

MATH 111 - Autumn 2006
Final Exam
December 9, 2006

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	20	
2	10	
3	15	
4	15	
5	12	
6	16	
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.
- Unless otherwise specified, you may round your **final answer** to two digits after the decimal.

GOOD LUCK!!

1. (20 points)

- (a) You want to retire in 30 years with \$2 million. How much money do you need to invest now in an account paying 8% per year, compounded monthly?

ANSWER: \$_____

- (b) A bacteria population doubles every two hours. If you start with 10,000 bacteria now, how many bacteria do you have one hour later? (Give a whole number of bacteria for your answer.)

ANSWER: _____ bacteria

- (c) You buy a computer for \$800 today. Your computer **depreciates** by 40% each year. How much can you sell it for in a year and a half?

ANSWER: \$_____

(d) Inflation is 3% per year. What is the future value of a \$9 movie ticket 15 years from now?

ANSWER: \$_____

(e) You deposit \$10,000 into a bank account paying 8% interest per year. How much money do you have after 15 months, if the interest paid by the bank is simple interest?

ANSWER: \$_____

2. (10 points) You have \$10,000 to invest for a duration of 5 years, and a choice of two investments.

Account A: You first pay a one-time fee of 10% of your investment in management fees, and then the rest of your money earns 9.5% per year, compounded continuously.

Account B: Has no fees, and pays 8% per year, compounded semi-annually.

Compute the balance you'd have in each of the accounts after 5 years, and determine which account you should choose.

ANSWERS: balance in account A: \$_____

balance in account B: \$_____

You should choose: (circle one) Account A Account B

3. (15 points) Wendy is training to run the marathon. When she starts her training, she can run 2 miles. Each day, she pushes herself to run 7% farther than the previous day. Let $D(k)$ denote the distance Wendy runs on the k^{th} day of her training program. ($D(0) = 2$.)

(a) Circle the number (i or ii) corresponding to the true statement and fill in the corresponding blank. (You need not show any work.)

The daily distances run by Wendy, $D(k)$, form:

i. an additive sequence with increment $I =$ _____

ii. a multiplicative sequence with multiplier $m =$ _____

(b) Write the recursive and explicit formulas for the sequence $D(k)$. (You need not show any work.)

ANSWERS: recursive: _____

explicit: _____

(c) What is the proportionate change in the distance run by Wendy over 1 week?

ANSWER: _____

(d) After how many days can Wendy run a half-marathon (13 miles)? (Give a whole number of days for your answer.)

ANSWER: _____ days

(e) If Wendy starts by running 2 miles on day 0 and runs farther by a certain percentage $(p \times 100)\%$ each day, what such percentage will allow her to run 13 miles after 20 days?

ANSWER: $(p \times 100)\% =$ _____%

4. (15 points) You produce and sell Husky T-shirts, in batches of one to a hundred shirts. You sell your shirts on a linear price scale: if someone buys q T-shirts, you charge them $p = -0.05q + 12$ dollars per T-Shirt. Your fixed costs are \$100, and each T-shirt costs you \$5 to produce.

(a) Find formulas, in terms of the quantity q , for the following functions. Simplify your formulas.

i. your total revenue

ANSWER: $TR(q) =$ _____

ii. your total cost

ANSWER: $TC(q) =$ _____

iii. your profit

ANSWER: $P(q) =$ _____

(b) What is your largest possible profit?

ANSWER: \$ _____

(c) Compute your marginal revenue at $q = 70$ T-shirts.

ANSWER: $MR(70) =$ \$ _____

(d) What is the smallest whole number of T-shirts produced and sold for which you make a (positive) profit?

ANSWER: $q =$ _____ T-shirts

5. (12 points) You sell Morkles. The following chart gives values of marginal revenue and marginal cost.

q (in Morkles)	0	1	2	3	4	5	6	7	8	9	10	11	12
MR (in dollars)	20	18.61	17.22	15.83	14.44	13.06	11.67	10.28	8.89	7.50	6.11	4.72	3.33
MC (in dollars)	10	7.81	6.25	5.31	5	5.31	6.25	7.81	10	12.81	16.25	20.31	25

- (a) Fixed costs are \$478. What is the total cost to produce 4 Morkles?

ANSWER: \$ _____

- (b) Give the longest interval over which **profit** is increasing. (You need not show any work.)

ANSWER: from $q =$ _____ to $q =$ _____ Morkles

You also sell Flotides. Flotides sell for a market price of \$2.50 each and the total cost (in dollars) for producing q Flotides is given by

