Math 120 A, B - Winter 2010
Mid-Term Exam Number Two
February 25, 2010

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	10	
2	10	
3	10	
4	10	
Total	40	

- Complete all four questions.
- Show all work for full credit.
- You may use a scientific calculator during this examination. Graphic calculators are not allowed. Also, other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.
- If you use a trial-and-error or guess-and-check method 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. Write your name on your notesheet and turn it in with your exam.
- You have 50 minutes to complete the exam.

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1. You have 100 cm of wire. You plan to cut the wire into two pieces and make a square and an equilateral triangle.

   Useful formula: the area of an equilateral triangle of side length s is $\frac{\sqrt{3}}{4}s^2$.

   (a) What should the side lengths of the triangle and square be to *minimize* the combined area of the square and triangle?

   (b) What should the side lengths be to *maximize* the combined area of the square and triangle?

2. Let $f(x)$ be the linear-to-linear rational function with the following properties.

   - It has a horizontal asymptote of $y = 40$.
   - Its graph passes through the point $(6, 10)$.
   - Its graph passes through the point $(20, 18)$.

   (a) Find $f(x)$.

   (b) Find the fixed points of $f(x)$.

3. A small farming town had a population of 800 in 1960. In 1970, the population was 950.

   The town produced 40,000 pounds of potatoes in 1965. In 1980, they produced 90,000 pounds of potatoes.

   Assume that the population of the town and the amount of potatoes produced each year are exponential functions of time.

   When did the town grow 150 pounds of potatoes per person? Express your answer in years after 1960.

4. Let $h(x) = \dfrac{3x}{x-3}$ and $j(x) = \dfrac{x}{x+1}$.
   Let $f(x) = h(j(x))$.

   (a) Find $f(x)$.

   (b) Find $f^{-1}(x)$.