

Example Optimization Problems

1. A farmer has 300 feet of chicken wire with which to construct a rectangular pen to hold a flock of chickens. A 400-foot long chicken coop will be used for one side of the pen, so the wire is only needed for the remaining three sides of the pen. How can the pen be constructed so that the chickens have the maximum space in which to roam?
2. An open box will be constructed from a single sheet of cardboard. The sheet is 10 inches wide and 14 inches long. A square will be cut from each corner and the resulting sides folded up to form a rectangular box with no top. What size square cut from each corner of the sheet will create the box with the largest volume?
3. A rectangle is to be inscribed in a semicircle of radius 2 inches. Find the dimensions of the rectangle that encloses the maximum area.
4. Find two positive real numbers whose product is 16 and whose sum is a minimum.
5. A rectangular box with a square top and bottom is to have a volume of 2250 cm^3 . Find the dimensions of the box with the minimum cost if material for the top and bottom of the box costs \$0.04 per square cm and material for the sides costs \$0.015 per square cm.
6. A standard can has a volume of 900 cm^3 . The can is in the shape of a right circular cylinder with a top and a bottom. Find the dimensions of the can that minimize the amount of material needed for construction.
7. A pipeline for transporting oil will connect two points A and B that are 3 miles apart and on opposite sides of a river that is one mile wide. Part of the pipeline will run under water from A to a point C on the opposite bank and then above ground from C to B . If the cost of running the pipeline under water is four times the cost of running it above ground, find the location of C that will minimize the total cost of the pipeline.
8. A beer distributor has determined that 200 gallons of light beer can be sold to a tavern if the price is \$2 per gallon. The beer costs the distributor \$0.90 per gallon. For each cent that the price to the tavern is lowered, 10 more quarts of beer will be sold. At what price should the beer be sold to the tavern so that the distributor has the greatest profit?
9. Find the ratio of the radius to the height of a right circular cylinder that has the minimal surface area, assuming that the volume of the cylinder is constant and that the cylinder has no top or bottom.
10. A paper drinking cup in the shape of a cone is to be constructed by removing a circular sector from a circular disk of paper of radius a and then joining the two straight edges. What is the largest cup volume?