

Problem Set 8 — Optimization

Prof. Doug Baldwin

Math 221 05

Complete By Sunday, November 5

Grade By Wednesday, November 8

Purpose

This problem set reinforces your ability to solve optimization problems using calculus.

Background

This problem set is based on material in section 4.7 of our textbook. We covered that material in classes between October 26 and 30.

Activity

Solve the following problems.

Problem 1. (Based on OpenStax *Calculus, Volume 1*, Problem 317 in Section 4.7.)

Find the non-negative integer n that minimizes the sum $n + \frac{1}{n}$.

Problem 2. (OpenStax *Calculus, Volume 1*, Problem 322 in Section 4.7.)

Two poles are connected by a wire that is also connected to the ground. The first pole is 20 ft tall and the second pole is 10 ft tall. There is a distance of 30 ft between the two poles. Where should the wire be anchored to the ground to minimize the amount of wire needed? (See the textbook for a diagram of this situation.)

Problem 3. (Based on OpenStax *Calculus, Volume 1*, Problems 330 and 331 in Section 4.7.)

A certain limousine has gas mileage $m(v) = \frac{120-2v}{5}$ miles/gallon, where v is the limousine's speed in miles/hour. The limousine's chauffeur is paid \$15 per hour, and gas costs \$3.50 per gallon.

Part 1. Find an equation for the cost per mile of operating the limousine.

Part 2. Find the cheapest driving speed, i.e., the speed that minimizes the cost from Part 1.

Problem 4. (Based on OpenStax *Calculus, Volume 1*, Problem 341 in Section 4.7.)

Find the largest-volume right circular cylinder that fits inside a sphere of radius 1. Start by drawing a diagram of the situation.

Follow-Up

I will grade this exercise in a face-to-face meeting with you. During this meeting I will look at your solution, ask you any questions I have about it, answer questions you have, etc. Please bring a written solution to the exercise to your meeting, as that will speed the process along.

Sign up for a meeting via Google calendar. Please make the meeting 15 minutes long, and schedule it to finish before the end of the “Grade By” date above.