Math 120 C and E - Autumn 2004
Mid-Term Exam Number One
October 21, 2004

Name: _____ Section: _____

1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

- Complete all questions.

- You may use a calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.

- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.

- You may use one hand-written 8.5 by 11 inch page of notes.

- Show all work for full credit.

- You have 50 minutes to complete the exam.

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1. Let $f(x) = x^2 + 2x, g(x) = x + 1$.
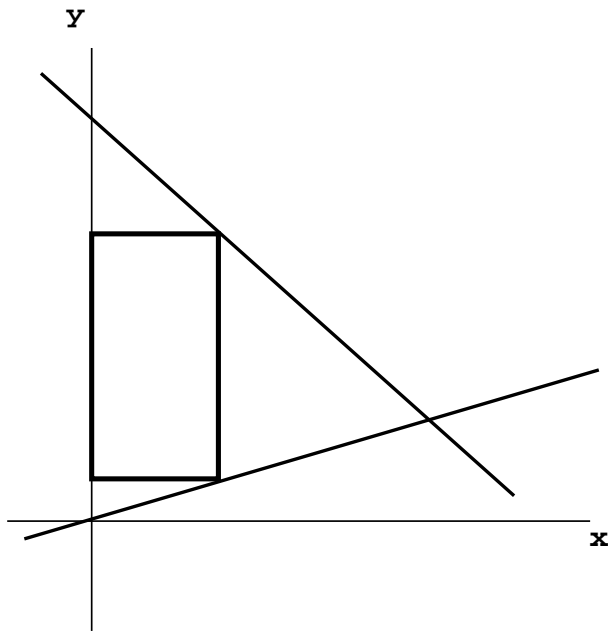
   (a) Evaluate the expression
   $$f(g(x)) - f(x)$$
   and simplify it as much as possible.

   (b) The graphs of $y = f(g(x))$ and $y = g(f(x))$ are both parabolas. Which one has its vertex farther from the x-axis?

2. Consider the triangle formed by the y-axis and the lines $y = \frac{1}{3}x$ and $y = 2 - x$.

Consider a rectangle placed inside this triangle, with one side on the y-axis. An example of one such rectangle is shown in the figure. What is the area of the largest such rectangle?

3. A plane begins its flight from a point 40 miles west and 30 miles south of Hampton airport. The radar at Hampton airport has a range of 40 miles (that is, it can detect anything within 40 miles). The plane flies in a straight line toward a point 80 miles north and 10 miles east of Hampton airport. The plane flies at a constant speed of 380 miles per hour. How long (in hours) will the plane be on the radar at Hampton airport?

4. The population of Cambridge in 1990 was 12,000, and in 2000 it was 13,400.

   Essex has a population of 18,100 in 1980, and in 1995 it was 17,500.

   Use linear models to describe the populations of Cambridge and Essex. According to your models, when will there be twice as many people in Cambridge as Essex?

5. Let
$$g(x) = 2|x + 1| + x^2 - 6x - 1.$$

(a) Write the multipart rule for $g(x)$.

(b) Find all solutions to the equation $g(x) = 10$.