MATH 116 – Spring 2005
Practice Problems for Exam 3

Problem 1. Compute the indicated partial derivatives of the given functions at the indicated points.
(A) $f(x,y) = \sin(xy) - 2x^2 - y^2, \quad f_{xy}(1,\pi)$.
(B) $f(x,y) = xe^{yx^2}, \quad f_x(0,1)$.

Problem 2. Find the relative extreme values of each of the following functions
(A) $f(x,y) = 2x^2 + y^2 + 2xy + 4x + 2y + 5$.
(B) $f(x,y) = \ln(2x^2 + 3y^2 + 1)$.
(C) $f(x,y) = e^{-5(x^2+y^2)}$.

Problem 3. A company manufactures two products. The price function for product A is $p = 16 - x$ (for $x \leq 16$) and for product B is $q = 19 - \frac{1}{2}y$ (for $y \leq 38$), both in thousands of dollars, where x and y are the amounts of product A and B, respectively. If the cost function is $C(x,y) = 10x + 12y - xy + 6$, in thousand dollars, find the quantities and the prices that maximize profit. Also find the maximum profit. (Hint: the profit function is the sum of the two prices time the respective quantities of each products minus the cost.)

Problem 4. The consumer price index (CPI) is shown in the table below. Fit a least squares line to the data and use it to predict the CPI in the year 2000 ($x = 6$).

Year	x	**CPI**
1975	1	53.8
1980	2	82.4
1985	3	107.6
1990	4	130.7

Problem 5. Use Lagrange multipliers to maximize each function $f(x,y)$ subject to the given constraint (the maximum values do exist).
(A) $f(x,y) = xy - 2x^2 - y^2, \quad x + y = 8$.
(B) $f(x,y) = 2xy, \quad x^2 + y^2 = 8$.

Problem 6. A company's profit is given by $P = 300x^{1/3}y^{1/3}$, where x and y are the amounts spent on advertising and production. The company has a total of \$60,000 to spend. Find the amounts that the company should spend in advertising and production to maximize its profit.

Problem 7. A company's profit from producing x radios and y televisions per day is given by a function of two variables $P(x,y)$. When 25 radios and 36 televisions per day are produced, it is known that the profit is \$1,826 ($P(25,36) = 1,826$), the marginal profit for radios is \$36 ($P_x(25,36) = 66$) and the marginal profit for televisions is \$79 ($P_y(25,36) = 79$). Use the given information and total differential to estimate the profit when 26 radios and 35 televisions are produced per day.