$$TC(q) = 0.001q^3 - 0.05q^2 + 2.5q + 526.$$

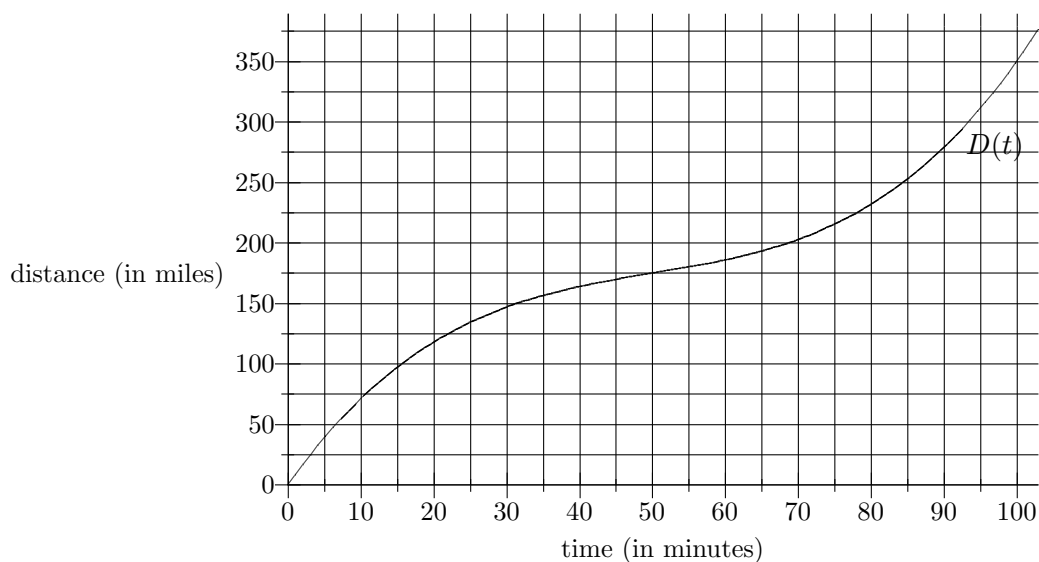
- (c) Find the quantity (other than $q = 0$) at which the **variable cost** for producing Flotides is the same as the **total revenue**.

ANSWER: $q =$ _____ Flotides

- (d) Recall that the shutdown price is the lowest value of average variable cost. Find the shutdown price for producing Flotides.

ANSWER: \$ _____

6. (16 points) The graph below is of distance versus time for an extremely fast car.



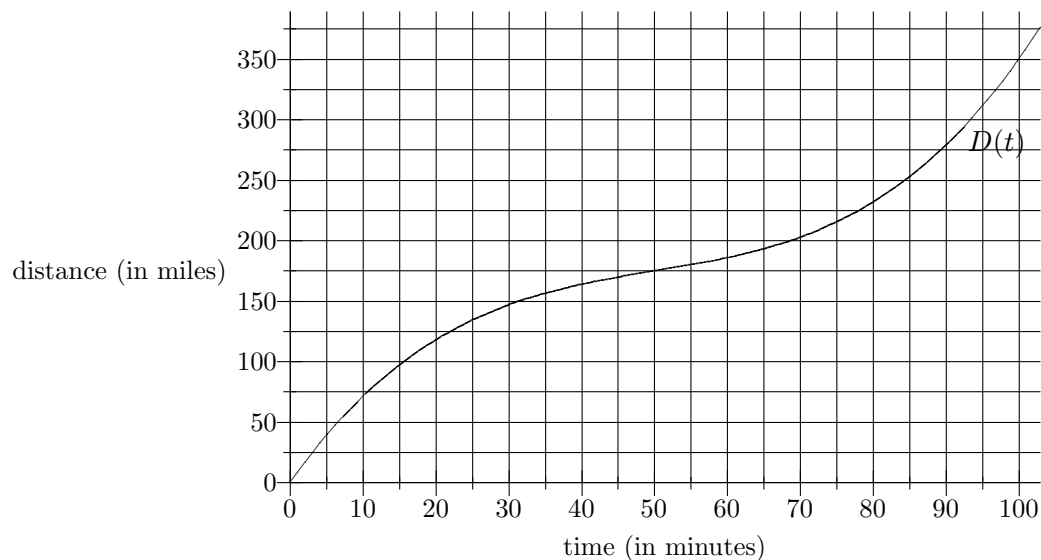
- (a) Find the average speed over the interval from $t = 25$ to $t = 35$.

ANSWER: _____ miles per minute

- (b) Find the lowest value of average trip speed.

ANSWER: _____ miles per minute
(This question is continued on the next page.)

Here's that graph again.



- (c) Translate the following statement into functional notation and then find a value of t that makes the statement true.

The car's average trip speed after t minutes is 3 miles per minute.

TRANSLATION:

ANSWER: $t =$ _____ minutes

- (d) Translate the following statement into English and then find a value of t that makes the statement true.

The slope of the secant line through the distance graph at t and $t + 10$ is 2.

TRANSLATION:

ANSWER: $t =$ _____ minutes

7. (12 points) Two balloons, A and B , rise and descend vertically. Their respective altitudes (heights above ground) are given by the following functions of time:

$$A(t) = -t^2 + 60t \text{ and } B(t) = 0.5t^2 - 10t + 75.$$

The time t is measured in minutes, and the altitudes $A(t)$ and $B(t)$ are measured in feet.

- (a) When is balloon A 10 feet higher than balloon B for the first time (if ever)?

ANSWER: $t =$ _____ minutes

- (b) Find the incremental rate of change in altitude for balloon A from $t = 1$ minute to $t = 3$ minutes. What are the units?

ANSWER: _____ Units: _____

- (c) Another balloon, C , is always the same height that balloon B was 3 minutes earlier. Find a formula for $C(t)$, balloon C 's altitude in feet after t minutes. Simplify your formula until it is in the form $C(t) = at^2 + bt + c$.

ANSWER: $C(t) =$ _____