Math 8

Lagrange Multipliers

Practice Problems

1) Using Lagrange Multipliers find the minimum and/or maximum for the following:

a. $f(x, y) = x^2 + y^2$ subject to the constraint $xy = 1$.

b. $f(x, y) = y^2 - x^2$ subject to the constraint $x^2 + 4y^3 = 4$.

c. $f(x, y) = e^{x+y}$ subject to the constraint $x^2 + y^2 = 1$.

d. $f(x, y, z) = xy^2z$ subject to the constraint $x^2 + y + z^2 = 1$.

e. $f(x, y, z) = 2x + 3y + 5z$ subject to the constraint $x^2 + y^2 + z^2 = 38$.

2) A soft-drink manufacturer wants to design an aluminum can in the shape of a right circular cylinder to hold 8 oz. If the object is to minimize the amount of aluminum used (top, sides, bottom), what dimensions should be used?

3) Find the points on the circle $x^2 + y^2 = 5$ that are closest and farthest from the point $(2, 1)$. (Hint: Consider the distance squared.)

4) **Using** Lagrange Multipliers, find the points on the surface $z^2 = x^2 + y^2$ that are closest to the point $(4, 2, 0)$. Compare this with HW #9.3.

5) Show that the rectangular box of maximum volume that can be inscribed in the sphere $x^2 + y^2 + z^2 = 9$ is a cube.