MATH 111
Final Exam
March 11, 2017

Name _____

Signature _____

Student ID #_____

Section _____

1	9	
2	13	
3	10	
4	12	
5	14	
6	13	
7	13	
8	16	
Total	100	

- You are allowed to use a Ti-30x IIS Calculator, a ruler, and one hand-written 8.5 by 11 inch page of notes. If we see a different calculator model, we will take it from you and you can get it back from us at the end of the final.

- You must show your work on all problems. The correct answer with no supporting work may result in no credit.

- Unless otherwise indicated, you may round your final answer to two digits after the decimal.

- If you need more room, use the backs of the pages and indicate to the reader that you have done so. If you still need more paper, please ask for some.

- Raise your hand if you have a question.

- Any student found engaging in academic misconduct, even if the copying is only on one part of one problem, will receive a score of 0 on the entire exam and will be reported to the College for academic misconduct.

- You have 2 hours and 50 minutes to complete the exam.

GOOD LUCK!

1. (9 points) Karl is riding his bicycle on a straight path. His distance function is given below. Mark any lines you draw on the graph so we can follow your work. Give units with your answers.
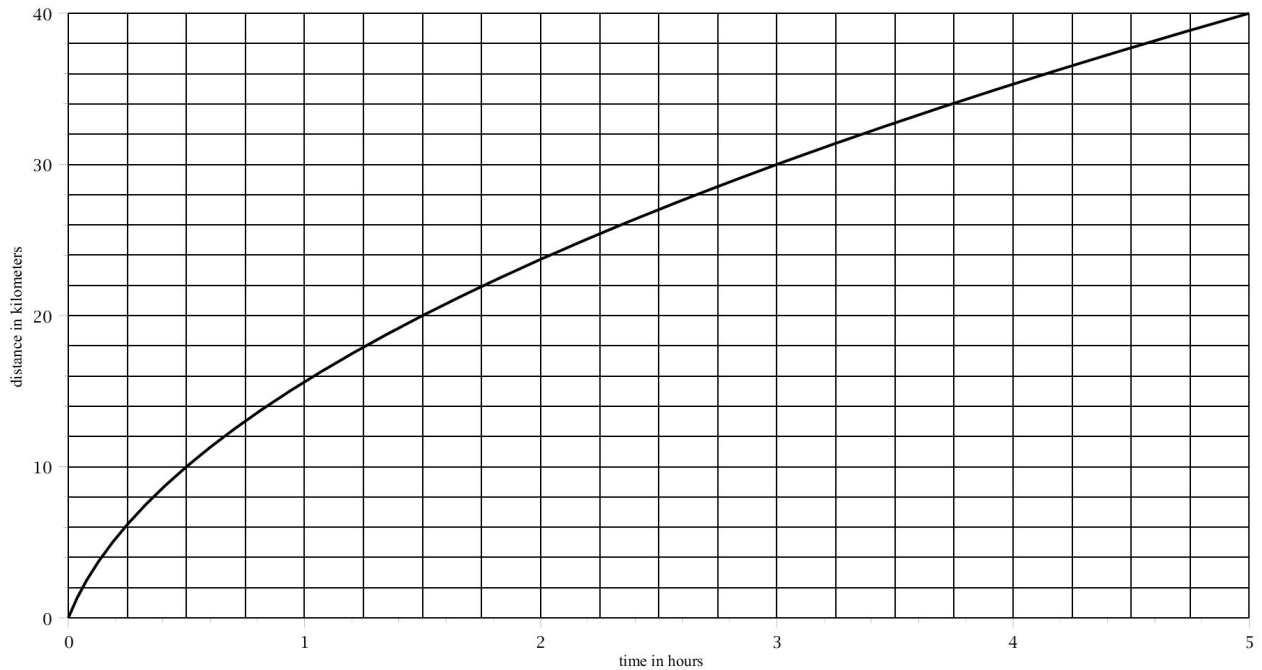

(a) (2 points) What is Karl's speed during the first minute?

