These exercises are intended to help you cement your knowledge and to make concrete the theory we discussed in class. Look over and attempt the exercises before the DGD. Not all exercises will be done in the DGD due to limited time but please ensure that you ask the TA to do those exercises that you had difficulty with!

Questions marked with ** are challenging and interesting, and beyond the scope of this course.

1. Any questions left over from last week.

2. Sketch the following sets. The values $a, b, \delta$ are constants. Hint: start by supposing $(a, b) = (0, 0)$ and $\delta = 1$ to make things simpler, and then translate and scale appropriately.
   - (a) $\{(x, y) \mid \max\{|x - a|, |y - b|\} < \delta\}$
   - (b) $\{(x, y) \mid \sqrt{(x - a)^2 + (y - b)^2} < \delta\}$
   - (c) $\{(x, y) \mid |x - a| + |y - b| < \delta\}$
   - (d) $\{(x, y) \mid 2 \max\{|x - a|, |y - b|\} < \delta\}$

3. Sketch the following sets.
   - (a) $\{(x, y) \mid x^2 + y^2 > 2\}$
   - (b) $\{(x, y) \mid x^2 - y^2 > -1\}$ (I made an error on this one in class!)
   - (c) $\{(x, y) \mid x^2 - y^2 > 1\}$

4. Stewart, Ch 11.3 #3 (estimating partial derivatives)

5. Stewart, Ch 11.3 #15, 19, 21, 25, 29, 31, 33, 39 (etc) (computing partial derivatives)

6. Stewart, Ch 11.3 #45, 47, 49 (implicit differentiation)

7. Stewart, Ch 11.3 #51, 53, 55, 57, 59 (etc) (second derivatives)

8. Stewart, Ch 11.3 #65, 89

9. **Stewart, Ch 11.3 #71 (partial differential equations), #91 (thinking about Clairaut’s theorem)