MA104 Lesson 45

LESSON 45 - Partial Derivatives I

Thursday, 10 April, 2008

Outline

1. Admin
2. Last Class
3. PARTIAL DERIVATIVES I
   - Course Guide
   - Definitions
   - Notation
   - Rules for Finding Partial Derivatives and Higher Derivatives
4. Examples and Board Problems
5. Look Forward - PARTIAL DERIVATIVES II
6. Look Forward - DIRECTIONAL DERIVATIVES

Admin

1. Project II is available on the MA104 website and due May 2nd!
2. TEE 21 May 2008
3. Class Points so far:
   1. Total Points so far 855.
   2. Total Points still available 1145.
   3. Bottom Line - Everyone can still get a B.
   4. The worst grade in the class is a C if the person with the worst grade in the class got 80% of the 1145 points left they would get a C+. If they got 90% they would get a B.
   5. Don't lose hope

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4. Quiz - You will have 10 minutes!

Limits of Functions of Two Variables

Questions?

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Objectives

1. Understand what a partial derivative is and describe geometrically what a partial derivative is for a function of two variables.
2. Given a function of several variables, calculate the partial derivatives with respect to each variable by hand and using Mathematica.
3. Given a function of several variables, calculate mixed partial derivatives and partial derivatives of a higher order by hand and using Mathematica.
4. Approximate the partial derivative of a function of two variables at a point both numerically and graphically.

READ

1. Stewart: Section 14.3, pages 878-886 (Omit Example 4; Stop at Partial Differential Equations).

THINK ABOUT

1. Could you develop an expression for a plane tangent to a surface using the partial derivatives of a function?

DO Problems

1. Section 14.3/ 3, 7, 15, 19, 23, 25, 30, 35

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3. $f_y(x,y) = \lim_{h \to 0} \dfrac{f(x,y+h) - f(x,y)}{h}$

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Notations For Partial Derivatives

If $z = f(x, y)$ we write

1. $f_x(x, y) = f_x = \dfrac{\partial f}{\partial x} = \dfrac{\partial}{\partial x} f(x, y) = \dfrac{\partial z}{\partial x} = f_1 = \mathbf{D}_1 f = \mathbf{D}_x f$

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Rules for Finding Partial Derivatives of $z = f(x, y)$

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1. To find f_x, regard y as a constant and differentiate $f(x, y)$ with respect to x.
2. To find f_y, regard x as a constant and differentiate $f(x, y)$ with respect to y.
3. To find the second or higher derivatives keep taking the derivative of the derivative.

The Football

1. The Football shape

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5. Find fb_x and fb_y
6. Find $fb_x(2, \frac{1}{2})$ and $fb_y(2, \frac{1}{2})$

The Football

1. Projectile Motion - Max Range

Board Work

1. find the first partial derivative of $f(x, y) = x^4y^3 + 8x^2y$
2. find the first partial derivative of $f(x, y, z, t) = \frac{xy^2}{t+2z}$
3. find all second partial derivatives of $f(x, y) = x^3y^5 + 2x^4y$

LESSON 46 - PARTIAL DERIVATIVES II

1. OBJECTIVES:
   1. Complete lesson problems and objectives from lesson 45.
2. READ:
   1. Stewart: Section 14.3, pages 878-886 (Omit Example 4; Stop at Partial Differential Equations).
3. THINK ABOUT:
   1. Could you develop an expression for a plane tangent to a surface using the partial derivatives of a function?
4. DO:
   1. Section 14.3/ 4, 16, 36, 51, 77, 82

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

Questions?

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