MA104 Lesson 48-47

LESSON 48 & 47 - The Gradient and Directional Derivatives

Tuesday, 15 April, 2008

Outline

Admin

1. Part II - Orioles (20.5) and Braves (53910)
2. We will have class tomorrow (16 April 2008) and Thursday (17 April 2008), but not have class on Friday.
3. This means we will have a Problem Solving Lab on 16 April and a quiz on 17 April.
4. In other words - Show up Wednesday and Thursday, but not Friday - Any Questions?

Gradient

Questions?

Outline

Objectives

1. Given a function of two variables, find the gradient vector by hand and using Mathematica at a specified point.
2. Find the vector that is normal to the level curve f(x, y) = c at a specified point.
3. Understand that the gradient vector gives the direction of the greatest increase in functional value at a given point for a differentiable function.

READ

1. Stewart: Section 14.6, pages 910-919.

THINK ABOUT

1. In what ways could the gradient be helpful in 3D optimization?

DO Problems

1. Section 14.6/ 21, 23, 28, 32

LESSON 47 - DIRECTIONAL DERIVATIVES

1. OBJECTIVES:
   1. Understand what a directional derivative is in terms of a rate of change.
   2. Given a function f of two variables, find the directional derivative of f at a given point in any direction by hand and using Mathematica.
2. READ:
   1. Stewart: Section 14.6, pages 910-919.
3. THINK ABOUT:
   1. Under what assumptions does your answer in problem 3 below accurately describe the rate of change?
4. DO:
   1. Section 14.6/ 1, 3, 7, 8, 11, 15

Outline

Directional Derivative

1. Definition 9 $D_u f(x,y) = \nabla f(x,y) \cdot \mathbf{u}$

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2. What is the Directional Derivative?
3. The change in f in any direction.
4. How much I change if I don't want to go in the steepest path!

Outline

Rules for Finding the Gradient

1. Get the gradient by taking the partial derivatives and put them in vector notation! Then get the gradient and the point you are at by subbing in the values of (x,y,z)

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2. Get the direction you want into vector notation
3. Get the vector into a unit vector
4. Take the dot product of the unit vector and the gradient - $D_u \cdot f_x f_y = D_u f f$

Board Work

1. 14.6.13
2. 14.6.16
3. 14.6.17
4. 14.6.20

Board Problems

1. Duff Beer

Board Problems

1. Duff Beer
2. Mathematica version of the do problems

Outline

DO Problems

1. Section 14.6/ 1, 3, 7, 8, 11, 15
2. Section 14.6/ 21, 23, 28, 32

LESSON 50 - EXTREMA OF FUNCTIONS OF TWO VARIABLES I

1. OBJECTIVES:
   1. Given the surface , defined by a function which has continuous partial derivatives over some region, examine the level curves for possible maximum or minimum values.
   2. Understand the definition of a critical point and be able to find the critical points of a function of two variables.
   3. Use the Second Derivatives Test to classify a critical point as a local maximum, local minimum, or saddle point.
   4. Understand why the discriminant will always be negative for a saddle point.
2. READ:
   1. Stewart: Section 14.7, pages 922-928 (Stop at Absolute Max and Min Values).
3. THINK ABOUT:
   1. Compare the methods of finding extrema for single and multivariate functions. What are the similarities/differences?
4. DO:
   1. Section 14.7/ 3, 5, 7, 9, 11

Questions?

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