

**Business Optimization Problems**

MATH 104/184

October 29, 2013

1. A fuel tank of volume  $144\pi$  cubic meters consists of a cylindrical part capped by hemispheres at each end. The construction cost is \$5 per square meter for the cylindrical wall, but \$10 per square meter for the hemisphere ends. Find the minimum total cost for constructing such a tank.
2. Fion is an 80 year old widow and is diagnosed with lung cancer. Her doctors say she will probably die one year from today. She currently owns an apartment that is worth \$50 million and it is expected that the building will worth \$45 million one year from today. When she dies, she will donate all her assets (cash and apartment) to the BC Cancer Society. Fion is not sure whether she should sell the building now or donate the building property in one year. Her annual profit from collecting rent is given by the function

$$P(x) = -96x^2 + 38,400x - 960,000. \quad (1)$$

Where  $x$  is the number of rooms rented out.

There are only 250 rooms in the apartment.

- (a) How many rooms should Fion rent out to maximize profit?
  - (b) What is the maximum profit?
  - (c) Should Fion sell her property today, or wait until one year from now to donate the \$45 million property plus the rent profit from the past year to the BC Cancer Society?  
(*Assume rents are collected at the end of each year*)
3. A gas pipeline is to be constructed from a storage tank, which is right on a road, to a house which is 600 feet down the road and 300 feet back

from the road. Pipe laid along the road costs \$8.00 per foot, while pipe laid off the road costs \$10.00 per foot. What is the minimum cost for which this pipeline can be built?

*(Assume the pipeline path is piecewise linear, with at most two pieces.)*

4. Kevin and his friends recently started a company selling calculators. The start-up cost is \$50,000 and the cost of each calculator is \$5.50. A recent market study shows if the price,  $p$ , is \$5.50, the quantities sold will be 150,000 units, but for every increase of \$5 of the price, the quantities sold will be halved. What should price  $p$  be in order to maximize profit.