

NAME: _____

QUIZ SECTION: _____

Student ID #: _____

**Math 111 -- Winter 2007
Final Exam**

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: _____

INSTRUCTIONS:

- When the exam starts, verify that your exam contains **8 pages** (including this coverage).
- Please turn your cell phone OFF and put it away for the duration of the exam.
- Unless otherwise indicated, you **must show your work in order to get full credit**. The correct answer with incorrect or missing work may result in little or no credit.
- On problems in which you use a graph, show your work by clearly drawing & labeling any lines and points you use.
- If you use a graphing calculator or a guess-and-check method when an algebraic method is available, you will not receive full credit.
- Unless otherwise specified, you may round your **final answer** to two decimal digits.
- You are allowed to use a calculator, a ruler, and one sheet of notes. You have 3 hours for this exam.

GOOD LUCK!!

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Total:	100	

1. (16 Points)

a) The Seattle Metropolitan Area had 2,414,616 residents in the year 2000. Assuming the population increases at the rate of 2.1% each year, how many residents will the Seattle Metropolitan Area have in the year 2030?

Answer: _____ residents.

b) The average car depreciates (goes down in value) by 19% each year. If you buy a \$30,000 car today, how much can you expect to sell it for after six and a half years?

Answer: \$_____

a) How much money should you deposit in a bank account paying 10% interest each year (compounded annually) in order to have \$11,000 after 20 months?

Answer: \$_____

d) A bacteria colony triples its population every 4 hours. If there are 300 bacteria in the colony at 9 a.m., how many bacteria will be in the colony at 6 p.m. on the same day?

Answer: _____ bacteria.

2. (16 pts) Consider the following two bank accounts:

Account A: has an annual rate of $r \times 100\%$, compounded quarterly (4 times a year).

Account B: has an annual rate of 8%, compounded continuously.

a) What is the annual percentage yield (APY) of account B?

Answer: APY = _____%

b) Suppose the balance in account A triples every 10 years. What is the interest rate $r \times 100\%$ of account A?

Answer: $r \times 100\%$ = _____%

c) How long will it take to double your balance in account B?

Answer: _____ years.

d) What is the percentage change in the balance of account B over any half year?

Answer: _____%

3. (10 pts) This problem has three parts. In each part, you are given the first few terms of a sequence and you are asked to determine whether the given sequence is additive, multiplicative or neither (justify your claim). If it's additive, list the increment and compute the 100th term of the sequence; if it's multiplicative, list the multiplier and compute the 100th term of the sequence.

a) Sequence A: **2, 3.1, 4.2, 5.3, 6.4, 7.5, ...**

Which kind of sequence is A?

- additive with increment _____ where $A(0)=2$ and $A(100)=$ _____
- multiplicative with multiplier _____ where $A(0)=2$ and $A(100)=$ _____
- neither

Work:

b) Sequence B: **2, 2.1, 2.11, 2.111, 2.1111, 2.11111, ...**

Which kind of sequence is B?

- additive with increment _____ where $B(0)=2$ and $B(100)=$ _____
- multiplicative with multiplier _____ where $B(0)=2$ and $B(100)=$ _____
- neither

Work:

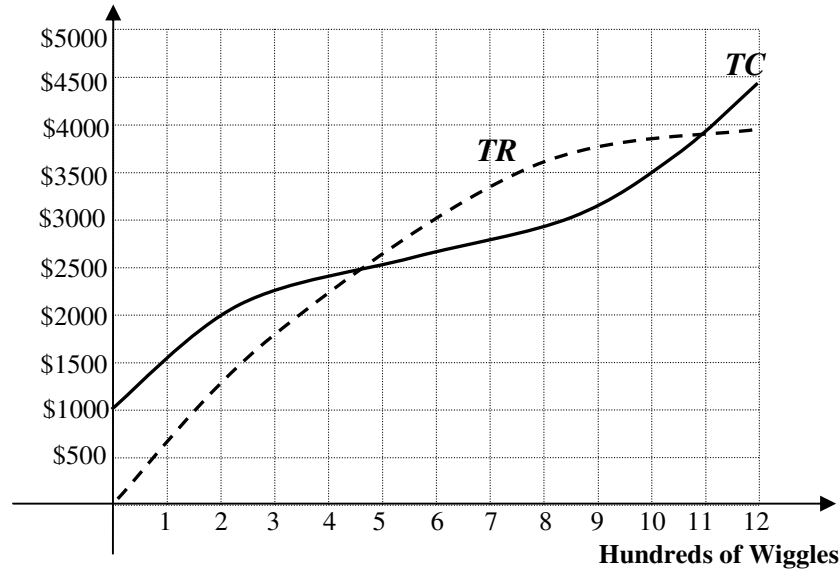
c) Sequence C: **2, 2.2, 2.42, 2.662, 2.9282, ...**

Which kind of sequence is C?

- additive with increment _____ where $C(0)=2$ and $C(100)=$ _____
- multiplicative with multiplier _____ where $C(0)=2$ and $C(100)=$ _____
- neither

Work:

4. (16 points) The graph below is of the total cost (TC) for your business of producing and selling Wiggles.



a) Find a quantity q which results in a profit of \$500.

