

MATH 111
Final Exam
March 12, 2005

Name _____

Student ID # _____

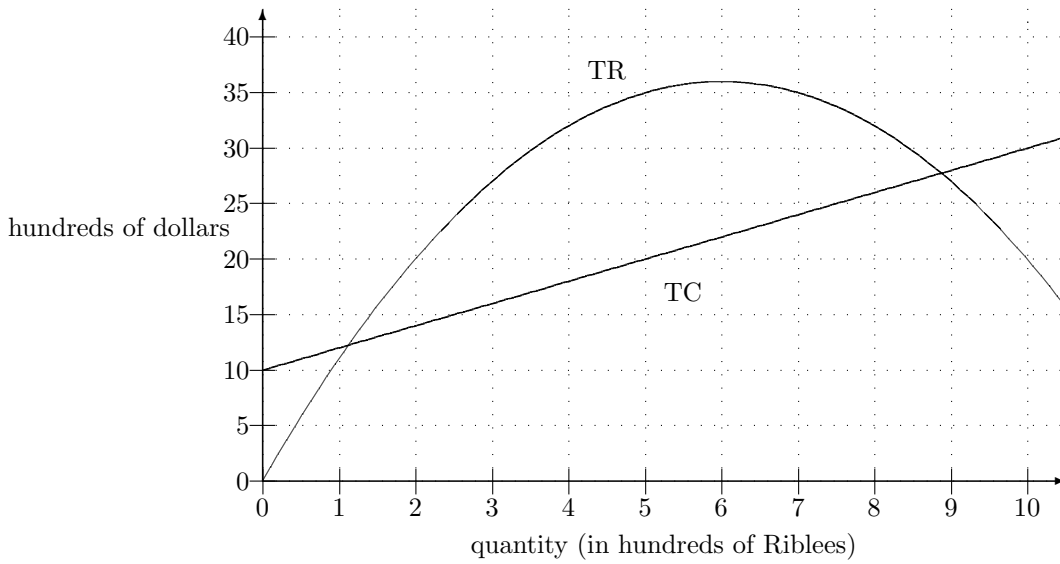
Section _____

1	10	
2	12	
3	12	
4	11	
5	10	
6	9	
7	16	
8	20	
Total	100	

- You are allowed to use a calculator, a ruler, and one sheet of handwritten notes.
- Check that your exam contains 8 problems and eleven pages.
- Please turn your cell phone OFF and put it away for the duration of the exam.
- You must show your work on all problems. On graphical questions, clearly draw any lines and mark any points that you use in your computations. The correct answer with no supporting work may result in no credit.
- If you use trial-and-error or a guess-and-check method when an algebraic method is available, you will not receive full credit.
- Write your answers in the specified locations. Unless otherwise indicated, you may round your **final answer** to two digits after the decimal.
- Raise your hand if you have a question.
- Any student found engaging in academic misconduct will receive a score of 0 on this exam.
- You have three hours to complete the exam.

GOOD LUCK!

1. (10 points) Your company sells Riblees. The graphs below show total revenue and total cost versus quantity.



- (a) Give the largest interval over which profit is positive and increasing.

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

- (b) What is your marginal cost when you produce 676 Riblees?

ANSWER: \$ _____

- (c) Which of the following best describes the graph of average cost from $q = 1$ to $q = 10$ hundred Riblees?

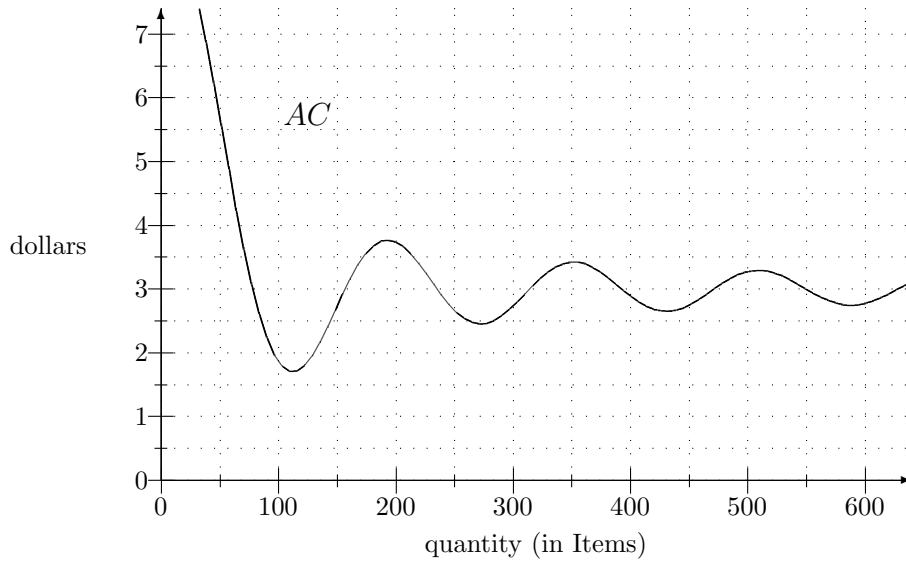
- i. It is always increasing.
- ii. It is always decreasing.
- iii. It increases and then decreases.
- iv. It decreases and then increases.
- v. None of the above.

ANSWER: _____

- (d) What is the maximum possible profit?

ANSWER: _____ hundred dollars

2. (12 points) You sell *Items*. The following graph shows average cost (AC) versus quantity q .



(a) Name all quantities at which average cost is \$3.50.

ANSWER: $q =$ _____ Items

(b) Compute the total cost (TC) to produce 450 Items.

