

MATH 111
Final Exam
December 8, 2007

Name _____

Student ID # _____

Section _____

HONOR STATEMENT

“I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam.”

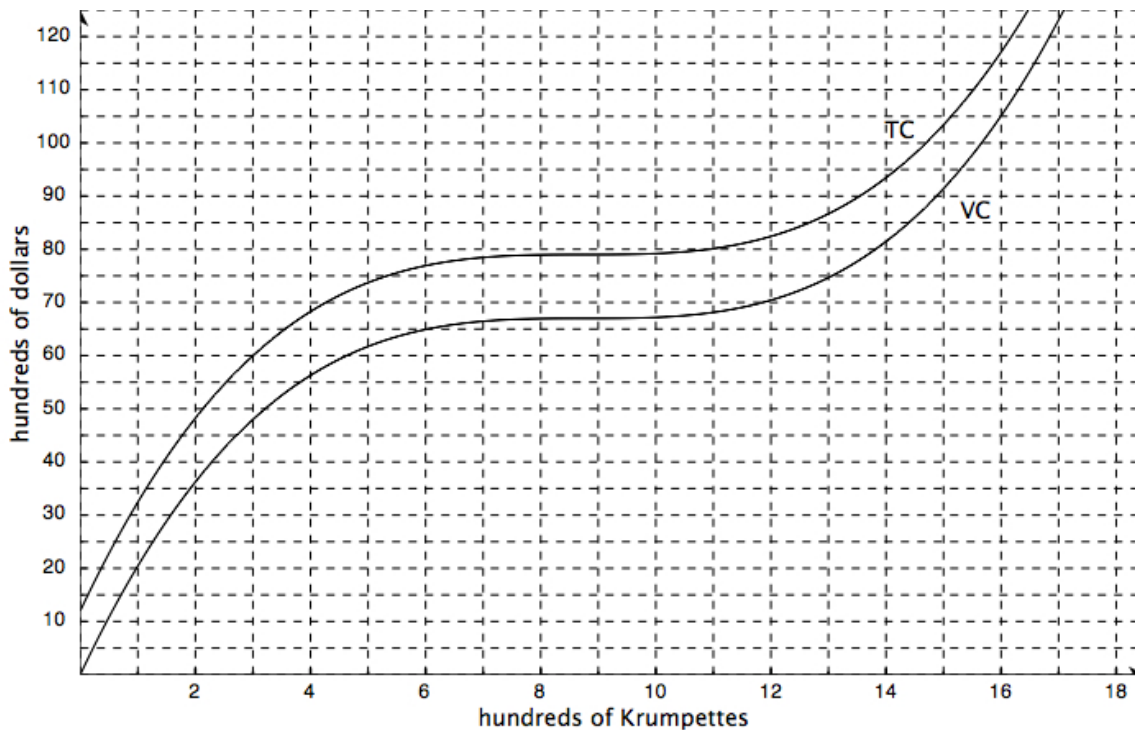
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1	18	
2	10	
3	10	
4	13	
5	10	
6	12	
7	15	
8	12	
Total	100	

- Check that your exam contains 8 problems.
- Please turn your cell phone OFF and put it away for the duration of the exam.
- Unless otherwise indicated, you must show your work. The correct answer with no supporting work may result in no credit.
- On problems that require you to work with a graph, show your work by clearly marking all lines and points that you use.
- If you use a guess-and-check method when an algebraic method is available, you may not receive full credit.
- Unless otherwise specified, you may round your **final answer** to two digits after the decimal.

GOOD LUCK!

1. (18 points) You sell Krumpettes. Below are the graphs of total cost and variable cost (in **hundreds** of dollars) for producing q **hundred** Krumpettes.



- (a) Compute the breakeven price.

ANSWER: \$ _____ per Krumpette

- (b) Find the quantity at which the average variable cost is \$11 per Krumpette.

