

Calculus III (Math 233) Quiz 1

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Problem 1. Let $f(x, y) = (y - x)e^y$. Let $x = 2s - t$ and $y = st$. Use the chain rule to compute $\frac{\partial f}{\partial s}$ at the point $(s, t) = (5, 3)$.

Problem 2. Find all the critical points of $f(x, y) = 6xy - x^3 - y^3$, and classify them using the Second Derivative Test.

Problem 3. Let $f(x, y) = 4x^2 + 9y^2$.

- (a) Use Lagrange multipliers to find the extreme value of f subject to the constraint $2x + 3y = 6$.
- (b) Is this extremum a maximum or minimum? Explain.

Problem 4. Use Lagrange multipliers to find the maximum and minimum values of

$$f(x, y, z) = 2x + 6y + 10z$$

on the sphere, $x^2 + y^2 + z^2 = 35$.

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

- (a) Find critical points of f in the region $x^2 + y^2 < 9$.
- (b) Find the extreme values on the circle $x^2 + y^2 = 9$ using Lagrange multipliers.
- (c) Find the extreme values of f on $x^2 + y^2 \leq 9$ using the above information.