

**Analytic Geometry and Calculus III (22005 Section 002)**  
**HW3, due Wednesday, September 21**  
**Instructor: Prof. Artem Zvavitch**

**Problem 1.** Find the domain of  $f(x, y) = \ln(100 - 4x^2 - 4y^2)$ . Describe the level curves of this function.

**Problem 2.** Sketch the graph of function  $f(x, y) = x^2$

**Problem 3.** Show that  $\lim_{(x,y) \rightarrow 0} \frac{x^2 - y^2}{x^2 + y^2}$  does not exist.

**Problem 4.** Let  $f(x, y) = y \cos x + \ln(xy)$ . Please, find

- $f_x$ ,
- $\frac{\partial f}{\partial y}$ ,
- $f_{yy}$ ,
- Check that  $f_{xy} = f_{yx}$ .