Math 225: Calculus III Name:____________________________

Exam II *March 21, 1996* Section:____________________________

Record your answers to the multiple choice problems by placing an $\times$ through one letter for each problem on this answer sheet. There are 15 multiple choice questions worth 5 points each. You start with 25 points.

Find parametric equations of the line perpendicular to the surface defined by $x^2y - z^2 = 1$ at the point $(1, 2, 1)$. $x = 1 + 4t$, $y = 2 + t$, $z = 1 - 2t$ $x = 1 + 2xyt$, $y = 2 + x^2t$, $z = 1 - 2zt$ $x = 1 + t$, $y = 2 + 2t$, $z = 1 - t$ $x = t$, $y = 2t$, $z = -t$ $x = 1 - 4t$, $y = 2 + t$, $z = 1 + t$

Determine which function below has a graph like the following:

$f(x, y) = y^3 - y^2 - x^2$ $f(x, y) = y - x - 1$ $f(x, y) = y^2 - y - x$ $f(x, y) = x - y^2 + y$ $f(x, y) = x^2 - y^3 + y$

Compute the slope of the line tangent to the plane curve defined by the equation $x^2y^3 - x + y^2 = 1$ at the point $(1, 1)$. $-1/5$ $1/4$ 6 1 $-1/6$

If $f(x, y, z) = \cos(x^2y)e^{-z} + e^{y^2}x^3$, compute $f_{xz}(1, \pi/2, 0)$.

π 0 1 2 $-\pi/e$

Suppose $f(x, y)$ satisfies $f_x(6, 13) = -4$ and $f_y(6, 13) = 3/2$. If $x = uv$, and $y = u^2 + v^2$, compute $\frac{\partial f}{\partial v}$ at the point $(u, v) = (3, 2)$.

-6 5 -9 1 8

Find the derivative of $f(x, y, z) = y\log(x + 3) - 2xz^2e^y$ at the point $(-2, 0, 3)$ in the direction of the vector $= - \subset -2 \supset +2$.

-2 -6 $(18, 36, 24)$ $(-18, -72, 48)$ -3

Compute the gradient of the function $f(x, y, z) = \sin(xy) + y^3 - xz^2$ at the point $(\pi, 1, 2)$.

$-5 \subset +(3 - \pi) \supset -4\pi$ $- \subset +3 \supset -4\pi$ $-(1 + 4\pi) \subset +2 \supset -4$ $- \subset +3 \supset -(2 - \pi)$ $-5 \subset -\pi \supset -4$

Determine the equation of the plane tangent to the graph of $f(x,y) = x^3 - 3x^2y + 2y^4$ at the point $(1,1,0)$.

$3x - 5y + z = -2$ $3x - y + z = 2$ $6x - 8y + z = 2$ $6x - 4y - z = 2$ $3x - 5y = -2$

Find all the critical points of the function $f(x,y) = 5x^3 - 21xy^2 + 14y^3 + 24x + 3$.

$(-2,-2)$, $(2,2)$ $(1.36,0)$, $(-1.36,0)$, $(-2,-2)$, $(2,2)$ $(-2,-2)$, $(-2,2)$, $(2,-2)$, $(2,2)$, $(1.36,0)$, $(-1.36,0)$, $(-2,2)$, $(2,-2)$ $(1.36,0)$, $(-1.36,0)$

Choose the statement below that is **true** about the function $f(x,y) = e^{-y}(x^2 + y^2)$.

$(0,2)$ *is* **not** *a critical point of* f f *has a local minimum at* $(0,2)$ f *has a local maximum at* $(0,2)$ f *has a saddle point at* $(0,2)$ *none of the above*

Find the minimum of $f(x,y) = x^3 - 6xy + y^2$ on the rectangle $0 \le x \le 10$, $0 \le y \le 20$.

-108 -106 -120 -200 0

Find a point on the curve $13x^2 + 10xy + 13y^2 = 4$ where the value of the function $f(x,y) = x^2y^2$ is greater than or equal to its value at any other point on the curve.

$(\frac{1}{2}, -\frac{1}{2})$ $(\frac{1}{3}, \frac{1}{3})$ $(-1,1)$ $(1, -\frac{1}{\sqrt{5}})$ $(\frac{2}{\sqrt{13}}, -\frac{2}{\sqrt{13}})$

Compute $\int_0^1 \int_0^y e^{y^2}\, dx\, dy$. $(e-1)/2$ e 0 $\frac{1}{2} - e$ 1

Reverse the order of integration in the integral $\int_1^2 \int_1^{y^3} f(x,y)\, dx\, dy$ $\int_1^8 \int_{x^{1/3}}^2 f(x,y)\, dy\, dx$ $\int_1^{y^3} \int_1^2 f(x,y)\, dy\, dx$ $\int_1^2 \int_{y^3}^1 f(x,y)\, dy\, dx$ $\int_0^8 \int_{x^3}^2 f(x,y)\, dy\, dx$ $\int_0^8 \int_0^{x^{1/3}} f(x,y)\, dy\, dx$

The area of the region bounded by $y = 9 - x^2$ and the x-axis is 36. Find the centroid of this region.

$(0,3.6)$ $(0,4.0)$ $(0,2.4)$ $(0,3.2)$ $(0,2.8)$