

Math 111 - Winter 2010
Final Exam
March 13, 2010

Name: _____

Quiz Section: _____

Student ID Number: _____

1	16	
2	16	
3	17	
4	17	
5	18	
6	16	
Total	100	

- You are allowed to use a calculator, a ruler, and one **hand-written** 8.5 by 11 inch page of notes.
- Check that your exam contains all the problems listed above.
- You must **show and explain your work** on all problems. Specifically, if you use the quadratic formula or vertex formula you must write out the formula with the appropriate numbers (you won't get full credit if you do it all in your head or all in your calculator). The correct answer with no supporting work may result in no credit. We need to see where your answers are coming from.
- Unless otherwise stated, round your final answers to two digits after the decimal point.
- If you need more room use the back of the previous page and indicate to the grader that you have done so.
- There are multiple versions of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated.
- Grades will be posted on the course website by Friday of finals week. You can pick up your graded final exam during any of my posted office hours spring quarter.

GOOD LUCK!

1. (16 pts) Consider three different bank accounts:

Account A: annual interest rate of 6%, compounded continuously

Account B: annual interest rate of 5.2%, compounded quarterly

Account C: annual interest rate of $(r \times 100)\%$, compounded continuously

Round all **final** answers to two digits after the decimal point.

(a) (4 pts) How much must you deposit in Account B in order to have \$40,000 in 12 years?

_____ dollars

(b) (4 pts) Sawyer deposits \$9000 in Account A today.

How much **interest** does Sawyer make in 3 years and 9 months?

_____ dollars

(c) (4 pts) What is the annual percentage yield (*APY*) for Accounts A and B?

APY for Account A = _____ %

APY for Account B = _____ %

(d) (4 pts) Kate invests \$2000 into Account C. At $t = 8$ years, she gets a bank statement that says the balance is exactly \$6250. What is interest rate for Account C?

$(r \times 100) \% =$ _____ %

2. (16 points)

- (a) (4 pts) A bacteria colony **triples** its population every 20 minutes. If there are 6500 bacteria in 1.5 hours from now, how many bacteria are in the colony now? (Round your answer to the nearest whole number of bacteria)

_____ bacteria

- (b) (4 pts) An account balance grows from \$650 to \$5000 over 20 years. If the account paid interest compounded semiannually (twice a year), what was the annual interest rate?

_____ percent

- (c) (4 pts) Hurley deposits \$525 into an account that pays 8.4% annually, compounded monthly. What is the percentage change in the balance over 6 months?

_____ percent

- (d) (4 pts) Jack deposits \$7800 into an account that pays 12% annually, compounded quarterly. How long will it take for the balance of the account to reach \$250,000?

_____ years

3. (17 points) After leaving Math 111, you get two job offers, **Job A** and **Job B**. Job A has a starting salary of \$44,800 and Job B has a starting salary of \$38,000. The two jobs use different methods to give yearly raises. The salaries at the end of each year for each job are given by the sequences:

Job A : 44800, 47100, 49400, 51700, ...

Job B : 38000, 39900, 41895, 43989.75, ...

- (a) (4 pts) Give the explicit formulas for the sequences A and B .

A : _____

B : _____

- (b) (2 pts) Give the percentage change in salary for Account B for any one year period.

percent change over 1 year = _____ percent

- (c) (2 pts) Give the salaries each job would pay at the end of the 15th year of employment.

$A(15)$ = _____ dollars

$B(15)$ = _____ dollars

- (d) (5 pts) Find how long it will take each salary to reach \$100,000. (Round to the nearest year).

