

MATH 111 - Autumn 2005  
Final Exam  
December 10, 2005

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.”

SIGNATURE: \_\_\_\_\_

1	16	
2	18	
3	10	
4	16	
5	16	
6	12	
7	12	
Total	100	

- Check that your exam contains seven 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.

GOOD LUCK!

1. (16 points)

- (a) An account bears interest of 7.1% annually, compounded quarterly. What is the present value of \$1 ten years from now?

ANSWER: \$\_\_\_\_\_

- (b) An account bears interest of 6.9% annually, compounded every four months. Compute the APY for this account.

ANSWER: APY = \_\_\_\_\_%

- (c) An account bears interest of 5.4% annually, compounded monthly. What is the percentage change in the balance over any six-month period?

ANSWER: \_\_\_\_\_%

- (d) An account bears interest of 4.7% per year, compounded semi-annually. If you deposit \$1700 in the account today, when would the balance be \$7220?

ANSWER: \_\_\_\_\_years

2. (18 points) Money is held in two accounts.

**Account A:** Compounded continuously at an annual rate of  $(r \cdot 100)\%$

**Account B:** Compounded every two months at an annual rate of  $(r \cdot 100)\%$

- (a) By what factor is the balance in Account A at the end of 4 years multiplied to get the balance 9 months later?

ANSWER: \_\_\_\_\_

- (b) Find the value of  $r$  that makes the following statement true: The balance in Account A quadruples every 12 years.

ANSWER:  $r =$  \_\_\_\_\_

- (c) Find the value of  $r$  that makes the following statement true: The APY of Account B is 3.45%.

ANSWER:  $r =$  \_\_\_\_\_

- (d) Suppose  $r = 0.045$  and you have \$5,000 to deposit into Account B. Compute how much interest the account earns in one year and when the account will have earned exactly one-half that much interest.

ANSWERS: interest = \$ \_\_\_\_\_;  $t =$  \_\_\_\_\_ years

3. (10 points) Suppose  $S(k)$  is an additive sequence with increment 7.

(a) Write an equation that relates  $S(k)$  to  $S(k + 1)$ .

ANSWER: \_\_\_\_\_

(b)  $T(k)$  is a sequence with the following property:

$$T(0) = 6S(0) - 5, T(1) = 6S(1) - 5, T(2) = 6S(2) - 5, \dots$$

Is  $T(k)$  an additive sequence? If so, find its increment.

ANSWER: (circle one) yes no ; increment=\_\_\_\_\_

(c)  $T(17) = 750$ . Compute the value of  $T(200)$ .

ANSWER:  $T(200) =$  \_\_\_\_\_

4. (16 points) You sell things. The total revenue ( $TR$ ) and average cost ( $AC$ ) are given in dollars as functions of quantity  $q$  by

$$TR(q) = 60q - 3q^2 \quad AC(q) = \frac{30}{q} + 14 - 2q.$$

- (a) What is the value of your fixed cost?

ANSWER: \_\_\_\_\_ dollars

- (b) Find the quantity  $q$  at which the average variable cost ( $AVC$ ) is \$10 per thing.

ANSWER:  $q =$  \_\_\_\_\_ things

- (c) What is the marginal revenue ( $MR$ ) at  $q = 3$ .

ANSWER:  $MR(3) = \$$ \_\_\_\_\_

- (d) Find the quantity that gives the maximum profit.

ANSWER:  $q =$ \_\_\_\_\_ things

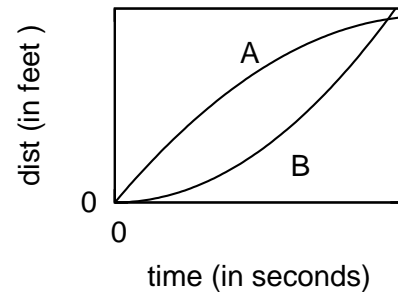
5. (16 points)

Two abnormally fast runners travel on a long straight trail. We have formulas for the distance traveled (in feet) by each runner after  $t$  seconds:

$$A(t) = -t^2 + 50t$$

$$B(t) = 1.3t^2$$

The graphs for the distance *vs.* time are given.



