

## Graphs and Level Curves

Read Lesson 10 in the study guide

Read Section 12.2 in the text

Continue work on online homework

Also Try 11, 15, 21, 25, 27, 31, 33, 43, 47

## Functions of Several Variables

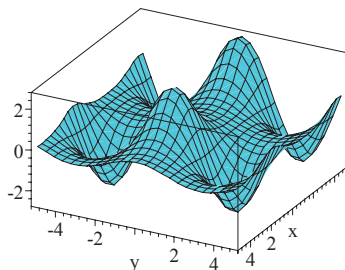
- Real valued functions  $f : R \rightarrow R$   
(Differential, Integral Calculus)
- Vector Valued functions  $f : R \rightarrow R^n$   
(Space Curves)
- Functions of Several Variables  $f : R^n \rightarrow R$ ,

### Terminology:

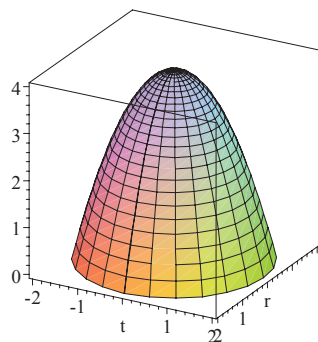
- function of two variables  $f : R^2 \rightarrow R$   
 $f(x, y) = z$
- domain, range
- independent variables, dependent variables

## Examples

$$f(x, y) = \cos(y)e^{\sin x}$$



$$f(x, y) = 4 - x^2 - y^2$$



## Level Curves:

**Def:** If  $f$  is a function of two variables with domain  $D$ , then the *graph of  $f$*  is

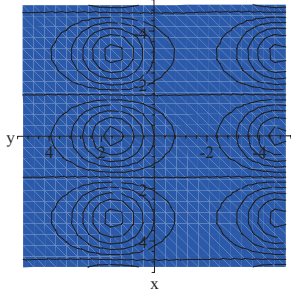
$$\{(x, y, z) \in \mathbf{R}^3 \mid z = f(x, y)\}$$

for  $(x, y) \in D$ .

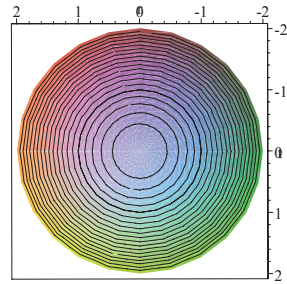
**Def:** The *level curves* of a function  $f(x, y)$  are the curves **in the plane** with equations  $f(x, y) = k$  where  $k$  is a constant in the range of  $f$ . The *contour curves* are the corresponding curves on the surface, the intersection of the surface with the plane  $z = k$ .

## Examples

$$f(x, y) = \cos(y)e^{\sin x}$$

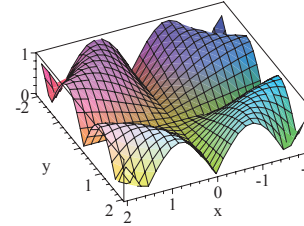


$$f(x, y) = 4 - x^2 - y^2$$

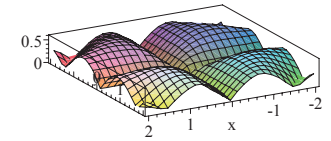


## Other Examples

$$\sqrt{|\sin(xy)|}$$



$$\frac{\sqrt{|\sin(xy)|}}{x^2 + y^2}$$



## Functions of 3 or more variables

$$f(x, y, z)$$

$$f(x_1, x_2, \dots, x_n)$$

### Examples: