

15.3: Lagrange Multipliers

Calculus III

College of the Atlantic

1. Consider the function $f(x, y) = x + y$.
 - (a) Sketch a contour map for this function.
 - (b) Find the maximum and minimum values of $x + y$ on the circle $x^2 + y^2 = 4$.
 - (c) Suppose you are standing on the maximum that you just found in the previous problem. What is the maximum directional derivative at that point?
2. Let's return now to the example I did on the board. Maximize

$$f(x, y) = x^{2/3}y^{1/3}, \quad (1)$$

subject to the budget constraint of $g(x, y) = x + y = 3.78$. We found that the maximum output of f occurs when $x = 2.52$ and $y = 1.26$. This led to a production of $f(2.52, 1.26) \approx 2$. We also found that $\lambda \approx 0.53$.

Suppose we now have a different budget constraint: $x + y = 4.78$.

- (a) What values of x and y maximize $f(x, y)$ subject to this new constraint?
- (b) What level of production results?
- (c) What do you notice?
- (d) Whoa.