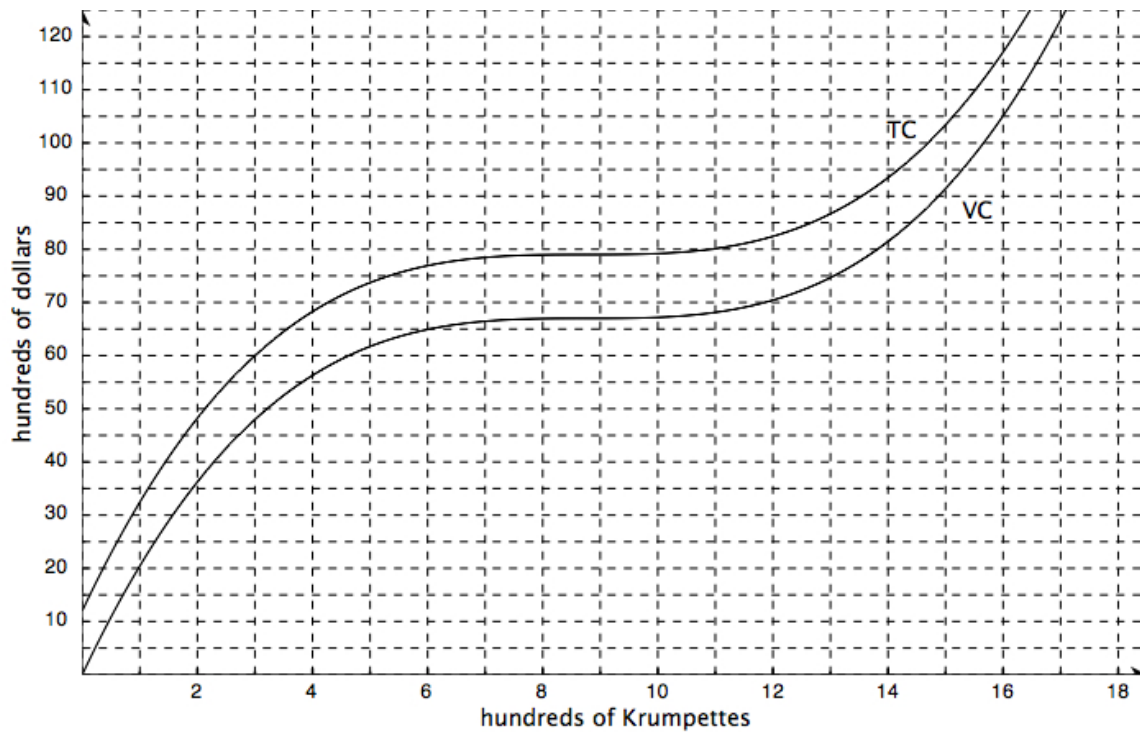
ANSWER: $q =$ _____ hundred Krumpettes

- (c) Estimate the marginal cost at $q = 15$ hundred Krumpettes. Give units with your answer.

ANSWER: $MC =$ _____, UNITS: _____

THIS QUESTION IS CONTINUED ON THE NEXT PAGE.

Here are the graphs of TC and VC for selling Krumpettes again.



Suppose that Krumpettes sell for \$7.50 each.

(e) Name the largest interval on which you do not lose money.

