University of Technology - HCMC
Faculty of Applied Mathematics

Calculus 2 Project
Semester 2 (2022 - 2023)

Instruction

The students work in a group and write a report for the given project. (See the team information).

Using Matlab or Python to solve the following problems and write a report.

The report must have 3 parts:

i) The theory and algorithm (as your understanding);
ii) The Matlab or Python commands (it isn't allowed any direct command to solve the problem, explain important steps);
iii) The results and conclusion.

Project 1

Problem 1. Let $z = f(x, y) = x^4 - 2x^2 - y^3 + 3y$.

(a) Draw the graph of the function.

(b) Draw the contour plot of the function. Point out the local extreme and the saddle point on that figure.

(c) Find the exact local extreme and saddle point (using calculus technique).

Problem 2. Find the maximum and minimum values of $z = 2x^2 - 2xy + y^3$ subject to the single constraint $x^2 + y^2 = 4$.

(a) Using Lagrange multiplier method.

(b) Using contour plot (Draw the contour plot of the function and the constraint curve in the same figure).

Problem 3. Let C be the intersection of the surface $x^2 + y^2 + z^2 = 9$ and the cylinder $x^2 + 3y^2 = 4$, $z > 0$.

(a) Draw the surfaces and the curve C.

(b) Find the length of the curve.

(c) At any given point (x_0, y_0, z_0) belongs to the curve, draw the unit tangent vector.

Project 2

Problem 1. Let $z = f(x, y) = x^2 + 2y^2 + 3xy^3 - y^3$.

(a) Draw the graph of the function.

(b) Draw the contour plot of the function. Point out the local extreme and the saddle point on that figure.

(c) Find the exact local extreme and saddle point (using calculus technique).

Problem 2. Find the maximum and minimum values of $z = 2x^2 - 2xy + y^3$ subject to the single constraint $x^2 + y^2 = 4$.

(a) Using Lagrange multiplier method.

(b) Using contour plot (Draw the contour plot of the function and the constraint curve in the same figure).

Problem 3. Let C be the intersection of the surface $x^2 + y^2 + z^2 = 9$ and the cylinder $x^2 + 3y^2 = 4$, $z > 0$.

(a) Draw the surfaces and the curve C.

(b) Find the length of the curve.

(c) At any given point (x_0, y_0, z_0) belongs to the curve, draw the unit tangent vector.