Time for Job A salary to reach \$100,000 is _____ years

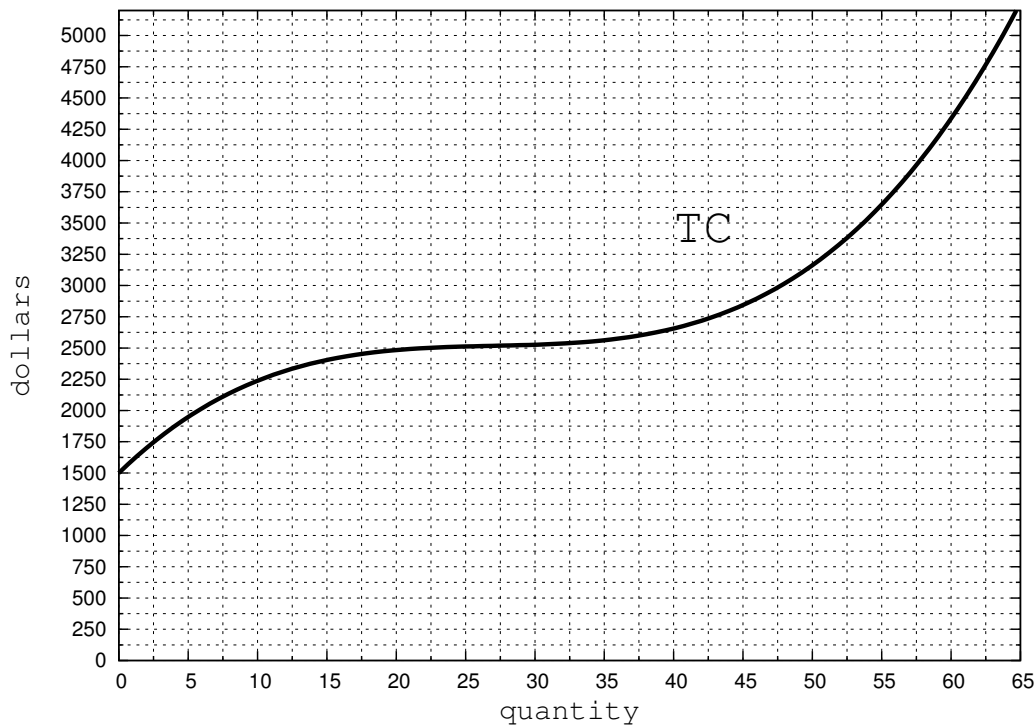
Time for Job B salary to reach \$100,000 is _____ years

- (e) (4 pts) The next day you get a third job offer, **Job C**. Job C has a starting salary of \$35,000 and a raise of 1.5% every 3 months.

Find the salary at the end of the 20th year of employment for Job C.

$C(20)$ = _____ dollars

4. (17 points) The following graph shows total cost (TC) for selling Things.



For each part, clearly explain your work in a sentence and label your work in the graph.

(a) (3 pts) Find the breakeven price (BEP).

$$BEP = \text{_____} \text{ dollars per Thing}$$

(b) (3 pts) Find the average (incremental) rate of change of total cost from $q = 50$ to $q = 60$.

$$\text{_____} \text{ dollars per Thing}$$

(c) (3 pts) Find all quantities when the **marginal cost** is 50 dollars per Thing

$$q = \text{_____} \text{ Things}$$

(d) (3 pts) Recall: $AVC(q) = \frac{VC(q)}{q}$. Find the **average variable cost** at $q = 10$ Things.

$$AVC(10) = \text{_____} \text{ dollars per Thing}$$

(e) Suppose the market price is fixed at 80 dollars per Thing.

i. (2 pts) Draw and **clearly label** the graph of total revenue.

ii. (3 pts) Find the quantity that gives maximum profit and the corresponding profit value.

$$q = \text{_____} \text{ Things}$$

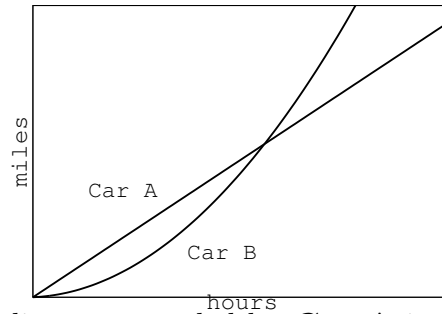
$$\text{MAX PROFIT} = \text{_____} \text{ dollars}$$

5. (18 points)

The distance, in miles, from some starting line for **Car A** and **Car B** at time t hours are respectively given by

$$D_A(t) = 45t \quad \text{and} \quad D_B(t) = 2t^2 + 3t.$$

The graphs of these functions are given.



(a) (4 pts) Find a time, other than $t = 0$, when the distance traveled by **Car A** is equal to the distance traveled by **Car B**.

$$t = \underline{\hspace{4cm}} \text{ hours}$$

(b) (4 pts) Find all times when the **average trip speed of Car A** exceeds the **average trip speed of Car B** by 15 miles per hour.

$$t = \underline{\hspace{4cm}} \text{ hours}$$

(c) (4 pts) Find the maximum distance that **Car A** ever gets ahead of **Car B**.

$$\underline{\hspace{4cm}} \text{ miles}$$

(d) (6 pts) Recall, in general, the **average speed (AS)** over the 5-minute interval starting at t is given by $AS(t) = \frac{D(t+5) - D(t)}{5}$. Find and completely simplify the formulas for the average speed over the 5-minute interval starting at t for both **Car A** and **Car B**.

$$AS_A(t) = \underline{\hspace{4cm}} \text{ mph}$$

$$AS_B(t) = \underline{\hspace{4cm}} \text{ mph}$$

