Math 35, Homework 2 on Sections 3.4, 14.8, 3.5
due Wed, Feb 19 at the start of class.

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(1) Use Lagrange multipliers to find the maximum and minimum values of

$$f(x, y) = 4x + 6y$$

subject to the constraint $x^2 + y^2 = 13$.

(2) Use Lagrange multipliers to find the maximum and minimum values of

$$f(x, y) = e^{xy}$$

subject to the constraint $x^3 + y^3 = 16$.

(3) Use Lagrange multipliers to find the maximum and minimum values of

$$f(x, y, z) = x^4 + y^4 + z^4$$

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

(4) Find the extreme values of

$$f(x, y) = 2x^2 + 3y^2 - 4x - 5$$

on the region described by the inequality $x^2 + y^2 \leqslant 16$.

(5) Use Lagrange multipliers to prove that the rectangle with the maximum area that has a given perimeter p is a square.

(6) Let $f(x, y) = (y + 1)^2 - x^3 + 6$. For what values of y does $f(x, y) = 0$ make y an implicit function of x? Find the two implicit functions by solving for y.

(7) Let

$$g(x, y, z) = \frac{xy}{z} + \frac{xz}{y} + 4\frac{yz}{x} - 6.$$

Then $(2, 1, 1)$ is a solution to $g(x, y, z) = 0$. Close to $(2, 1, 1)$ does $g(x, y, z) = 0$ make z an implicit function of x, y?

(8) Let $f : \mathbb{R}^2 \to \mathbb{R}^2$ be given by $f(x, y) = (xye^y + x^4, y \ln x)$. Find the Jacobian determinant of f.

(9) Suppose

$$x = a + b^2, \quad y = ab + 2b^3.$$

Near which points (a, b) can we solve for a and b in terms of x and y.