EXAM 4 - MATH 251 Friday, April 20

YOUR NAME:_____ George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. (a) Evaluate the partial derivative $\dfrac{\partial h}{\partial q}$ at $(q, r) = (3, 2)$, where $h(u, v) = ue^v$ and $u = q^3$, $v = qr^2$.

(b) Use implicit differentiation to evaluate $\dfrac{\partial z}{\partial y}$ if $e^{xy} + \sin(xz) + y = 0$.

2. Find the critical points of $f(x, y) = x^3 + x^2y + 2y^2$ and use the second derivative test to tell whether they give rise to local extrema or saddle points.

3. Compute the double integral of $f(x, y) = \sin x$ over the domain $\mathcal{D}$ bounded by $x = 0$, $y = 0$ and $y = \cos x$.

4. Calculate the average height above the x-axis of a point in the region $\mathcal{D}$ determined by $0 \leq x \leq 1$ and $0 \leq y \leq x^2$.
   (**Hint**: Be careful in choosing the function $f(x, y)$!)

5. Sketch the region of integration and evaluate by changing to polar coordinates the iterated integral $\int_0^3 \int_0^{\sqrt{9-y^2}} \sqrt{x^2+y^2} dx dy$.