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

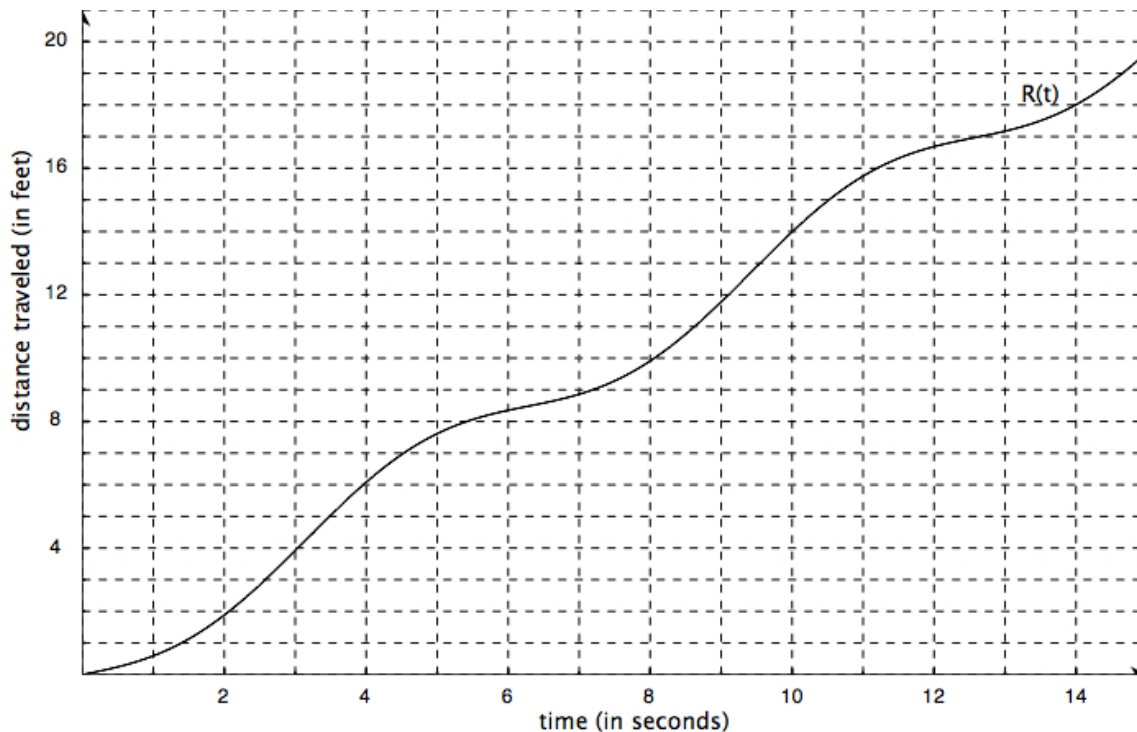
(f) Name all quantities at which marginal revenue is equal to marginal cost.

ANSWER: $q =$ _____ hundred Krumpettes

(g) What is the largest possible value of profit? Give units with your answer.

ANSWER: profit = _____, UNITS: _____

2. (10 points) Two toy cars, one red and one green, travel along a long straight track. The graph of $R(t)$, the distance in feet that the red car travels in t seconds, is given below.



- (a) Translate into English: $\frac{R(14)}{14} = 1.29$.

TRANSLATION:

- (b) Translate into functional notation: The red car travels farther in the time period from 1 to 5 seconds than in the time period from 2 to 6 seconds.

TRANSLATION:

- (c) The green car is next to the red car at $t = 0$ and travels at a constant rate of 1.25 feet per second. Let $G(t)$ represent the green car's distance traveled in the first t seconds. Determine whether each of the following is true or false.

Circle One

T F After $t = 0$, the green car is always ahead of the red car.

T F The two cars have the same average trip speed at $t = 10$.

T F $\frac{R(8)-R(4)}{4} < \frac{G(8)-G(4)}{4}$

3. (10 points) You produce and sell frozen Apple Pies. Each Pie costs you a constant amount $\$c$ to produce, and it sells at a constant market price $\$p$. Your fixed costs are $\$f$.

- (a) Write down the formulas for your total cost for producing q Pies and your total revenue from selling q Pies. You need not show any work. (Your formulas should involve the constants f , c , and p , and the variable q .)

ANSWERS: $TC(q) =$ _____, $TR(q) =$ _____

- (b) Find the quantity q that you need to produce and sell in order to make a profit of $\$100$. (Your quantity should be an expression in terms of the constants c , f , and p .)

