Calculus III, Mathematics 2210-90

Examination 2, October 16,18, 2003

You may use graphing calculators and a Table of Integrals. Each problem is worth 20 points. You MUST show your work. Just the correct answer is not sufficient for any points.

1a. Write down an equation of a hyperbola whose major axis is the line $y = x$.

1b. Write down an equation of an ellipse (not a circle) whose major axis is the line $y = x$.

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

a) What is ∇f ?

b) Find the equation of the line tangent to the curve $f(x, y) = 14$ at the point (2,1).

3. Let $w = x^2 - yz$. Let $\mathbf{X}(t) = e^t\mathbf{I} + e^{t+1}\mathbf{J} + e^{2t}\mathbf{K}$ describe the curve Γ. Find the formula for dw/dt along Γ as a function of t.

4. Let $f(x, y) = x^2y + 27y^2 + x$.

a) $\nabla f =$

b) What are the critical points of f?

c) What kind of critical points are they?

5. Find the minimum value of $3x^2 + y^2$ on the curve $x^2 + xy = 1$.