Lecture 16

Wednesday, February 17, 2021 2:32 PM

* Prayer
* Spiritual thought
* Answering questions ...

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* Reminder of the chain rule:

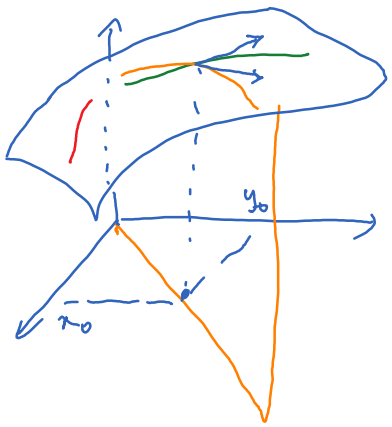
$$f(x,y), \quad x = u^2+v^2+w^2, \quad y = uvw$$

$$\frac{\partial f}{\partial u} = \frac{\partial f}{\partial x}\frac{\partial x}{\partial u} + \frac{\partial f}{\partial y}\frac{\partial y}{\partial u}, \quad \dots$$

Ex: $g(u,v) = f(u^2+v^2, uv)$

$$\frac{\partial g}{\partial u} = ? \quad , \quad \frac{\partial g}{\partial v} = ?$$

* Directional derivatives:



$$D_u f(x_0,y_0) = \lim_{h\to 0} \frac{f(x_0+ah, y_0+bh) - f(x_0,y_0)}{h}$$

$u = \langle a, b \rangle$

$$\frac{f(x_0+ah, y_0+bh) - f(x_0, y_0+bh)}{h} + \frac{f(x_0, y_0+bh) - f(x_0,y_0)}{h}$$

$\to a f_x(x_0,y_0)$ $\qquad$ $\to b f_y(x_0,y_0)$

Ex $f(x,y) = 2xy^2$ at point $(x_0, y_0) = (2,1)$

(1) Find the rate of change of f at (x_0, y_0) in the direction of vector $\langle 3, 2 \rangle$.

(2) What is the direction that gives the maximum rate of change?

* Tangent plane to a surface

Gradient vector is always perpendicular to the Level sets.