CALCULUS III NAME _____

EXAM II Rec. Instr. _____

SPRING 2002 Rec. Time _____

TO RECEIVE CREDIT YOU MUST SHOW YOUR WORK.

(20) 1) Find the equation of the tangent plane to the given surface at the specified point.

a) To $x^3z + y^3x + z^3 = 38$ at $(x, y, z) = (1, 2, 3)$.

b) To $z = xe^{xy}$ at $(x, y, z) = (1, 2, e^2)$.

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(20) 2) Let $f(x, y) = \sqrt{y^2 + 2x^2}$.

a) Find the gradient vector field of $f(x, y)$,

$\nabla f =$

b) Find the directional derivative of $f(x, y)$ at $(x, y) = (2, 1)$ in the direction of the vector $\vec{a} = -3\vec{i} + 4\vec{j}$.

c) Find a vector which points in the direction which gives the largest directional derivative for $f(x, y)$ at $(x, y) = (2, 1)$. Find the value of this largest directional derivative at $(2, 1)$.

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(20) 3) Suppose that z is a function of x and y, $z = f(x, y)$, and x and y are functions of u and v according to $x = \dfrac{u}{v}$, $y = u^2 v$. Suppose that at $(x, y) = (2, 4)$ you know that $\dfrac{\partial f}{\partial x}(2, 4) = 5$ and $\dfrac{\partial f}{\partial y}(2, 4) = 2$. <u>Use the chain rule</u> to find $\dfrac{\partial z}{\partial u}$ and $\dfrac{\partial z}{\partial v}$ at the point $(x, y) = (2, 4)$.

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(20) 4) Use the <u>method of Lagrange multipliers</u> to find the largest value and the smallest value for $f(x, y, z) = x^2 + 4y + 4z$ on the ellipsoid $x^2 + 2y^2 + z^2 = 24$.

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(20) 5. Find and classify the critical points of

$$f(x, y) = x^2 + y^3 - 6xy + 3x + 6y.$$