Problem Set 9

2019 Math Boot Camp for the Political and Social Sciences

Deeper Thinking

1. Plot some points of the graph $z = x^2 + y^2$. What shape do you get?
2. Consider the function $f(x, y) = \sin(x)\sin(y)$. What does the graph $z = f(x, y)$ look like? What does the set of points $f(x, y) = 0$ look like?
3. Look back over the topics we've studied this week. Which do you feel good about, which do you feel need some more attention? One good exercise is the following - pick a concept and come up with an exercise you would use to teach it to someone.

Some practice

1. For the function $f(x, y) = x^3(y + 1) + xe^y$ compute $\dfrac{\partial f}{\partial x}$ and $\dfrac{\partial f}{\partial y}$.
2. Compute ∇f for each of the following functions:
   (a) $f(x, y) = x + y$
   (b) $f(x, y) = \sin(x)\sin(y)$
   (c) $f(x, y) = e^{x+y^2}$
   (d) $f(x, y) = x^2y^2 + xy - x - y$
   (e) $f(x, y) = \log(x)\log(x + y)$
3. Find the extreme values of $f(x, y) = x^2y + 2y$ subject to the constraint $x^2 + y^2 = 4$.
4. If two numbers x and y satisfy $x + y = 20$, what is the largest value of the product xy?
5. A politician is organising their campaign trail, and has two final cities to consider. To secure x_1 votes in city one takes time $f_1(x_1) = x_1 + 5x_1^2$, and to secure x_2 votes in city two takes time $f_2(x_2) = x_2 + 3x_2^2$, both measured in seconds. If she needs 1000 votes from these two cities, what is the minimum amount of time she can spend campaigning in them in days?
6. Read the exercises from Chapters 15 and 16 in [Moore-Siegel] and either do them or thoroughly convince yourself they're not worth your time.
7. Pat yourselves on the back! It's been great working with you all.