(b) (2 points) At what times(s) is Karl's average trip speed 8 kilometers per hour?

(c) (3 points) Find a 2 hour interval where is average speed is 8 kilometers per hour.

(d) (2 points) Giacomo starts walking at a constant speed of 5 kilometers per hour at the same time Karl starts on his bicycle, but 10 kilometers ahead of Karl. At what time(s) do the meet?

2. (13 points) You produce and sell Kapelos. The following are the graphs of average cost (AC), average variable cost (AVC) and marginal cost (MC).

Marginal Cost, Average Variable Cost and Average Cost
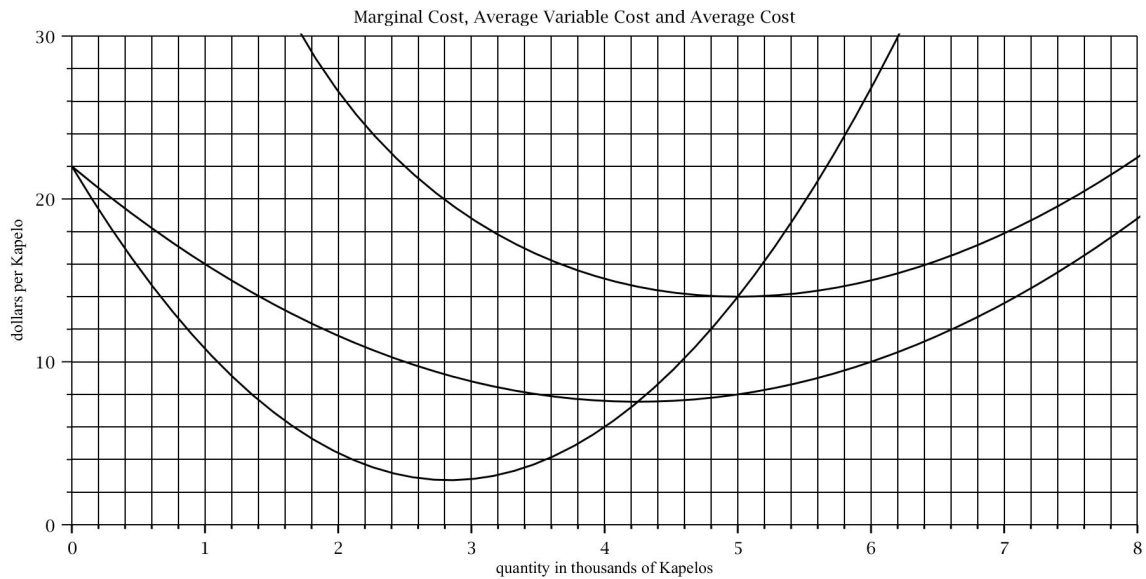
(a) (2 points) Mark the graphs with MC, AVC and AC keeping in mind that AC and AVC never intersect.

(b) (2 points) What is the breakeven price?

(c) (2 points) What is the shutdown price?

(d) (3 points) What is the fixed cost?

(e) (4 points) If you sell each Kapelo for 20 dollars, what is the maximum profit?
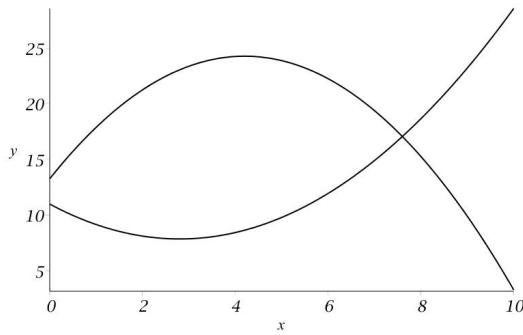
3. (10 points) Let $f(x) = 0.4x^2 - 2.24x + 11$ and $g(x) = -0.625x^2 + 5.25x + 13.28$.
You can see their graphs on the left. Use ALGEBRA to give EXACT answers to the questions below. You can compare your answers with what you can approximate from the graphs when you are done.

(a) (1 point) Mark the parabolas with the corresponding letters f and g.

