

Math 111 - Fall 2015
Final Exam
December 12, 2015

Name: _____

Section: _____

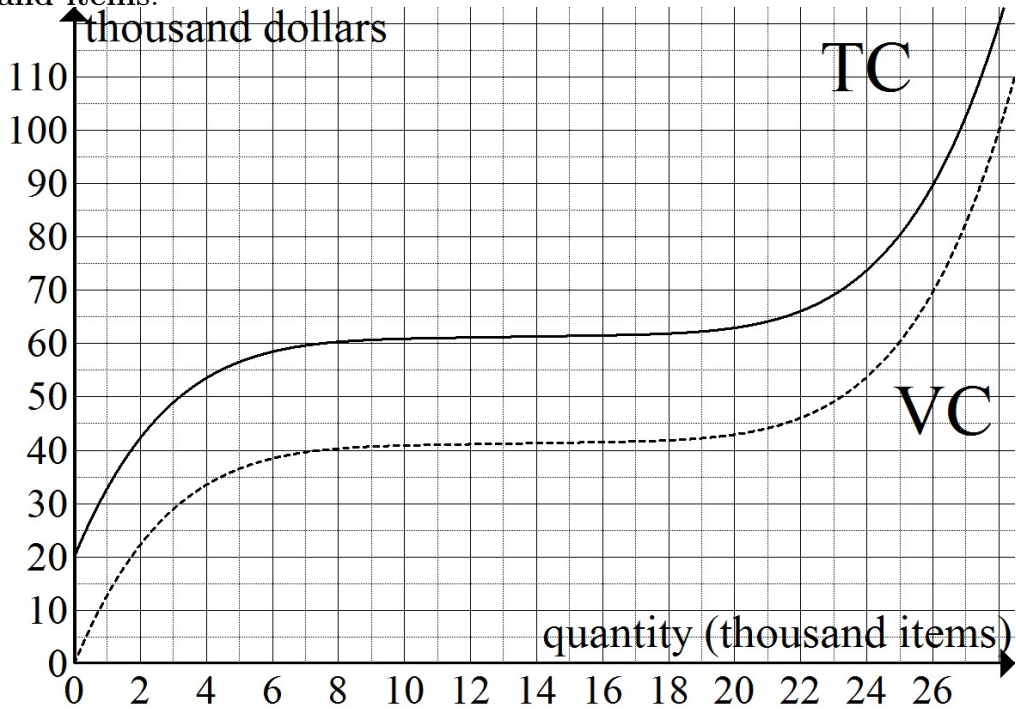
Student ID Number: _____

1	16	
2	14	
3	13	
4	11	
5	10	
6	12	
7	12	
8	12	
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 are 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 have already submitted cases of copying this quarter on the midterms and I submitted several cases of cheating last year on the final. 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. (16 points) The following graph shows total cost and variable cost in **thousand dollars** for selling x **thousand items**.



For each part, clearly explain and label your work. Be as accurate as possible.

- (a) Find the quantity at which average variable cost is equal to 6 dollars/item.

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

- (b) Find the average cost to produce $x = 8$ thousand items (give units for your answer).

$$AC(8) = \text{_____}$$

- (c) Find all quantities at which **marginal cost** is 3 dollars per item.

$$\text{(list answers)} \quad x = \text{_____} \text{ thousand items}$$

- (d) For both parts below, the selling price is fixed at $p = 4.50$ dollars/item.

