LECTURE OUTLINE
Multivariable Functions

Professor Leibon

Math 15

Oct. 25, 2004

Goals

Text, figure... Functions of Space

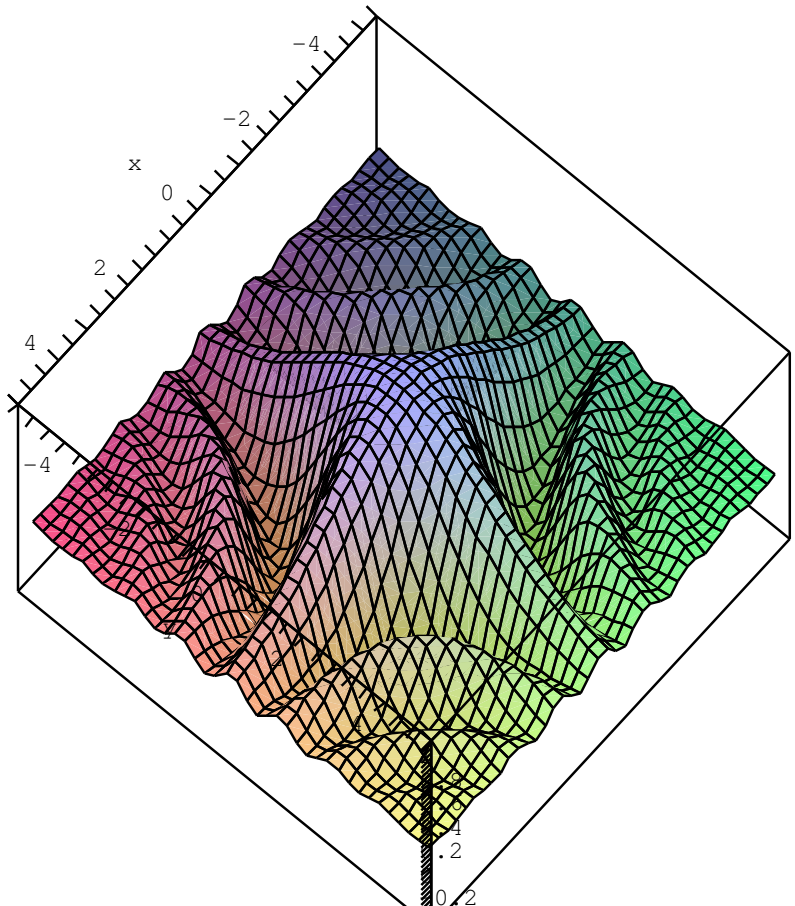
$$f(x, y)$$

$$\frac{\partial f}{\partial x}(x, y)$$

$$f(x, t)$$

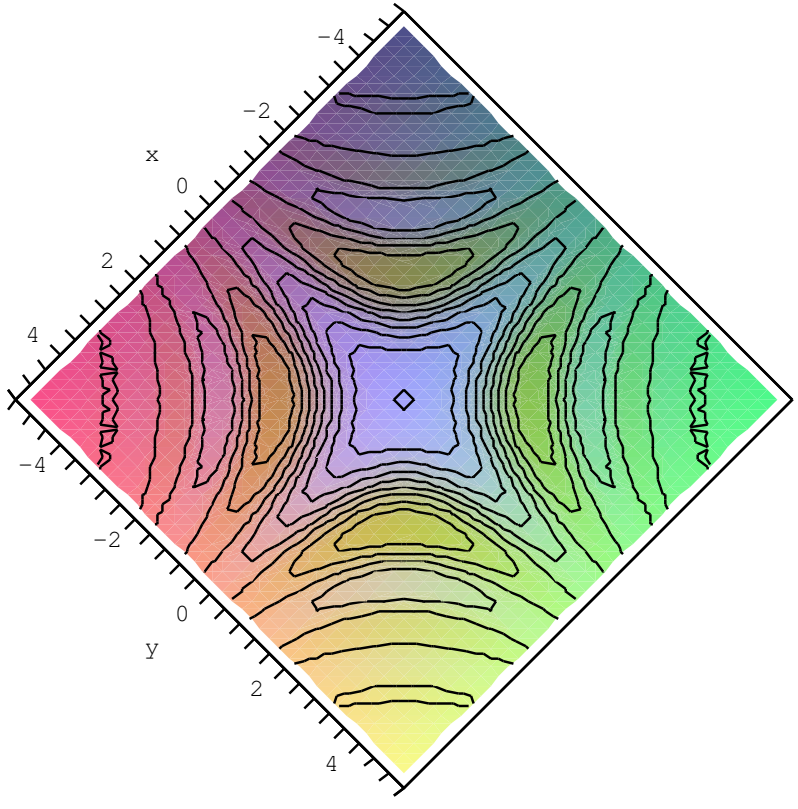
Mountain Range, graph

$$f(x,y) = \cos(xy)e^{\frac{-x^2-y^2}{10}}$$



Contour Plot, topo map, level curves

$$f(x,y) = \cos(xy)e^{\frac{-x^2-y^2}{10}}$$



Notation

$$f(x,y) = \cos(xy)e^{\frac{-x^2-y^2}{10}}$$

$$f : \mathbf{R}^2 \to \mathbf{R}$$

the graph

$$\{(x,y,f(x,y)) : (x,y) \in Domain\}$$

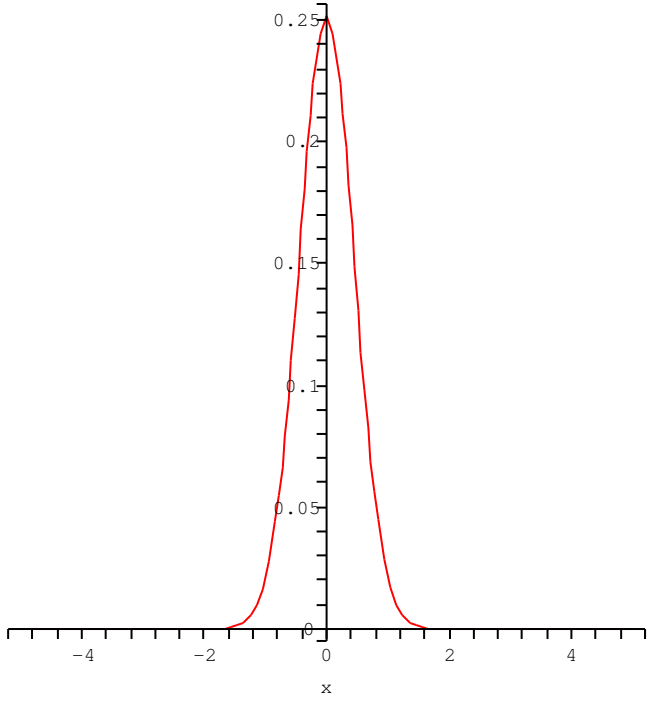
Partial Derivatives

$\frac{\partial f}{\partial x}(x, y)$ means take the derivative in x viewing y as constant.

Ex: Find $\frac{\partial f}{\partial x}(x, y)$ where $f(x, y) = \cos(xy)e^{\frac{-x^2-y^2}{10}}$

Time

$$f(x,t) = \frac{e^{-\frac{x^2}{4t}}}{\sqrt{4\pi t}}$$



Time

$$f(x,t) = \frac{e^{-\frac{x^2}{4t}}}{\sqrt{4\pi t}}$$

Ex: Confirm $\frac{\partial f}{\partial t} = \frac{\partial^2 f}{\partial x^2}$.

Time

$$f(x,t) = \int_{-\infty}^{\infty} \frac{e^{-\frac{(x-y)^2}{4t}}}{\sqrt{4\pi t}} g(y)dy$$

Ex: Explore the fact that $\frac{\partial f}{\partial t} = \frac{\partial^2 f}{\partial x^2}$, and $f(x,0) = g(y)$.