640:251:19-20 # Problems, Week 7 **10/24/96**

1. a) What is the maximum of the function $f(x, y) = 3x + 5y$ subject to the constraint $x^2 + y^2 = 1$, and where is it attained? Draw a picture of the constraint and of some level lines of f which illustrate the method of Lagrange multipliers and show where the maximum is attained.

b) What is the maximum of the function $f(x, y) = 3x + 5y$ subject to the constraint $x^{10} + y^{10} = 1$ and where is it attained? Find your result exactly in terms of known or computable values of familiar functions and then give numerical approximations of your answers. Draw a picture as in a).

c) What is the maximum of the function $f(x, y) = 3x + 5y$ subject to the constraint $x^{1/10} + y^{1/10} = 1$, and where is it attained? Find your result exactly in terms of known or computable values of familiar functions and then give numerical approximations of your answers. Draw a picture as in a).

d) What do you think happens to the maximum of the function $f(x, y) = 3x + 5y$ subject to the constraint $x^n + y^n = 1$ and to where it is attained when $n \to +\infty$? Draw a picture.

e) What happens to the maximum of the function $f(x, y) = 3x+5y$ subject to the constraint $x^n + y^n = 1$ and to where it is attained when $n \to 0^+$? Draw a picture.