Math 2411 **Quiz Three** **October 10, 2000**

You may use any books, notes, tables, calculators, or computers you wish. Write your answers so that someone other than yourself can understand your exposition. Please do not return this sheet.

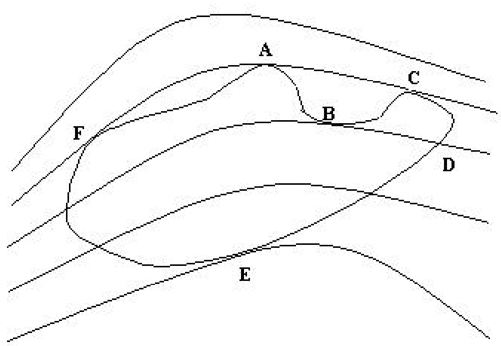
1. In the picture below, the closed curve is the graph of $g(x,y) = 0$, while the other curves are level curves of the function f. It is also true that $\nabla f \neq 0$ for all (x,y).

a)At which of the points **A, B, C, D, E, F** does a local extremum of f on $g(x,y) = 0$ occur? Explain!

A local extremum occurs at each of the points **A, B, C, E,** and **F**. At each point the level curve and the constraint curve $g(x,y) = 0$ are tangent, and the constraint curve does not cross the level curve–thus on $g(x,y) = 0$ the function f changes from decreasing to increasing, or from increasing to decreasing (We can't which because the level curves are not labeled.).

b)At which of the points **A, B, C, D, E, F** does an extremum of f on $g(x,y) = 0$ occur? Explain!

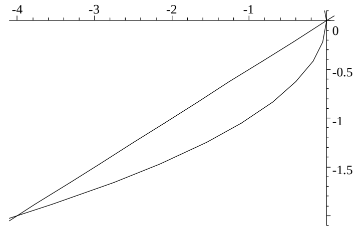
An extreme value occurs at **A, C, E,** and **F**. Here the constraint curve stays completely on one side of the level surface to which it is tangent.



2. Suppose the two-dimensional integral $\iint_\Omega f(x,y)dA$ is given by the iterated integral

$$\iint_\Omega f(x,y)dA = \int_{-2}^{0} \int_{2y}^{-y^2} (x+3y)dxdy$$

Make a neat sketch of the region Ω and give an iterated integral for $\iint_\Omega f(x,y)dA$ in the which the first, or "inside", integration is with respect to y. You need not evaluate either iterated integral.



To see where the curves intersect, solve the equations $\begin{matrix} x = -y^2 \\ x = 2y \end{matrix}$. Thus, $-y^2 = 2y$, or $2y + y^2 = y(2+y) = 0$. The curves thus intersect at $(0, 0)$ and $(-4, -2)$.

Now, integrating first in the y-direction:

$$\iint_{\Omega} f(x,y)dA = \int_{-4}^{0} \int_{-\sqrt{-x}}^{x/2} (x+3y)dydx$$

Finis