

Math 140 – Calculus 1
Extra Optimization Problems

1. The sum of two positive numbers is 48. What is the smallest possible value of the sum of their squares?

2. The manager of a computer shop must decide how many computers to order from a manufacturer. If the size of the order is x computers, then the shipping and storage cost is C dollars, where

$$C = 15x + \frac{24000}{x} + 6400.$$

How many computers should be ordered to minimize costs?

3. Among all rectangles having perimeter 100 meters, find the dimensions of the one with the largest area. What if the perimeter is L meters?

4. A school is planning construction of a new running track enclosing an area in the shape of rectangle with semicircular sides. The perimeter of the track is to be 400 meters. What choice of dimensions will make the rectangular area as large as possible? What dimensions will make the entire area as large as possible?

5. A wire two meters long is cut into two pieces. One piece is bent into a square, and the other is bent into a circle. How should the wire be cut to minimize the total area of the two shapes? How should it be cut to maximize the total area?

6. A wire six meters long is cut into 12 pieces. The pieces are welded together to form the frame of a box with a square base. What should be the lengths of the pieces in order to maximize the surface area of the box?

7. A factory produces cylindrical cans of volume 500 cm^3 . What should the diameter and height of the cans be in order to use the least amount of metal in production? If the cost to produce the top and bottom of the can is twice as much as the sides, what should the dimensions be to minimize cost?

8. Find the coordinates of the point (x, y) on the curve $y = \sqrt{x}$ closest to the point $(1, 0)$.

9. A farmer is planning an orchard and wants to maximize the amount of fruit produced. If he plants 60 or fewer trees, the fruit harvest will be 120 kg per tree. For each tree over 60 that he plants, the total yield per tree will decline by 2 kg per tree due to overcrowding. How many trees should he plant to maximize his harvest?

10. The cost of running a small van at a speed of v mph is $25 + 0.01v^2$ \$/hr. If the van is driven for 100 miles at a constant speed of v mph, how long will the trip take? How much will it cost? (Both answers will be in terms of v .) What speed v will minimize the cost of this trip?

**Adapted from a problem set created by the Department of Mathematics at the
University of Michigan.**