(a) Find two times at which runner  $A$  is ahead of runner  $B$  by a distance of 50 ft.

ANSWER:  $t =$  \_\_\_\_\_ sec and  $t =$  \_\_\_\_\_ sec

(b) Find a formula for the average speed of runner  $A$  from time  $t$  to  $t + 5$ . Simplify as much as possible.

ANSWER: Average Speed = \_\_\_\_\_

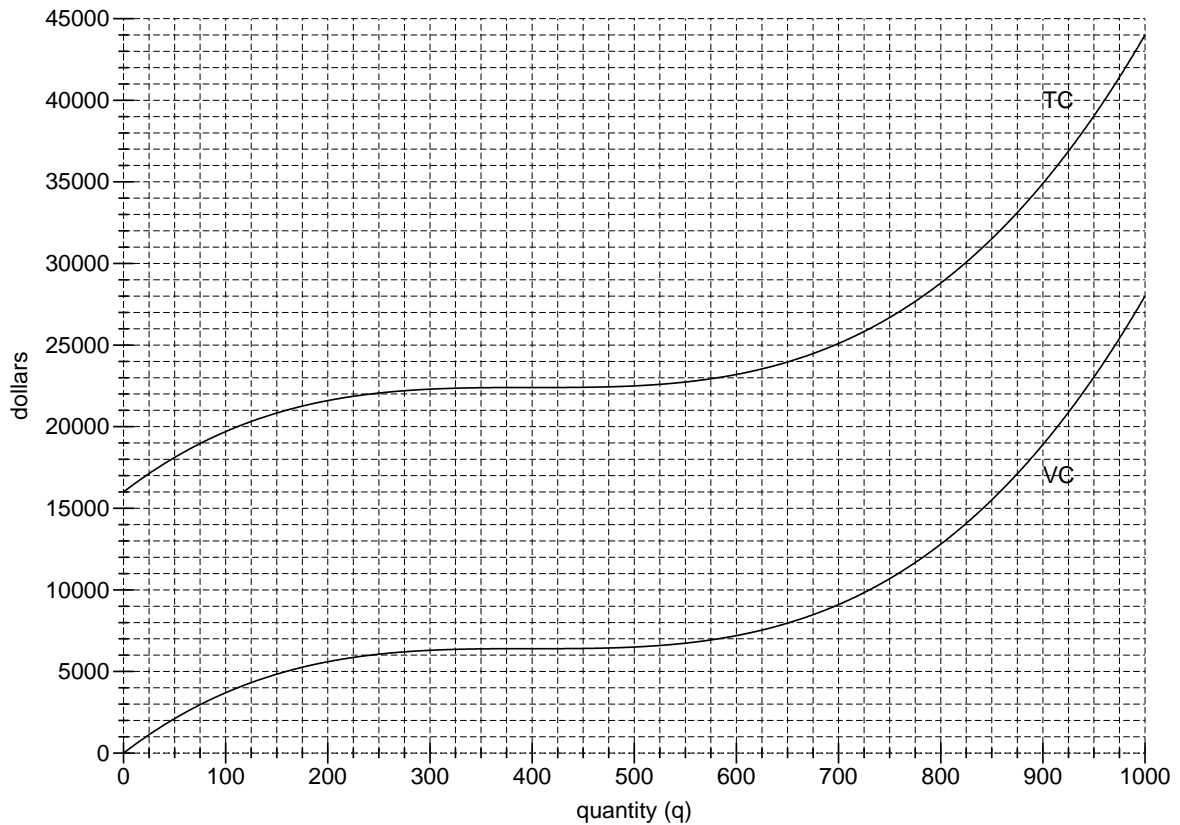
(c) Find the greatest difference that runner  $A$  is ahead of runner  $B$ .

ANSWER: \_\_\_\_\_ feet

(d) Find a time when the Average Trip Speed for runner  $A$  is 40 feet per second.

ANSWER:  $t =$  \_\_\_\_\_ sec

6. (12 points) You make and sell Gizmos. Your total costs and variable costs are shown in the figure below.



