

MA104 Lesson 48-47

LESSON 48 & 47 - The Gradient and Directional Derivatives

Monday, 14 April, 2008

Outline

- 1 Admin
- 2 Last Class
- 3 THE GRADIENT
 - **Course Guide**
- 4 DIRECTIONAL DERIVATIVES
 - **Definitions**
 - **Rules for Finding the Gradient**
- 5 Examples and Board Problems
 - **Do Problem Help**
- 6 Look Forward - DIRECTIONAL DERIVATIVES

Admin

- 1 Part II - Orioles (20.5) and Braves (53910)
- 2 We will start with the Gradient and work back to directional derivatives

Partial Derivatives II

Questions?

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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

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Gradient

① Definition 8 $\nabla f(x, y) = \langle f_x(x, y), f_y(x, y) \rangle$

Gradient

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- 2 What is the Gradient?

Gradient

- 1 Definition 8 $\nabla f(x, y) = \langle f_x(x, y), f_y(x, y) \rangle$
- 2 What is the Gradient?
- 3 The steepest path.

Gradient

- 1 Definition 8 $\nabla f(x, y) = \langle f_x(x, y), f_y(x, y) \rangle$
- 2 What is the Gradient?
- 3 The steepest path.
- 4 The fastest path to get better!

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Rules for Finding the Gradient

- 1 Take the partial derivatives and put them in vector notation!

Board Problems

- 1 14.6.4
- 2 14.6.6
- 3 14.6.10
- 4 14.6.12

The Map

1 The Map

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DO Problems

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

Board Work

- 1 find the gradient

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