7.2 - Partial Differentiation

1. Find all the first partial derivatives of each of the functions:

$$f(x,y) = xe^{x^2y^2}, \qquad g(x,y) = \frac{e^x}{1+e^y}, \qquad h(x,y) = \frac{x-y}{x+y}$$

2. Find the first and second partial derivatives of each of the functions:

$$f(x,y) = x^3y + 2xy^2, \qquad g(x) = xe^y + x^4y + y^3$$

3. The demand for a certain gas-guzzling car is given by $f(p_1, p_2)$ where p_1 is the price of the car and p_2 is the price of gasoline.
Do you expect $\dfrac{\partial f}{\partial p_1}$ to be positive or negative (or zero) and why?
Do you expect $\dfrac{\partial f}{\partial p_2}$ to be positive or negative (or zero) and why?

7.3 - Maxima and Minima

1. Find and classify all the critical points for the following functions

$$f(x,y) = x^4 - x^2 - 2xy + 10y^2, \qquad g(x,y) = -2x^2 + 2xy - y^2 + 4x - 6y + 5$$

2. We are designing a rectangular building having a volume of 147,840 cubic feet. Assuming daily loss of heat is given by the formula

$$w = 11xy + 14yz + 15xz$$

What dimensions do we choose so that the daily heat loss is minimal?

7.5 - Least Squares

1. Given the data points (1,8), (2,5), (3,3), (4,4), and (5,2) and a fitted line $y = -1.3x + 8.3$, what is the error of the fit?

2. Given the data points (1,9), (2,8), (3,6), and (4,3) which of the two following lines fit best and why?

$$y = -2x + 12, \quad \text{or} \qquad y = -2x + 11$$

7.4 - Lagrange Multipliers

1. Maximize $x^2 + xy - 3y^2$ subject to constraint $2 = x + 2y$

2. Minimize $18x^2 + 12xy + 4y^2 + 6x - 4y + 5$ subject to the constraint $3x + 2y = 1$

3. The material for a closed rectangular box costs \$2 per square foot for the top and \$1 per square foot for the sides and bottom. Use Lagrange multipliers to find the dimensions for which the volume of the box is 12 cubic feet so that the cost of materials is minimized.

4. Do problem 2. from the above section 7.3 using Lagrange multipliers this time

Attendance Passcode: Frogs