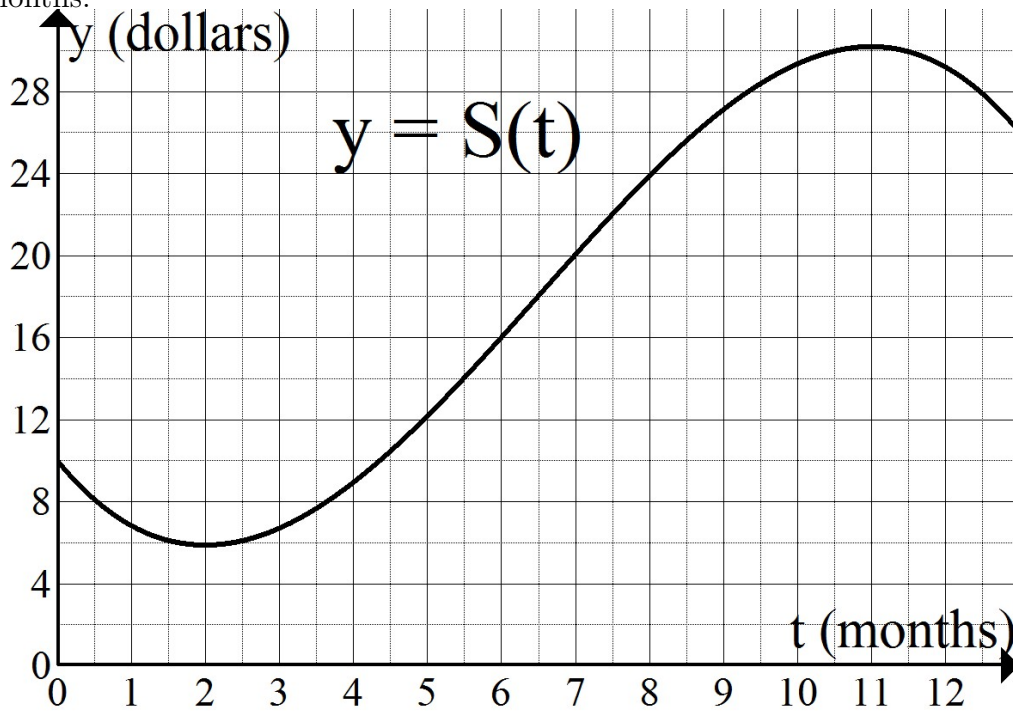
- i. At what quantity is profit maximized?

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

- ii. What is the profit if you sell 16 thousand items?

$$\text{Profit} = \text{_____} \text{ thousand dollars}$$

2. (14 points) The graph below shows the price per share, $S(t)$, (in dollars) for a particular stock after t months.



For each part, clearly label your work in the graph and show your computations in the problems.

- (a) Find the largest overall rate of change (That is, find the largest value of $\frac{S(t)-S(0)}{t}$).

_____ dollars per month

- (b) Compute the change in stock price over the first 8 months.

_____ dollars

- (c) As accurately as possible, estimate the rate of change in the stock value over the first day of the 4th month. In other words, what is the rate from 4 to about 4.03? (Give units)

$$\frac{S(4.03)-S(4)}{0.03} \approx \underline{\hspace{2cm}}$$

- (d) Another stock, $R(t)$, also starts at a value of 10 dollars, but it increases at a constant rate of 1.50 dollars per month. Find all times (after $t = 0$) when the two stocks have the same value.

(list answers) $t =$ _____ months

3. (13 pts) You sell Things.

The price per Thing, p , on an order of q Things is given by $p = 35 - 0.25q$.

The total cost is a **linear** function that has a fixed cost of $TC(0) = 100$ and you also know that if you produce $q = 2$ Things, then the total cost is $TC(2) = 135$ dollars.

(a) Find the formulas for Total Revenue and Total Cost.

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

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

(b) Find and completely simplify the formulas for Marginal Revenue and Marginal Cost.

$$MR(q) = \text{_____} \text{ dollars per Thing}$$

$$MC(q) = \text{_____} \text{ dollars per Thing}$$

(c) Find all quantities at which total revenue is 15 dollars more than total cost.
(Round your answers to the nearest Things).

(list all): $q = \text{_____}$ Things

4. (11 pts) You sell shirts. For this problem, x is in hundreds of shirts.

The total revenue is $TR(x) = 23x - x^2$ hundred dollars.

The total cost is $TC(x) = x^2 + 8x + 12$ hundred dollars.

(Round all final answers to the nearest dollar or nearest shirt, appropriately).