Answer: $q =$ _____ hundred Wiggles.

b) Find a quantity q at which the marginal cost (MC) is equal to \$4 per Wiggle. Show your work on the graph.

Answer: At $q =$ _____ hundred Wiggles.

c) What is the average variable cost (AVC) per Wiggle if you produce 500 Wiggles?

Answer: _____ \$ per Wiggle.

d) The market conditions have changed, and each Wiggle sells for the market price of \$3.

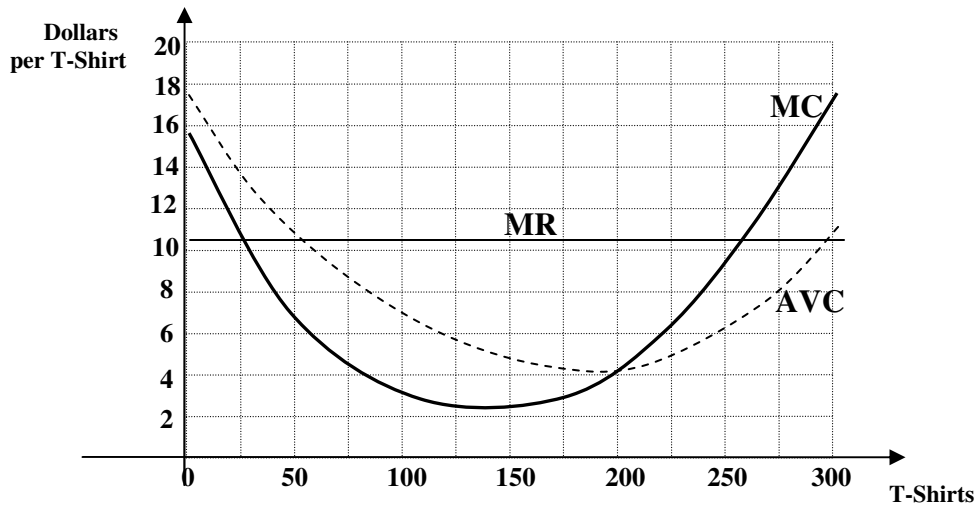
i) On the grid above, draw the graph of the total revenue in these market conditions. Label it "new TR".

ii) In these market conditions, is it better to produce a certain number of Wiggles or should you shut down and produce nothing? Justify.

Answer (pick one): Shut down and produce nothing

OR Produce about _____ hundred Wiggles

5. (12 pts) The graphs below represent the **marginal cost (MC)**, the **marginal revenue (MR)**, and the **average variable cost (AVC)** for a business which is producing and selling T-shirts.



a) Find all the quantities at which the average variable cost (AVC) is no more than \$6 per T-Shirt.

Answer: From _____ to _____ T-Shirts

b) Find the change in the total cost if you produce 101 T-Shirts instead of 100 T-Shirts.

Answer: $TC(101) - TC(100) =$ _____ dollars.

c) What quantity of T-Shirts produced and sold maximizes the profit?

Answer: Maximum profit is achieved at $q =$ _____ T-Shirts.

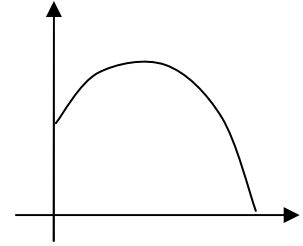
d) Find the shutdown price (SDP).

Answer: SDP = _____ \$ per T-shirt.

6. (18 pts) The amount of water in a vat, is given by the following function:

$$A(t) = -2t^2 + 10t + 5$$

where $A(t)$ denotes the water in vat, in gallons, and t is the time, in hours.



- a) (5 pts) What is the largest amount of water in this vat?

Answer: _____ gallons.

- b) (5 pts) During what time interval does this vat contain at least 6 gallons of water?

Answer: from _____ to _____ hours.

- c) (5 pts) Compute the average rate of change of the amount of water in this vat from 1 hour to 2.5 hours. Include correct units for your answer.

Answer: _____ Units: _____

- d) (3 pts) The amount of water in another vat, Vat B, after t hours is denoted by $B(t)$. We are told that **at all times Vat B contains as much water as Vat A contained 2 hours before.** Which of the following is the correct translation of this statement into functional notation? (circle the correct one, no need to explain your answer or show work)

- i. $B(t) = A(t) - 2$
- ii. $B(t) = A(t) + 2$
- iii. $B(t) = A(t + 2)$
- iv. $B(t) = A(t - 2)$

7. (12 pts) The average trip speed (ATS) of a certain car after t **seconds** is given by the following formula:

$$s(t) = \frac{10}{t} + 60 \text{ feet/sec.}$$

a) (2 pts) What is the average trip speed of this car after 1 **minute**?

Answer: _____ feet/sec

b) (2 pts) Find the formula, in terms of the time t , for the distance $D(t)$ covered by the car in t seconds.

Answer: $D(t) =$ _____ feet.

c) (4 pts) Find the value of t for which $D(t)=60$ feet.

Answer: At $t =$ _____ seconds

d) (4 pts) Another car has the following formula for its average trip speed vs. time: $p(t) = 1.5t + 2$ feet/sec. Find the time t when the average trip speed of the first car is twice the average trip speed of the second car (that is, find the time t when $s(t)=2p(t)$).

Answer: At $t =$ _____ seconds.