

**Problem statement** a) What is the maximum value 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 the appropriate level set of the objective function.

b) Suppose  $n$  is a positive real number. What is the maximum value of the function  $f(x, y) = 3x + 5y$  subject to the constraint  $x^n + y^n = 1$  and where is it attained? Your answers should all be functions of  $n$ .

c) What happens to the maximum value found in b) when  $n \rightarrow \infty$ ? Try to draw a picture of the constraint and the level set when  $n$  is large.

d) What happens to the maximum value found in b) when  $n \rightarrow 0^+$ ? Try to draw a picture of the constraint and the level set when  $n$  is small.

**Comment** Graphing programs don't seem to handle the extreme situations described in c) and d) very well. Some thought may be necessary to sketch the situations.