MA104 Lesson 57

LESSON 57 - LAGRANGE MULTIPLIERS I

Thursday, 01 May, 2008

Outline

1. Admin
2. Last Class
3. LAGRANGE MULTIPLIERS I
   - Course Guide
   - Steps for LaGrange Multipliers
   - Examples
   - Board Work
   - Do Problem Help
4. Look Forward - LAGRANGE MULTIPLIERS II

Admin

1. Most of the class has filled out the survey, Good Job! Cut off for bonus points is the end of this week. There are still a few who have started the survey but not completed it.

Admin

2. Project is due Friday in class.

Admin

3. WPR IV is on Friday, 9 May. If you will not be there let me know now.

Admin

4. WPR - Non Technical Portion (4 questions - 140 points), Technical Portion (2 questions - 110 points)

Admin

5. Mini-WPR Return

Lesson 55 - Optimization and Board Work

Questions?

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Objectives

1. Understand why the method of Lagrange identifies potential minimum and maximum function values.
2. Using the method of Lagrange multipliers, solve optimization problems for functions of several variables subject to a single constraint.

THINK ABOUT

1. Given a function and a single constraint on the function, why is the Lagrange multiplier (the symbol λ) needed if the gradient of the function and the vector comprised of the partial derivatives of the constraint lie on the same line or in the same hyperplane?

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Steps for LaGrange Multipliers

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Steps for LaGrange Multipliers

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2. Find the Constraint Equation - Our limitations. Our Surface Area has to satisfy $2xz + 2yz + xy = 12$.
3. Find the gradient of both the Objective and Constraint Equation $\nabla Ob, \quad \nabla Co$ by taking the partial derivatives and putting them in vector notation. $\nabla Ob(x, y, z) = \langle yz, xz, xy \rangle$, $\nabla Co(x, y, z) = \langle 2z + y, 2z + x, 2x + 2y \rangle$

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4. Set $\nabla Ob(x, y, z) = \lambda Co(x, y, z)$. $\langle yz, xz, xy \rangle = \lambda \langle 2z + y, 2z + x, 2x + 2y \rangle$

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4. Set $\nabla Ob(x, y, z) = \lambda Co(x, y, z)$. $\langle yz, xz, xy \rangle = \lambda \langle 2z + y, 2z + x, 2x + 2y \rangle$
5. Solve the equations $\nabla Ob(x, y, z) = \lambda Co(x, y, z)$ and $Co(x, y, z) = k$ for all values of x, y, z, λ by solving the system of four equations and four unknowns.

Steps for LaGrange Multipliers

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6. Evaluate Ob at all the points (x, y, z). The largest of these values is the max; the smallest is the minimum.

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Examples

1. Plastic Sheet

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Board Work

1. Find Max & Min of $f(x, y) = 4x + 6y$ subject to the constraint $x^2 + y^2 = 13$.
2. Find Max & Min of $f(x, y) = e^{xy}$ subject to the constraint $x^3 + y^3 = 16$.

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DO Problems

1. Section 14.7/ 3, 5, 7, 9, 11
2. Section 14.7/ 30, 32, 33
3. Section 14.7/ 39, 43, 46
4. Section 14.7/ 48, 50, 51
5. Section 14.7/ 52, 54
6. Section 14.8/ 1, 3, 5, 7, 8

LESSON 58 - LAGRANGE MULTIPLIERS II

1. OBJECTIVES:
   1. Model and solve optimization problems using the method of Lagrange Multipliers.
2. READ:
   1. Stewart: Section 14.8, pages 934-938 (Stop at Two Constraints).
3. DO:
   1. Section 14.8/ 27, 32, 34, 38

Questions?

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