- (a) Suppose the market price for Gizmos is \$70. At what quantity  $q$  would you break even?

ANSWER:  $q =$  \_\_\_\_\_ Gizmos

- (b) Find the market price if your profit at  $q = 700$  is \$5,000.

ANSWER: \$ \_\_\_\_\_

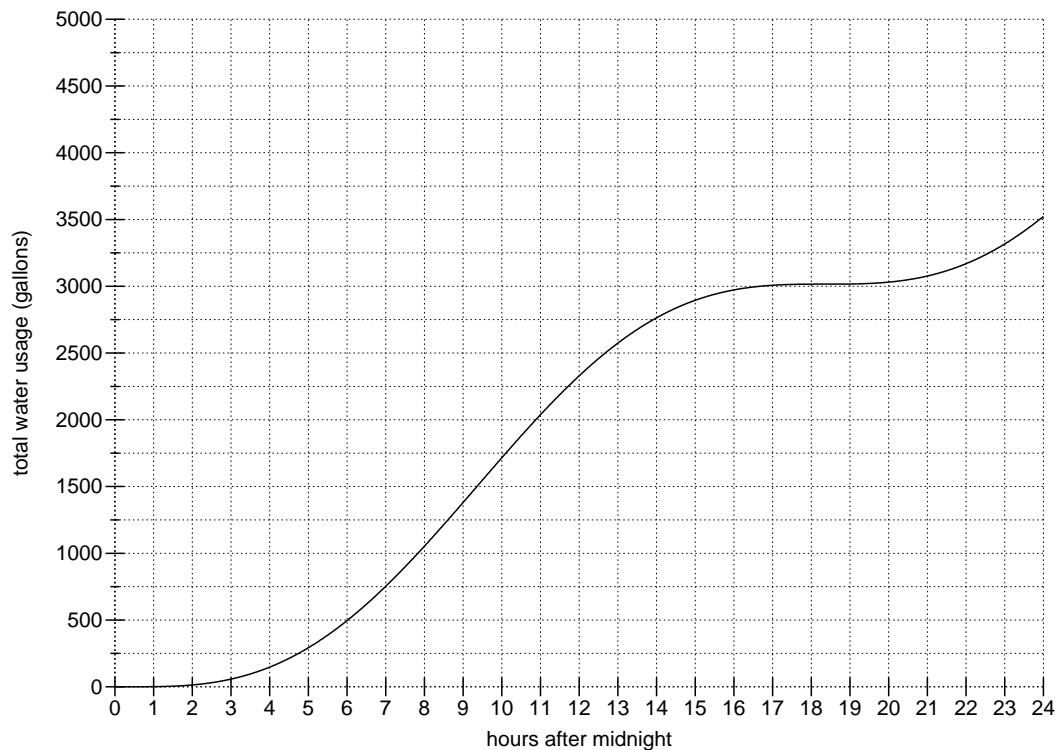
- (c) Find the shutdown price (SDP).

ANSWER: \$ \_\_\_\_\_

- (d) Find the marginal cost at  $q = 100$ .

ANSWER: \$ \_\_\_\_\_

7. (12 points) A town is using water from a reservoir that is being refilled with a system of aquaducts. The graph below shows the total water drawn from the reservoir over the course of a day, starting at midnight.



- (a) Name a time when the overall average rate of water usage was 150 gallons per hour.

ANSWER:  $t =$  \_\_\_\_\_ hours after midnight

- (b) Suppose the reservoir was empty at midnight and was being filled by the aquaduct at a constant rate. How small could that rate be and provide enough water for the town during this 24 hour period?

ANSWER: \_\_\_\_\_ gallons per hour

- (c) Suppose that the reservoir had 3000 gallons at midnight and was being filled by the aquaduct at a constant rate. How small could that rate be and provide enough water for the town during this 24 hour period?

ANSWER: \_\_\_\_\_ gallons per hour

- (d) Suppose the aquaduct was filling the reservoir at a constant rate of 100 gallons per hour. How much water would there have to be in the reservoir at midnight for the town to get all the water it needed?

ANSWER: \_\_\_\_\_ gallons