Math 208 Assignment 2: Due Wednesday, November 3, 2004 at the beginning of class:

1. According to the article “Fidelity slashes index-fund fees” on page D1 of the Boston Globe on September 1, 2004, when a mutual fund company charges a fee of 0.47% on its index funds, it has $41 billion in its index funds. When a mutual fund company charges a fee of 0.18% on its index funds, it has $300 billion in its index funds. Assume the amount in the index funds is a linear function of the fee charged on the index funds. Find the fee that should be charged on the index funds to maximize the revenue the mutual fund company receives from the fee on its index funds. What is the maximum revenue? (Note: I recommend using fractions, until you find the final answer. If you use decimals, don't round off until you obtain your final answer).

2. Assume 100 gallons of gas per hour can be sold for a price of $2.00 per gallon and 95 gallons of gas per hour can be sold for a price of $2.01 per gallon. Also, assume the price is a linear function of the number of gallons per hour sold.
   (a) Use calculus to maximize the revenue. Be sure to write a sentence specifying the price, the number of gallons sold per hour and the corresponding maximum revenue.
   (b) Assume the gas costs $1.90 per gallon and the fixed costs are $10 per hour. Use calculus to maximize the profit. Be sure to write a sentence specifying the price, the number of gallons sold per hour and the corresponding maximum profit.

3. The cost, in fuel and wear and tear, of operating a light truck at a steady speed of \( v \) miles per hour is \( \left( 0.30 + \frac{v}{400} \right) \) dollars per mile. This does not include the driver's pay. The driver's wage is $10 per hour. Find the steady speed at which the truck should make a 600 mile freeway trip in order to minimize the total cost of the trip (defined to be the operating cost plus the payment to the driver).

4. The total cost of producing \( q \) barrels of oil is given by \( C(q) = 10q^2 - 5q + 90 \), where \( q \geq 0 \).
   (a) Find the value of \( q \) which minimizes the marginal cost, \( C'(q) \).
   (b) Find the value of \( q \) which minimizes the average cost, \( A(q) = \frac{C(q)}{q} \). At this value of \( q \),
      (i) what is the average cost?
      (ii) what is the marginal cost?

5. Consider the function \( f(x) = 50 + x^2 - \frac{4}{x} \).
   (a) Find all vertical asymptotes.
   (b) Find the interval(s) on which this function is increasing. Where does this function assume relative maximum and minimum values and what are these values?
   (c) Find the interval(s) on which this function is concave up. What are the inflection points of this function?
   (d) Sketch the graph of this function.

6. A rectangular parking lot of area 10,000 square feet is to be surrounded on three sides by a fence costing $6 per foot and on one side by a brick wall costing $10 per foot. Find the dimensions of the parking lot to minimize the cost of materials surrounding it.