(a) Find the fixed cost and give the formulas for Average Cost and price per item.

$$FC = \text{_____} \text{ hundred dollars}$$

$$AC(x) = \text{_____} \text{ dollars per shirt}$$

$$p = \text{_____} \text{ dollars per shirt}$$

(b) Find all quantities at which average cost is equal to 15 dollars per shirt.

$$\text{(list all) } x = \text{_____} \text{ hundred shirts}$$

(c) What quantity and price maximize profit?

$$\text{quantity} = \text{_____} \text{ hundred shirts}$$

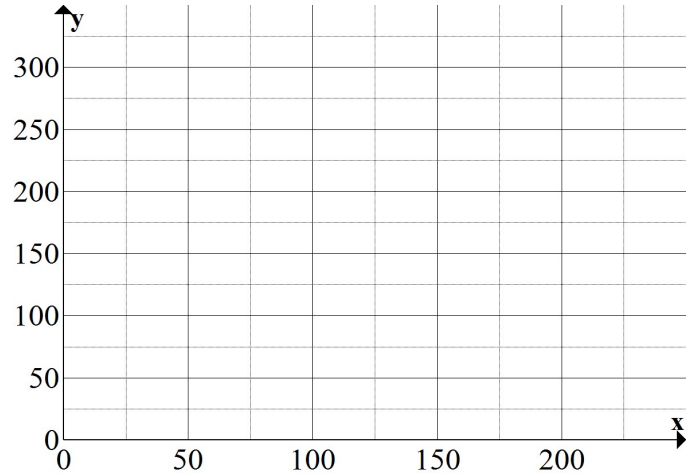
$$\text{price} = \text{_____} \text{ dollars per shirt}$$

5. (10 points) Your company manufactures two types of chairs: metal chairs and plastic chairs. Each metal chair requires 3 hours of labor to assemble and 2 hours of labor to paint. Each plastic chair requires 1/2 hour of labor to assemble and 1 hour of labor to paint. The profit for each metal chair is \$15 and the profit for each plastic chair is \$12.

The maximum number of hours of labor available to assemble the chairs is 150 hours each day. The maximum number of hours of labor available to paint the chairs is 168 hours each day.

Let x be the number of metal chairs you produce in a day and y be the number of plastic chairs you produce in a day.

- (a) Give the constraints, then sketch and shade the feasible region. (Show your work for how you found ALL the necessary points).



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

$x =$ _____ metal chairs

$y =$ _____ plastic chairs

Max Profit = _____ dollars

6. (12 points)

(a) Suppliers are willing to produce 96 items if the price is \$410/item and 136 items if the price is \$540/item. The supply curve is **linear**.

i. Give the equation of the line for the supply curve. (Use p for price and q for quantity).

$$p = \underline{\hspace{10cm}}$$

ii. You are also told that the demand curve is $2p + 6q = 921$.

Find the quantity and price that corresponds to market equilibrium.

$$q = \underline{\hspace{10cm}} \text{ items}$$

$$p = \underline{\hspace{10cm}} \text{ dollars/item}$$

(b) Which account is better?

Account A: 3.97% annually, compounded continuously, or

Account B: 4% annually, compounded quarterly

Explain your answer (by computing appropriate numbers or explaining in some other way):

Circle the one that is better: Account A or Account B

7. (12 points) (For all your work below, round your **final answer** to two digits after the decimal)

- (a) Roger deposits \$1000 into an account that pays 5% annually, compounded continuously. How long will it take for him to earn \$600 in **interest**?

$t =$ _____ years

- (b) Steffi invests \$5000 into an account where the interest is compounded semi-annually. The balance of the account double in 9 years. What was her semi-annual interest rate?

_____ %

- (c) Andre invests \$15,000 in a CD certificate that pays 8% annual simple interest for 5 years. When the CD matures (at the end of the 5 years), he takes all the money and invests it into an new account that pays 7% annually, compounded quarterly for an additional 5 years. What is the ending balance of the new account?

_____ dollars

8. (12 points) (Round your **final answers** to the nearest dollar or year)

- (a) Serena starts saving for retirement. She plans to invest in a retirement account that earns 6% annually, compounded monthly. Today, she plans to start making equal monthly payments at the beginning of each month and she wants to have a balance of \$3,000,000 in her account in 35 years. Find the size of the monthly payments.

_____ dollars

- (b) Rafa just finished paying off his home loan. The loan balance was earning 4% annual interest, compounded monthly. Rafa made payments of \$2,000 at the end of each month for 20 years. What was the starting balance of the loan? And how much total interest did Rafa pay?

Starting Balance = _____ dollars

Total Interest Paid = _____ dollars

- (c) Pete has \$3,600,000 saved in his retirement account when he retires early at age 30. The money is in an account that earns 9% annually, compounded quarterly. He plans to withdraw \$90,000 from the account at the end of each quarter. How old will Pete be when the money is all gone?

Pete will be _____ years old