Math 203(01) **Practice Exam II** **9 November 2001**

1. Let $f(x, y) = 2x^2 - xy$. If $x = t\cos t$ and $y = t\sin t$, find $\dfrac{df}{dt}$. (Be sure to write your answer as a function of t.)

2. Find the linear Taylor approximation $L(x, y)$ and the quadratic Taylor approximation $Q(x, y)$ to the function f given by

$$f(x, y) = (4 - x^2)\cos y$$

at the point $(1, 0)$.

3. Find and classify all the critical points of the function f given by

$$f(x,y) \quad = \quad 2x^3 + xy^2 + 5x^2 + y^2.$$

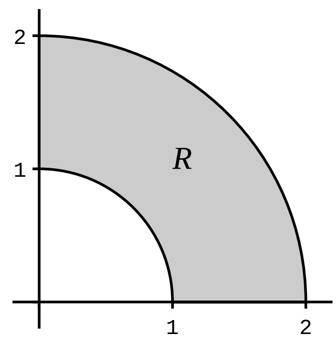
4. Use the Lagrange multiplier method to find the absolute maximum and minimum values of $f(x, y) = x^2 - 2x + y^2 - 2y$ on the disk $x^2 + y^2 \leq 4$.

5. Let R be the region in the first quadrant of the xy-plane bounded by the x-axis, the line $x = 2$ and the parabola $y = x^2$. Find the volume of the solid region lying over R and under the surface $z = 4 + y - x^2$.

6. Let $f(x, y) = y$. Set up, *but do not evaluate*, the integral

$$\iint_R f \, dA$$

where R is the region in the picture below. (Assume that the arcs in the picture are circular.)



Do this in two ways

(a) In rectangular coordinates.

(b) In polar coordinates.

7. Let $f(x, y, z) = x^2 + y^2$. Let W be the solid region lying above the cone $z = \dfrac{1}{2}\sqrt{x^2 + y^2}$ and below the upper hemisphere $z = \sqrt{5 - x^2 - y^2}$. Set up, *but do not evaluate*, the integral

$$\iiint\limits_W f \, dV$$

in two ways:

(a) In cylindrical coordinates.

(b) In spherical coordinates.