

MATH 111
Final Exam
December 6, 2008

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.”

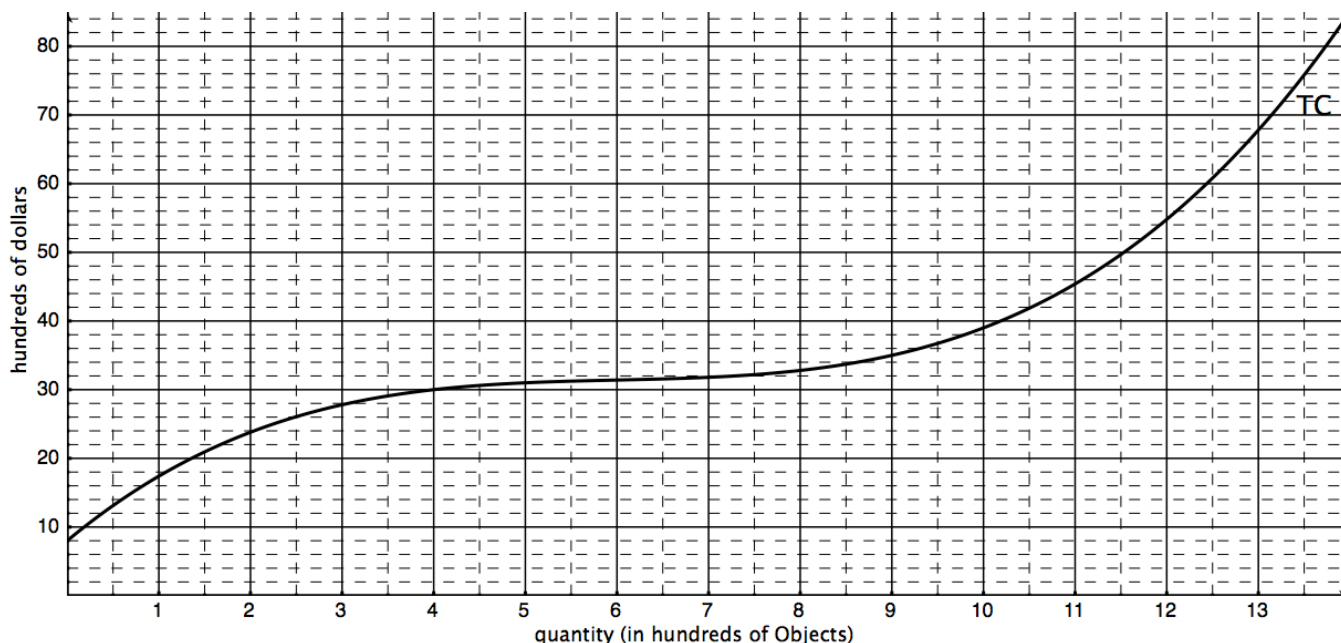
SIGNATURE: _____

1	16	
2	17	
3	14	
4	16	
5	16	
6	21	
Total	100	

- This exam consists of this cover page, followed by 6 problems on 7 pages. Check that you have a complete exam.
- 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 or read a value from a graph on your calculator 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. (16 points) You sell Objects. Below is the graph of total cost (in **hundreds** of dollars) for producing q **hundred** Objects.



- (a) Find the smallest value of **average cost**.

ANSWER: \$ _____ per Object

- (b) Compute the **average variable cost** to produce 850 Objects.

ANSWER: \$ _____ per Object

- (c) Find a value of q at which $TC(q) - TC(3) = 14$ hundred dollars.

ANSWER: $q =$ _____ hundred Objects

- (d) Give the largest interval over which **marginal cost** is decreasing. (You need not show any work.)

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

- (e) Suppose that Objects sell for \$5.25 each. Sketch and label the graph of **total revenue** and find:

- i. a quantity at which **average revenue** is equal to **average cost**.

ANSWER: $q =$ _____ hundred Objects

- ii. the largest possible **profit**.

ANSWER: _____ hundred dollars

2. (17 points) A car moves so that its distance traveled in t minutes is given by the formula

$$A(t) = -0.12t^2 + 2.4t \text{ miles.}$$

- (a) How long does it take the car to travel the first 7 miles?

ANSWER: _____minutes

- (b) Find a time at which the car's average trip speed is 1.404 miles per minute.

ANSWER: $t =$ _____minutes

- (c) Write out a formula for the car's average speed over the h -minute interval beginning at $t = 5$. Simplify as much as possible. (Your answer should be a formula in terms of h .)

ANSWER: average speed = _____

- (d) A second car moves so that its distance traveled is a **linear function** of time. The two cars are next to each other at $t = 0$ and $t = 10$. Let $B(t)$ be the formula for the distance traveled by this second car in t minutes. Find the formula for $B(t)$.

