Section 2.9 Optimization

1) The manager of a garden store wants to build a 600 square foot rectangular enclosure on the store's parking lot in order to display some equipment. Three sides of the enclosure will be built of redwood fencing, at a cost of \$7 per running foot. The fourth side will be built of cement blocks, at a cost of \$14 per running foot. Find the dimensions of the least costly such enclosure.

2) A concert promoter has found that if she sells tickets for \$50 each, she can sell 1200 tickets, but for each \$5 she raises the price, 50 less people attend. What price should she sell the tickets at to maximize her revenue and what will be the maximum revenue?

   a) Determine the solution by considering the revenue as a function of price.

   b) Determine the solution by considering the revenue as a function of demand.

   c) Determine the solution by considering the revenue as a function of the number of increases in price.

3) A company sells x ribbon winders per year at p per ribbon winder. The demand function for ribbon winders is given by: $p = 300 - 0.02x$. The ribbon winders cost \$30 apiece to manufacture, plus there are fixed costs of \$9000 per year. Find the quantity where profit is maximized.

4) A rectangular storage container for network cables with a closed top is to have a volume of 10 m^3. The length of its base is twice the width. The base and the top of the box must be reinforced and so the material for the base and for the top costs \$10 per square meter. Material for the sides costs \$6 per square meter. Find the dimensions of the container that minimize the cost of the materials.

5) A box with a square base and open top must have a volume of 4,000 cm^2. Find the dimensions of the box that minimize the amount of material used.

6) A rectangular storage area with base of 10 square meters is to be enclosed by a metal fence. Three sides of the wall are made of the material that costs \$60/m^2. The material for the fourth side costs \$180/m^2. If the height of the storage area is 2 m, find the dimensions of the base of the storage area that will allow for the most economical enclosure.

7) A homeowner has \$540 to spend on building an enclosure around a rectangular garden, which they will build in the corner of their already fenced back yard, using the existing backyard fence for two garden sides. One of two additional sides will be built using wire fencing at cost of \$4 per meter length. The other additional side will be built from wood fencing at a cost of \$12 per meter length and will include a 1.5 m wide gate at a cost of \$150. Find the dimensions and the area of the largest garden that can be enclosed as above within the \$540 cost limit.

8) An office technology manufacturer sells x thousand webcams per year at $\$p$ dollars per webcam. The price-demand equation for these markers is $p = -0.01x^2 - 0.8x + 100$. What price should the company charge for the webcams to maximize revenue? What is the maximum revenue?

9) A hospital cafeteria sells 1,600 cups of tea per day at a price of \$2.40 per cup.

   a) A market survey last summer showed that for every \$0.05 reduction in price, 50 more cups will be sold. How much should the cafeteria charge for a cup of tea in order to maximize revenue?

   b) A new survey showed that for every \$0.10 reduction in the original \$2.40 price, 60 more cups of tea would be sold. With these new results in mind, how much should the cafeteria charge for a cup of tea in order to maximize the revenue?

10) A local accessories production company is launching the new Cool-As-Cucumber sunglasses. Their research shows that the revenue R (in \$) and the cost C (in \$) of manufacturing and selling x thousand pairs of sunglasses per year can be modelled by

$$R(x) = 240x^2 - 0.8x^3$$

$$C(x) = 440000 + 2400x, \;\; 10 \leq x \leq 250$$

How many pairs of sunglasses should they make and sell each month to maximize profit? What is the maximum profit? Round your answers to the nearest thousand.