MATH 2A

Lagrange Multipliers: Organization and Perseverance

1. Find the maximum and minimum values of

$$f(x, y, z) = 2x - 3y + 4z$$

subject to the constraint $x^2 + y^2 + z^2 = 1$.

2. We have $10m^2$ of material to build a box. What are the dimensions of the box of maximum volume?

3. Find the global extrema of $f(x, y) = 2x^2 + 3y^2 - 4x - 5$ on the region given by $x^2 + y^2 \leq 16$.

4. What point on

$$z + 1 = x^2 + y^2$$

is closest to the origin?

5. Find the absolute (global) maximum and minimum values of xyz^2 on the solid $x^2 + 4y^2 + z^2 \leq 16$.

6. For some n, maximize the sum

$$x_1 + \cdots + x_n$$

with the constraint $\sum x_i^2 = 1$.

7. We can use Lagrange multipliers to find extrema when there is more than one constraint. To extremize f with constrains $g = c$ and $h = d$, solve the system

$$\begin{aligned} \nabla f &= \lambda \nabla g + \mu \nabla h \\ g &= c \\ h &= d \end{aligned}$$

and test the points.
Find the max and min of $f(x, y, z) = x + 2y + 3z$ on the intersection of the curves $x - y + z = 1$ and $x^2 + y^2 = 1$.