ANSWER: $B(t) =$ _____

- (e) Find the time in the first ten minutes at which the cars are farthest apart.

ANSWER: $t =$ _____minutes

3. (14 points) You produce and sell Scrapkins. The formulas for marginal cost, average cost, and average variable cost (each in **dollars per Scrapkin**) for producing q **thousand Scrapkins** are:

$$MC(q) = 0.3q^2 - 3.6q + 11.1$$

$$AC(q) = 0.1q^2 - 1.8q + 11.1 + \frac{12}{q}$$

$$AVC(q) = 0.1q^2 - 1.8q + 11.1.$$

- (a) What is the shutdown price for producing Scrapkins?

ANSWER: \$ _____ per Scrapkin

- (b) What is the **change in total cost** if quantity changes from 7,000 to 7,001 Scrapkins? Include units with your answer.

ANSWER: _____ UNITS: _____

- (c) Compute your **fixed costs**. Include units with your answer.

ANSWER: $FC =$ _____ UNITS: _____

- (d) You sell Scrapkins at a price of \$13.50 per Scrapkin. Find the quantity that maximizes profit.

ANSWER: $q =$ _____ thousand Scrapkins

4. (16 points) Anna, Bob, and Chuck just got hired by the Buy N Large Company. All three will start work on January 1, 2009, at the same initial annual salary of \$44,000. But, they each negotiated a different employment contract:

- Anna will receive a 5% raise at the end of each year of employment;
- Bob will receive a \$2,500 raise at the end of each year of employment;
- Chuck will receive a 2.2% raise every six months.

Let $A(k)$ denote Anna's annual salary, $B(k)$ denote Bob's annual salary, and $C(k)$ denote Chuck's annual salary after k years of employment at Buy N Large.

- (a) Determine if each of the sequences $A(k)$, $B(k)$, $C(k)$ is additive, multiplicative, or neither:

i. The sequence $A(k)$ is:

_____ additive with increment $r =$ _____
 _____ multiplicative with multiplier $m =$ _____
 _____ neither

ii. The sequence $B(k)$ is:

_____ additive with increment $r =$ _____
 _____ multiplicative with multiplier $m =$ _____
 _____ neither

iii. The sequence $C(k)$ is:

_____ additive with increment $r =$ _____
 _____ multiplicative with multiplier $m =$ _____
 _____ neither

- (b) Compute Chuck's annual salary after 10 years of employment at Buy N Large.

ANSWER: \$ _____

- (c) After how many years will Bob's annual salary be \$59,000?

ANSWER: after $k =$ _____ years

- (d) What is the first calendar year when Anna will make an annual salary of at least \$100,000?

ANSWER: in the year 2 _____

5. (16 points) A bacteria colony triples its population every two hours.

(a) Compute the present population of 1,500,000 bacteria 15 hours from now.

ANSWER: _____ bacteria

(Round your answer to the nearest whole number of bacteria.)

(b) If the colony contains 5,000 bacteria at 11 a.m., how many bacteria will it have at 7 p.m.?

ANSWER: _____ bacteria

(c) Compute the percentage change in the bacteria population over a 12-hour time interval.

ANSWER: percentage change = _____%

(d) How long (in hours) does it take for this bacteria colony to quadruple its population?

ANSWER: _____ hours

6. (21 points)

- (a) What is the future value of \$50,000, 10 years from now, if it is placed in a bank account with a nominal annual rate of 8%, compounded quarterly?

ANSWER: \$ _____

- (b) An account pays interest of 7% annually, compounded continuously. How much money should you deposit in this account in order to have \$100,000 eight years from now?

ANSWER: \$ _____

- (c) Compute the annual percentage yield of a bank account, Account C, paying 9.2% annually, compounded continuously.

ANSWER: _____%

- (d) Another account, Account D, pays 9.5% annually, compounded semiannually. Which account is better for a deposit: Account C (from part (c)) or Account D?

ANSWER: _____ is better

- (e) In an account that pays **simple** interest of 3% **every six months**, what is the future value of \$5,000, five and a half years from now?

ANSWER: \$_____

- (f) An account pays interest at the nominal annual rate of $(r \times 100)\%$, compounded continuously. Suppose the balance in this account gets doubled every 5 years. What is the value of r ?

ANSWER: $r =$ _____

(Round your answer to four digits after the decimal.)

- (g) You deposit \$10,000 in a bank account that pays 8.4% annually, compounded twice a year. How much interest, in **dollars**, do you earn during the second year of your deposit (from 1 to 2 years)?

ANSWER: \$_____