Math 209, Homework #5

1 (P940, Q4): Use Lagrange multipliers to find the maximum and minimum values of the function subject to the given constraint: $f(x, y) = 4x + 6y; \quad x^2 + y^2 = 13.$

2 (P940, Q6): Use Lagrange multipliers to find the maximum and minimum values of the function subject to the given constraint: $f(x, y) = e^{xy}; \quad x^3 + y^3 = 16.$

3 (P940, Q10): Use Lagrange multipliers to find the maximum and minimum values of the function subject to the given constraint: $f(x, y, z) = x^2y^2z^2; \quad x^2 + y^2 + z^2 = 1.$

4 (P940, Q16): Use Lagrange multipliers to find the maximum and minimum values of the function subject to the given constraints: $f(x, y, z) = 3x - y - 3z; \quad x + y - z = 0,\ x^2 + 2z^2 = 1.$

5 (P940, Q18): Find the extreme values of f on the region described by the inequality: $f(x, y) = 2x^2 + 3y^2 - 4x - 5,\ x^2 + y^2 \leqslant 16.$

6 (P940, Q20): Consider the problem of maximizing the function $f(x, y) = 2x + 3y$ subject to the constraint $\sqrt{x} + \sqrt{y} = 5$.

(a) Try using Lagrange multipliers to solve the problem.

(b) Does $f(25, 0)$ give a large value than the one in part (a)?

(c) (optional) Solve the problem by graphing the constraint equation and several level curves of f.

(d) Explain why the method of Lagrange multipliers fails to solve the problem.

(e) What is the significance of $f(9, 4)$?

7 (P941, Q41): The plane $x + y + 2z = 2$ interests the paraboloid $z = x^2 + y^2$ in an ellipse. Find the points on this ellipse that are nearest to and farthest from the origin.

8 (P947, Q56): Find the absolute maximum and minimum values of f on the set D: $f(x, y) = e^{-x^2-y^2}(x^2 + 2y^2)$; D is the disk $x^2 + y^2 \leqslant 4$.

9 (P947, Q59): Use Lagrange multipliers to find the maximum and minimum values of f subject to the given constraint: $f(x, y) = x^2y;\ x^2 + y^2 = 1.$

10 (P947, Q60): Use Lagrange multipliers to find the maximum and minimum values of f subject to the given constraint: $f(x, y) = \frac{1}{x} + \frac{1}{y};\ \frac{1}{x^2} + \frac{1}{y^2} = 1.$