Name (Please Print) _____ Rec. Instr. _____

Your Signature _____ Class Time _____

ANALYTIC GEOMETRY AND CALCULUS III

Exam III

December 1, 1994

The point value of each problem is indicated in the left margin. You must show all of your work for full credit. Points will be deducted for faulty reasoning, for sloppy notation, and for failure to simplify answers, even if your answer is correct. You may use a calculator, your class notes, and any reference material. Explicitly cite, in some manner, any published formulae you use.

(14) 1. Find an equation for the tangent plane to the ellipsoid $2x^2+4y^2+z^2 = 45$ at the point $(2,-3,-1)$.

Answer _____

(14) 2. Suppose that the temperature at the point (x,y) is given by $T = 10 + 0.003x^2 - 0.004y^2$. In what direction $\mathbf{u}$ should a bumblebee at the point $(40,30)$ initially fly in order to get warmer fastest?

Answer $\mathbf{u} =$ _____

(15) 3. Let $f(x, y) = 6xy^2 - 2x^3 - 3y^4$.

(a) Locate and classify the critical points.

Answers: local minima at _____

local maxima at _____

(b) Explain why when restricted to any closed disk centered at the origin, f must have a global minimum on the circumference of the disk.

(15) 4. Find the dimension of the triangle of largest area which has perimeter $= 6$. Hint: By Heron's formula, $f(x, y, z) = A^2 = 3(3 - x)(3 - y)(3 - z)$, with $0 < x, y, z < 6$.

Answers: $x =$ _____, $y =$ _____, $z =$ _____

(14) 5. Find the volume of the solid that lies below the surface $z = 1 + xy$ and above the depicted rectangle D.

Answer $V =$ _____

(14) 6. Use iterated integrals to express $\int\int_D 2x+2y\, dA$ where D is the region bounded by the parabola $x = y^2$ and the line $x+y = 2$. Do not evaluate.

Answer _____

(14) 7. Interchange the order of integration in $\int_0^2 \int_{\frac{y}{2}}^1 ye^{x^3} dxdy$.
Do not evaluate.

Answer _____