

**Math 8: Calculus in one and several variables**  
**Spring 2018 - Homework 9**

Return date: not collected

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**keywords:** *absolute maxima and minima, Lagrange multipliers*

**exercise 1.** The base  $B$  of an aquarium (without lid) is made of slate and the four sides are made out of glass. The volume of the aquarium is  $V$ . If slate costs five times as much as glass (per unit area), find the dimensions of the aquarium that minimize the cost of the material.

- a) Find the minimum using the methods from Chapter 14.7 of the book.
- b) Verify your result from part a) using the method of Lagrange multipliers.

**exercise 2.** Find the dimensions of a box with volume  $V = 1000 \text{ cm}^3$  that has minimal surface area.

- a) Find or guess a solution using your geometric intuition.
- b) Verify your result from part a) using the method of Lagrange multipliers.

**exercise 3.** Use the method of Lagrange multipliers to find the maximum and minimum of the function  $f$  subject to the given constraints

- a)  $f(x, y) = 3x + y$ , if  $x^2 + y^2 = 10$ .
- b)  $f(x, y, z) = xy^2z$ , if  $x^2 + y^2 + z^2 = 4$ .

**exercise 4.** Find the absolute maxima and minima of the function  $f$  in the region  $D$ .

- a)  $f(x, y) = 2x^2 + 3y^2 - 4x - 5$ , where  $D : x^2 + y^2 \leq 16$
  - b)  $f(x, y, z) = x^2 + 2y^2 + 3z^2$ , where  $D : x + y + 3z = 10$ .
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