(b) (3 points) Find the interval where f is increasing and g is decreasing.

(c) (3 points) Find the maximum value of the function $h(x) = g(x) - f(x)$.

(d) (3 points) Find the coordinates of the point where the two parabolas intersect in the picture.

4. (13 points) Solve for x in the following questions. Round your answers to three digits after the decimal.

    (a) (5 points) $\dfrac{3}{x+1} - \dfrac{2}{x-5} = 2$

    (b) (4 points) $1.43 = \dfrac{(1.03)^{7x} - 1}{0.27}$

    (c) (4 points) $0.3 = 2.4\ln(3 + 2.1x)$

5. (14 points) You produce and sell Milos. The average variable cost and marginal cost functions are given by

$$AVC(q) = 3.02q^2 - 7.56q + 6.6 \text{ and } MC(q) = 9.07q^2 - 15.1q + 6.6,$$

both in dollars per Milo, where the quantity q is in hundreds of Milos. Your fixed costs are 1.4 hundred dollars. You sell each Milo for \$4.20.

(a) (4 points) If you sell 200 Milos, are you at a loss or making a profit? How much?

(b) (4 points) What is the shutdown price?

(c) (6 points) What is the maximum profit you can make? How many Milos do have to sell for the maximum profit?

6. (13 points) A fish farm has sea bass and salmon. They eat shrimp, sardines and anchovies. Every day, each sea bass eats 0.1 kilograms of shrimp, 0.1 kilograms of sardines and 0.04 kilograms of anchovies. Every day, each salmon eats 0.12 kilograms of shrimp, 0.08 kilograms of sardines and 0.06 kilograms of anchovies. What is the maximum number of fish you can keep in a tank with 2.4 kilograms of shrimp, 2.2 kilograms of sardines and 1.14 kilograms of anchovies served every day?

7. (13 points) The two parts of this question are not related.

    (a) (7 points) You have $32,000 to invest for 3 years. If you have the following three options, what is the maximum interest you can get?

        i. 3.2% annual interest rate compounded monthly.

        ii. 3.15% annual interest rate compounded continuously.

        iii. 3.35% simple annual interest rate.

    (b) (6 points) You buy a house for $475,000 with a $125,000 down payment. For the rest, you take out a mortgage for 30 years at 3.96% annual interest rate compounded monthly. What are your payments at the end of each month?

8. (16 points) The Internal Revenue Service (IRS) pre-collects the taxes you would owe at the end of a tax year by withholding part of your paycheck during the year. If you have paid more than you own, you get a tax refund after April 15th. In that way, you don't find yourself writing a big check to the IRS on April 15th and IRS makes sure it collects the taxes on time. But, by prepaying your taxes, you might be losing some money.

Let's say your annual income was $45,000 for 2016. The total tax you owe for 2016 is calculated from the table:

Taxable Income	Tax Rate
$0 - $9,275	10%
$9,276 - $37,650	$927.50 plus 15% of the amount over $9,275
$37,651 - $91,150	$5,183.75 plus 25% of the amount over $37,650
$91,151 - $190,150	$18,558.75 plus 28% of the amount over $91,150

(a) (3 points) What is the total tax you owe for the year 2016?

(b) (1 point) You got paid twice a month in 2016 so you got 24 paychecks with the same amount. How much tax should be withheld from each paycheck so you pay your taxes during the year?

(c) (7 points) Now, you can opt out of IRS withholding these amounts on your paycheck. Instead of sending the money you computed in part (b) to IRS at the end of each half-month, you put it in a savings account with 1.2% annual interest compounded twice a month. How much did you have in your account at the end of December in 2016?

(d) (4 points) The taxes are due on April 15th. How much money will you have in your account on April 15th, assuming you stop sending money to the account after the tax year ends on December 31st, but you keep earning the same compound interest since your money is still in the account?

(e) (1 point) On April 15th, you send the total tax you owe from part (a) to IRS. The rest is yours. What are you left with, to spend and enjoy?