ANSWER: \$ _____

(c) Suppose you know that variable cost to produce 200 Items is \$500. What is the value of your fixed cost?

ANSWER: $FC =$ \$ _____

(d) What is the break even price? Explain clearly how you arrived at your answer.

ANSWER: \$ _____

3. (12 points) The amount of water in two vats, Vat A and Vat B, is given by the following:

$$\text{Vat A: } A(t) = 3 - \sqrt{t} + 2t$$

$$\text{Vat B: } B(t) = 5\sqrt{t},$$

where t is in hours and the amounts are in gallons.

- (a) What is the overall rate of change in the amount of water in Vat B at $t = 7$ hours?

ANSWER: _____ gallons per hour

- (b) What is the incremental rate of change in the amount of water in Vat A during the interval from $t = 2$ to $t = 5$ hours?

ANSWER: _____ gallons per hour

- (c) Find the two times at which the vats contain the same amount of water.

ANSWER: $t =$ _____ and _____ hours

4. (11 points) To encourage larger orders on a purchase, a company uses the following sliding price scale for its most popular product, the Object:

$$p = 21 - 0.4q$$

where q is the number of Objects in an order and p is price per Object, measured in dollars. Suppose that the average cost of producing an order with q Objects is given by

$$AC(q) = 12 + \frac{16}{q}.$$

where AC is in dollars.

- (a) Give formulas for total revenue and marginal revenue, both in dollars.

ANSWER: $TR(q) =$ _____

$MR(q) =$ _____

- (b) What size order will maximize profit? (Assume that you cannot sell a fraction of an Object. Give the whole number of Objects that maximizes profit.)

ANSWER: $q =$ _____ Objects

- (c) What is the maximum profit that can be obtained on an order?

ANSWER: _____ dollars

5. (10 points) Suppose that the distance a car has traveled up to time t is given by $D(t) = at^2 + bt$ where t is in hours and D is in miles.

- (a) Give a formula for $ATS(t)$, the car's overall average trip speed after t hours. (Your formula will involve a and b .)

ANSWER: $ATS(t) =$ _____

- (b) Suppose that the overall average speed of the car during the first 5 hours of its trip is 35 miles per hour, and during the first 9 hours of its trip is 25 miles per hour. Find a and b .

ANSWER: $a =$ _____, $b =$ _____

- (c) How far has the car traveled when its overall average trip speed is 28.4 miles per hour?

ANSWER: _____ miles

6. (9 points) Tell whether each of the following sequences is additive, multiplicative, or neither. If the sequence is additive, give its increment, a recursive formula, and an explicit formula. If the sequence is multiplicative, give its multiplier, a recursive formula, and an explicit formula.

(a) A : 160, 40, 10, 2.5, 0.625, ...

This sequence is: (circle one) additive multiplicative neither

If additive, increment=_____.

If multiplicative, multiplier=_____

If additive or multiplicative,

• recursive formula: _____

• explicit formula: _____

(b) B : 2, 3, 4, 6, 8, 10, 12, 13, 14, 16, 18, 20, ...

This sequence is: (circle one) additive multiplicative neither

If additive, increment=_____.

If multiplicative, multiplier=_____

If additive or multiplicative,

• recursive formula: _____

• explicit formula: _____

(c) C : 5, 5.08, 5.16, 5.24, 5.32, ...

This sequence is: (circle one) additive multiplicative neither

If additive, increment=_____.

If multiplicative, multiplier=_____

If additive or multiplicative,

• recursive formula: _____

• explicit formula: _____

7. (16 points)

- (a) How much money must you invest today at 5.75% per year, compounded monthly, to have one million dollars in 25 years?

ANSWER: \$ _____

- (b) Pablo wants to do some home repairs and borrows \$8000 with simple interest of 9% per year. He pays off the loan in one payment of \$8818. How long did it take him to pay off the loan?

ANSWER: _____ years

- (c) Sally has just been offered a job at an internet superstore and is currently negotiating the terms of her employment. She wants to be earning an annual salary of \$150,000 when she retires in 30 years. The company guarantees that Sally will receive a salary increase of 2% per year. What starting salary should Sally request in order to meet her goal?

ANSWER: \$ _____

- (d) John won \$50,000 in the lottery 5 years ago. He took half his winnings and invested in a friend's company whose stock value has appreciated (increased) in value by 1.25% per year. He used the other half of his winnings and purchased Certificates of Deposit that yielded 6% interest per year, compounded continuously. How much are John's winnings worth today?

ANSWER: \$ _____

8. (20 points) Consider the following three bank accounts:

Account A: 8.45% interest per year, compounded **every two months**

Account B: 10.25% interest per year, compounded continuously

Account C: $(r \times 100)\%$ interest per year, compounded quarterly

(a) Compute the annual percentage yield (*APY*) of accounts *A* and *B*.

ANSWER: *A*: _____%; *B*: _____%

(b) How long will it take to double an investment in Account *A*?

ANSWER: _____years

Once again, those accounts were:

Account A: 8.45% interest per year, compounded **every two months**

Account B: 10.25% interest per year, compounded continuously

Account C: $(r \times 100)\%$ interest per year, compounded quarterly

(c) If you deposit \$3000 in account B , how long will it be until the balance is \$5280?

ANSWER: _____ years

(d) You deposit \$4000 into account C and in 20 years, the balance is \$12,000. What is the interest rate, r ?

ANSWER: $r =$ _____

(e) You deposit \$10,000 in account A today. What do you need to deposit into account B today so that the two accounts have exactly the same balance in 40 months?

ANSWER: \$ _____