4.5 Optimization Problems

MATH 205

Strategies for Solving Applied Optimization Problems

1. Understand the problem: Read and re-read.
2. Draw a picture.
3. Determine your variables and constants.
4. Write an equation to model the unknown.
5. Test the critical points and domain endpoints to determine your optimum point.

Problem 1

- An open-top box is to be made by cutting small congruent squares from the corners of a 12-in by 10-in sheet of tin and bending the sides. How large should the squares cut from the corners be to make the box hold as much as possible?

Problems 2 and 3

- A farmer wants to form a rectangular pen with 100 feet of fencing. If he is to use a river for one side of the pen, what dimensions maximize the area of the pen.

- Suppose you need to cut a beam with maximal rectangular cross section from a circular log of radius 1 ft. What are the shape and cross-sectional area of such a beam

$\sqrt{16}$ Problem

- A drilling rig 12 miles offshore is to be connected by pipe to a refinery onshore, 20 miles straight down the coast from the rig. If underwater pipe costs $500,000 per mile and land-based pipe costs $300,000 per mile, what combination of the two will give the least expensive connection?

Problem 5

- Suppose you have been asked to design a 1-liter can in the shape of a right-circular cylinder. What dimensions will use the least amount of material?

  {1 liter = 1000 cm^3}

Problem 6

- A wall, 10 feet high, is 25 feet from the side of a building. Determine the shortest straight beam that will reach the building from the ground outside the 10 foot wall.

Problem 7

- Two poles, one 6 meters tall and one 15 meters tall, are 20 meters apart. A length of wire is attached to the top of each pole and it is also staked to the ground somewhere between the two poles. Where should the wire be staked so that the minimum amount of wire is used?

Problem 8

- A farmer wants to hire workers to pick 900 bushels of beans. Each worker can pick 5 bushels per hour and is paid $1.00 per bushel. The farmer must also pay a supervisor $10 per hour while the picking is in progress and he has additional miscellaneous expenses of $8 per worker. How many workers should he hire to minimize the total cost? What then will the cost per bushel picked?