	Homework 1	
	Discipline: Data Science, Computer Science	**Code:**
	Professor: Dr. Mohsin Ali	
	Semester:	
	Course: Deep Learning	

Calculus for Deep Learning

Instructions:

- **Submit all of your codes and results in a single zip file with name FirstName_RollNumber_Homework_01.zip**
- **zip file should include code, scanned handwritten solution for all questions and report.**
- **There should be Report.pdf detailing your experience and highlighting any interesting results. Kindly don't explain your code in the report, just explain the results. Your report should include your comments on the results of all the steps, with images, for example what happened when.**
- **For each convention, there is a 3% penalty if you don't follow it.**
- **2% (of obtained marks) deduction per day for late submission.**
- **Email instructor or TA if there are any questions. You cannot look at others solution or use others code, however you can discuss with each other.**
- **Plagiarism will lead to a straight zero with additional consequences as well.**

Due Date: 11:59 PM on Wednesday, 31rd March 2022

Refrences and further reading

https://www.tutorialspoint.com/sympy/index.htm
https://openstax.org/books/calculus-volume-3/pages/4-7-maxima-minima-problems

Note:

In report add plots for each question and its derivative and points and your analysis

Question 1 Find the critical point of following function by solving on paper as well as using SymPy python library and plot the function and the critical point on same plot.

(a) $f(x, y) = x^4 + y^4 + 16xy$
(b) $f(x, y) = \sqrt{x^2 + y^2} + 1$
(c) $f(x, y) = e^{-(x^2+y^2+2x)}$

Question 2 Find the extreme values, critical points and the saddle points using second derivative test on paper and do the same using SymPy python Library to solve it and plot it.

(a) $f(x, y) = xe^y - e^x$
(b) $f(x, y) = xsin(y)$
(c) $f(x, y) = 4xy - x^4 - y^4$

Some Functions from SymPy

- Declaring a variable x=Symbol('x')
- Derivative diff(function ,x)
- Set up an equation Eq(x,y) this will give x=y

- Solve one or more equation for one or more variables respectively solve(x**2 - 1, x)
- For 2d plot plot(x**2, line_color='red')
- For 3d plot plot3d(x*y, (x, -10,10), (y, -10,10))