Math 210, Calculus III **Sample Second Hour Exam**

1. (10 pts) Let $z = e^{x+y}\sin(xy)$. Compute $\dfrac{\partial z}{\partial x}$ at $(\pi, 1)$.

2. (10 pts) Use the method of Lagrange Multipliers to find the minimum value taken by the function $f(x,y,z) = x^2 + y^2 + 2z^2$ on the plane $2x + 4y + 6z = 24$.

3. (15 pts) Find and classify the critical points of the function $f(u,v) = u^2 + v^2 + uv^2$. You must identify all local maxima, local minima and saddles for full credit.

4. (10 pts) Let $f(x,y) = xe^{-y} + 3y$. Find the value of the largest directional derivative of f at the point $(1,0)$.

5. (15 pts) The temperature in degrees at any point (x,y,z) is given by $T(x,y,z) = 90e^{-x-2y-3z}$. A fly is moving through space along a helical path with position function $\mathbf{r}(t) = \langle x(t), y(t), z(t)\rangle = \langle \cos t, \sin t, t\rangle$, where the time t is measured in seconds. Find the time rate of change of the fly's temperature at time $t = \pi$.

6. (10 pts) Evaluate the integral of $f(x,y) = x + y$ over the region $D = \{(x,y) |\ 0 \le x \le 1,\ 0 \le y \le 2\}$.

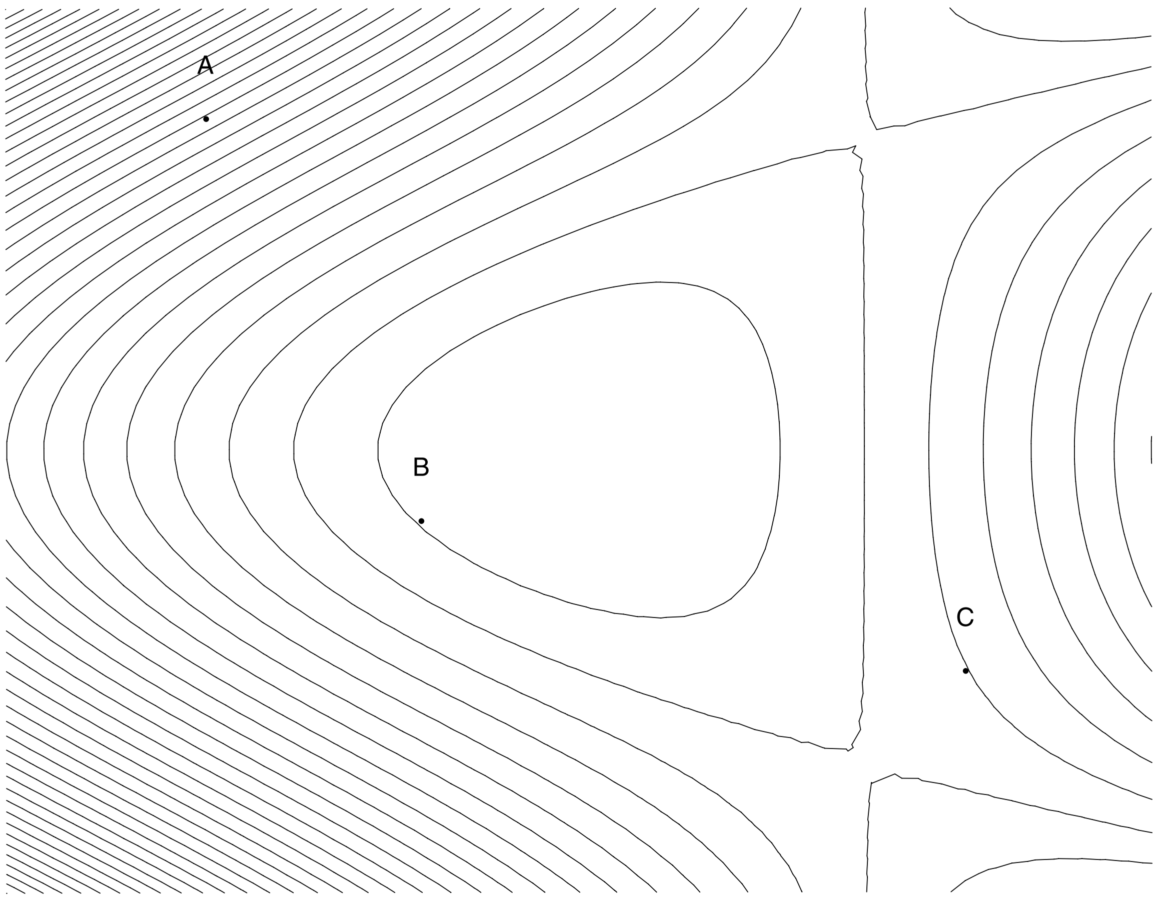
7. (10 pts) Evaluate the following limit if it exists; otherwise explain why does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{xy^3}{x^4 + y^4}$$

8. (10 pts) Find an equation for the tangent plane to the surface $x^2 + 3y^2 + 2z^2 = 6$ at the point $(1, -1, 1)$.

PROBLEM 9 IS ON THE BACK

9. (10 pts) A contour map of a function $f(x, y)$ is shown below. There are two saddles and one local minimum in the picture. Draw the gradient vector ∇f at the three indicated points A, B and C. Your drawing should clearly show the direction and the relative lengths of the three vectors.



DO NOT FORGET TO HAND IN THIS SHEET WITH YOUR EXAM!