Applied Optimization

NOTES 18

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4.6 Applied Optimization:

The methods we have learned in this chapter for finding extreme values have practical applications in many areas of life. Problems as maximizing areas, volumes, and profits and minimizing distances, times, and costs. In solving such practical problems, the greatest challenge is often to convert the word problem into a mathematical optimization problem by setting up the function that is to be maximized or minimized. (*Taken from Calculus, Stewart.*)

Solving Applied Optimization Problems:

1. Read the problem. Read the problem until you understand it. What is given? What is the unknown quantity to be optimized?
2. Draw a picture. Label any part that may be important to the problem.
3. Introduce variables. List every relation in the picture and in the problem as an equation or algebraic expression and identify the unknown variable.
4. Write an equation for the unknown quantity. If you can, express the unknown as a function of a single variable or in two equations in two unknowns. This may require considerable manipulation.
5. Test the critical points and endpoints in the domain of the unknown. Use what you know about the shape of the function's graph. Use the first and second derivatives to identify and classify the function's critical points.

Examples taken from University Calculus, by Thomas et al; textbook:

Example 1: An open-top box is to be made by cutting small congruent squares from the corners of a 12 in. by 12 in. sheet of tin and bending up the sides. How large should the squares cut from the corners be to make the box hold as much as possible?

Example 2: You have been asked to design a one-liter can shaped like a right circular cylinder. What dimensions will use the least material?

Example: A rectangle is to be inscribed in a semicircle of radius 2. What is the largest area the rectangle can have, and what are its dimensions?