
PROBLEM SET

Lagrange Multiplier Problems

Math 2350, Spring 2008

March 14, 2008

- Write all of your answers on separate sheets of paper. You can keep the question sheet.
- You **must** show enough work to justify your answers. Unless otherwise instructed, give exact answers, not approximations (e.g., $\sqrt{2}$, not 1.414).
- This problem set has 5 problems. There are **200 points total**.
- This problem set is due on Friday, March 28.

Good luck!

40 pts.

Problem 1.

Find the maximum and minimum of the function $f(x, y) = xy$ on the ellipse

$$x^2 + \frac{y^2}{4} = 1.$$

40 pts.

Problem 2.

Find the maximum and minimum values of $f(x, y, z) = xy + z$ on the ellipsoid

$$\frac{x^2}{4} + y^2 + z^2 = 1.$$

40 pts.

Problem 3.

A box is to be constructed with a volume of 27 cubic inches. The box has a bottom but no top. The material in the front and back of the box costs \$2 per square inch and the material on the sides and the bottom costs \$1 per square inch. Find the dimension of the cheapest such box.

40 pts.

Problem 4.

Find the maximum and minimum of the function $f(x, y) = x^2 - 2x + 1 + y^2$ on the disc bounded by the circle $x^2 + y^2 = 4$.

40 pts.

Problem 5.

Let C be the curve of intersection of the ellipsoid

$$\frac{x^2}{4} + y^2 + z^2 = 1$$

with the plane $x + y + z = 1$. Find the highest and lowest points on C , i.e., maximize and minimize the function $f(x, y, z) = z$ over C .
