:

$$2x + y \leq 70 \quad , \quad 2x + 3y \leq 120 \quad , \quad y \geq 12 \quad , \quad x \geq 0.$$

Clearly, shade the feasible region and label ALL corners of the shaded region for full credit. (Show your work and your solving! Do NOT estimate from the picture, you must show the necessary algebra to solve for the appropriate intersections to get full credit).



Corners of feasible region (list all): _____

6. (15 pts) (For all your work below, round your **final answer** to two digits after the decimal)

- (a) Ann found an investment that will pay her 5% annual interest, compounded quarterly. How much must Ann invest in the account now so that she will have \$10,000 in five years?

_____ dollars

- (b) Molly deposits \$600 into an account that pays 4% annually, compounded continuously. How long will it take for the account balance to triple?

_____ years

- (c) Sally buys a home for \$320,000. Six years later, she sells the home for \$400,000. What interest rate, compounded annually, did this investment represent for Sally?

_____ %

7. (15 pts) (Round your **final answers** to two digits after the decimal)

- (a) Samantha graduates with \$30,000 in student loans. Her loans have a 4% interest rate, compounded monthly. She will make her first payment at the end of this month and each month afterward for the next 10 years to pay off the entire loan. How big is each payment?

_____ dollars

- (b) Oscar starts to save for retirement and he plans to retire in 30 years. At the end of each month he deposits \$500 in an account that earns 6% annually, compounded monthly. How much money will be in the account when Oscar retires and how much total interest did the account earn?

Balance in 30 years = _____ dollars

Total Interest Earned = _____ dollars

- (c) Today, Julie has \$10,000 in an investment earning 6% annually, compounded semiannually. In addition, at the beginning of every six month period, she makes deposits of \$400 into the same type of account. How much money does she have altogether at the end of 5 years?

_____ dollars