ANSWER: $q =$ _____ Pies

- (c) Find the quantity q that you need to produce and sell in order to make a profit of $\$100$, if your fixed costs are $\$460$, each Pie costs $\$3$ to produce, and the market price is $\$7$ per Pie.

ANSWER: $q =$ _____ Pies

4. (13 points) Mary stands on a cliff and throws a rock toward the sea. At t seconds from the moment it was thrown, the height $H(t)$ of the rock above the sea level is given by the formula:

$$H(t) = -16t^2 + 25t + 15 \text{ (in feet).}$$

- (a) How high above the sea level is the rock at the moment when Mary throws it?

ANSWER: _____ feet

- (b) What is the greatest height of the rock above the sea level?

ANSWER: _____ feet

- (c) At what time does the rock splash into the sea?

ANSWER: _____ seconds

- (d) Ten seconds after throwing the first rock, Mary throws another rock toward the sea. The second rock happens to travel through the air exactly the same way as the first rock, just 10 seconds later. Write down the formula for the height of the second rock in terms of t , the number of seconds after the **first** rock was thrown. Simplify your answer so that it is in the form $at^2 + bt + c$.

ANSWER: () t^2 + () t + ()

5. (10 points) Suppose you invest $\$P$ with an effective annual interest rate of 2% per year so that, after t years, your balance is

$$A(t) = P(1.02)^t.$$

In each of the following questions, the value of P will be different. You should not use a value of P from one question to solve another.

- (a) What is the proportionate change in your balance from $t = 3$ to $t = 3.2$ years? (Round your final answer to three digits after the decimal.)

ANSWER: _____

- (b) Suppose that, after 5 years, your balance has grown to \$2345. Compute your balance 6 months later.

ANSWER: \$ _____

- (c) Suppose that your balance after ten years is \$1234. By how many dollars did your balance increase from $t = 7$ to $t = 8.5$ years?

ANSWER: \$ _____

6. (12 points)

- (a) A house purchased for \$295,000 appreciates in value by $r \times 100\%$ each year. After seven years, the house sells for \$367,000. Find the value of r .

ANSWER: $r =$ _____

- (b) A strain of bacteria doubles its population every ten minutes. If there are 260 million bacteria now, how many were there 42 minutes ago?

ANSWER: _____ million bacteria

- (c) Stock in a small business increases in value by 25% per year. Julie bought \$3000 worth of stock four years and nine months ago. What is her stock worth today?

ANSWER: \$ _____

7. (15 points) You have \$10,000 to invest and are comparing three investment options:

Account *A*: paying 8% a year in simple interest

Account *B*: paying 6.6% a year, compounded daily

Account *C*: paying 6.55% a year, compounded continuously

- (a) Suppose you plan to invest your money for a period of two years. Compare the balance you would have in each account and circle which account would be best.

Give each balance and circle the best account:

A: \$ _____ B: \$ _____ C: \$ _____

- (b) Suppose you plan to invest your money for a period of ten years. Compare the balance you would have in each account and circle which account would be best.

Give each balance and circle the best account:

A: \$ _____ B: \$ _____ C: \$ _____

- (c) What is the annual percentage yield (*APY*) of Account C?

ANSWER: _____%

8. (12 points)

- (a) You deposit \$50,000 in an account paying 9.8% a year compounded continuously, and you intend to retire when your account's balance reaches 1.5 million dollars. How long will you have to wait before retirement?

ANSWER: _____ years

- (b) You deposit \$50,000 in an account paying 9.8% a year compounded quarterly, and you intend to retire when your account's balance reaches 1.5 million dollars. How long will you have to wait before retirement?

ANSWER: _____ years

- (c) You have \$50,000 to invest and you want to retire in 40 years with \$2 million. If you invest the entire \$50,000 in an account whose interest is compounded monthly, what minimal annual interest rate should the account be offering so that your balance 40 years from now is 2 million dollars?

ANSWER: _____%