# MTH 1420, SPRING 2012
# DR. GRAHAM-SQUIRE

LAB 4: PROBLEM SOLVING

**Names**: ______________________________________

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## 1. Introduction

In this lab we look at some challenging problems that are not by any means standard. For some you will need to use technology to get an approximate answer, however you should find an exact answer if possible. Make sure you explain your reasoning as well as find the answer.

## 2. Instructions

(1) Introduce yourself to your lab partner(s).
(2) Work on the problems together with your partner for the remainder of the lab time. If you are confused about something, talk to your lab partner and explain your question to them to see if they can help. If everyone in the group is stumped, come talk to me for a hint. If you do not finish, it is okay to split up the remaining parts and work on them individually. However, you should meet up sometime outside of class to check each other's work before you turn in a final draft next week.
(3) Each member of the group will turn in a completed lab at the start of the next lab period. You can use this sheet as a cover sheet for the lab you turn in. Your score will be 80% your individual score and the remaining 20% will come from how well your lab partners do (this should encourage you to work with them to make sure you all get correct answers).

## 3. Problems

There are a total of 6 problems, and they are numbers 1, 6, 7, 9 and 13 on page 429 in the text, as well as number 2 on page 491. They are listed below as well, but the odd numbers have answers in the back of the textbook so you can check your answer if you are not sure your work is correct. I will give you the top 5 scores only, so you can skip one problem if you get totally stuck.

1) Three math students have ordered a 14-inch pizza. Instead of slicing it in the traditional way, they decide to slice it by parallel cuts, as shown in the figure (see book for figure, or look on the white board). Where must the cuts be made in order to insure that each student gets the same amount of pizza?

6) If $n$ is a positive integer, prove that

$$\int_0^1 (\ln x) dx = (-1)^n n!$$

where $n! = n \cdot (n-1) \cdot (n-2) \cdots 2 \cdot 1$.

7) Evaluate

$$\lim_{x \to 0} \frac{1}{x} \int_0^x (1 - \tan 2t)^{1/t}\, dt.$$

9) If $\int_0^4 e^{(x-2)^4}\, dx = k$, find the value of $\int_0^4 xe^{(x-2)^4}\, dx$.

13) Find the interval $[a, b]$ for which the value of the integral $\int_a^b (2 + x - x^2) dx$ is a maximum.

2) (page 491) The figure shows a horizontal line $y = c$ intersecting the curve $y = 8x - 27x^3$. Find the number $c$ such that the areas of the shaded regions are equal. (see textbook or board for diagram).