Mathematica Project 5: due April, 17rd (IN CLASS)
Multivariate Calculus, MTH 212, Spring 2019

Note: late projects will not be accepted.

Use the text input mode to start your Mathematica notebook with your name and project number. Your project should be well-organized and clear to read; make sure all the exercises are clearly labeled and all questions answered. (Failure to follow these directions will result in lost points.) Make sure that you get all your Mathematica input (functions, formulas, commands you use to answer questions) and the required output (evaluate all the necessary cells to produce/display your results, plots, etc.). Bring your project printout to class on 4/17/19. (Please staple it!)

1. Find all local extrema and saddle points of the function $f(x, y) = e^{-y}(x^2 + y^2)$. Do all the necessary calculations in Mathematica: finding partial derivatives and Hessian, solving equations for critical points, evaluating the Hessian and f_{xx} at the critical points. Your result should contain the max/min/saddle values of f and the points at which these values are attained. Show all your work. Plot these points on the surface $z = f(x, y)$.

   Use the demo notebook on min/max/saddle points posted on our web page for help.

2. Find the maximum and mimimum values of x^2+y^2, subject to the constraint $x^2-2x+y^2-4y=0$. Use the method of Lagrange multipliers. Do all the necessary calculations in Mathematica: finding partial derivatives, solving equations, evaluating the objective function at the critical points. Your result should contain the maximum and minimum values of x^2+y^2 and the points at which these values are attained. Show all your work.

   For the bonus points, plot several level curves of $x^2 + y^2$ together with the curve $x^2-2x+y^2-4y=0$, and gradient vectors of the objective function and the constraint function at the points of extrema.

   Use the Project 5 Help file posted on our web page.