

Homework#1

- I. (6 Points) Find and sketch the domain of the following functions.
- $f(x, y) = \ln|xy + x - y - 1|$
 - $f(x, y) = \cos^{-1} xy$
 - $f(x, y, z) = \ln(x^2 - y^2 + z^2)$
 - $f(x, y, z) = 1 - |y| - |z|$
 - $f(x, y, z) = \frac{\ln(x^2 + y^2 + z^2)}{\sqrt{z - \sin(xy)}}$
- II. (6 Points) Use Python (and GeoGebra) to graph the functions using various domains. (Attach the pictures)
- $f(x, y) = e^x \cos y$
 - $f(x, y) = xy^2 - x^3$ (Monkey Saddle)
 - $f(x, y) = xy^3 - yx^3$ (Dog Saddle)
 - $f(x, y) = \frac{x^2}{2} + \frac{y^2}{3}$
 - $f(x, y) = \frac{\sin(xy)}{x^2 + y^2}$

Also plot some of the Level curves by hands.

- III. (6 Points) a. Does the limit $\lim_{(x,y) \rightarrow (0,0)} y/x$ exist?
- b. Show that $\lim_{(x,y) \rightarrow (1,1)} \frac{\tan y - y \tan x}{y - x}$ does not exist.
- c. Find the limit of $f(x, y) = xy \frac{x^2 - y^2}{x^2 + y^2}$
- d. Find the limit of $f(x, y) = \frac{xy^2 \sin(x)}{x^2 + y^2}$ as $(x, y) \rightarrow (0, 0)$ using polar coordinates.
- e. Find the limit of $f(x, y) = \frac{x^3 \cos(y)}{x^2 + 2y^2}$ as $(x, y) \rightarrow (0, 0)$ using polar coordinates.