Math 2210-1

Monday 4 Oct. : §13.1-13.2

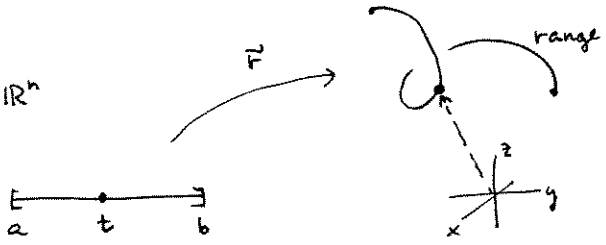
~ tests back Wednesday.

Chptr 12:

$\vec{F}: [a,b] \longrightarrow \mathbb{R}^n$

$\cap$

$\mathbb{R}$



domain

Chptr 13:

reversal!

$f: D \longrightarrow \mathbb{R}$ (and eventually $\vec{F}: \mathbb{R}^n \to \mathbb{R}^m$)

$\cap$

$\mathbb{R}^n$

D = admissable inputs

= domain

real examples:

$f(x,y)$ = (elevation) altitude above sea level (on earth) at longitude x, latitude y.

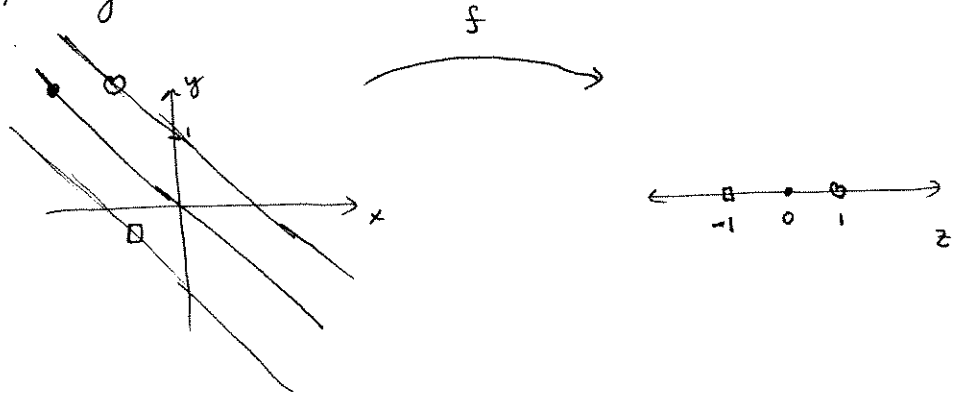
$T(x,y,t)$ = temperature at time t and location (x,y) on Earth

$T(x,y,z,t)$ = same, but also as a fcn of altitude

etc.

<u>example</u>

$f(x,y) = x+y$.



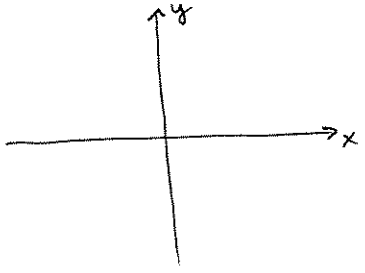
If the domain D is in $\mathbb{R}^2$
you draw the graph $z = f(x,y)$,
i.e. a picture of the points in
$\mathbb{R}^3$ for which $z = f(x,y)$ holds

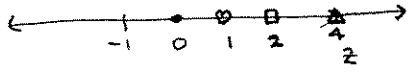
Can you draw the graph of
$z = x+y$?

Example

$$g(x,y) = x^2+y^2$$

mapping picture:





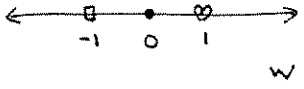
graph $z = x^2+y^2$:

example

$f: \mathbb{R}^3 \to \mathbb{R}$

$f(x,y,z) = x^2+y^2-z^2$

domain picture for ♡, •, □:



range

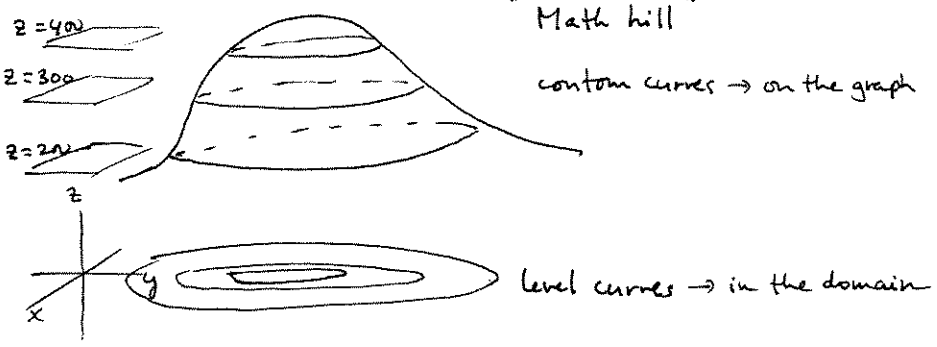
graph?

Def: If $f: \underset{\cap}{D} \to \mathbb{R}$ ($D \subset \mathbb{R}^2$)

then the intersection of of a horizontal plane $z = c$ with the graph $z = f(x,y)$ is called a <u>contour curve</u>

the set of (x,y) in the domain of f for which $f(x,y) = c$ is called a <u>level curve</u>

thus the level curve is the projection of the contour curve back to the x-y domain.



"Math hill"

contour curves → on the graph

level curves → in the domain

anyone who understands topo maps has used level curves of elevation to understand the 3-d graph of the elevation function → see also # 53-58 p. 903

Can you draw the level curve picture for

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

and the graph $z = x^2 - y^2$, with contours?

Def: If $f: \underset{\cap}{D} \to \mathbb{R}$ ($D \subset \mathbb{R}^3$), then the set of (x,y,z) in $\mathbb{R}^3$ for which $f(x,y,z) = c$ (constant) is called a <u>level surface</u> of f. For example, return to page 3.

Something to think about

We've talked about explicit (parametric) and implicit representations for lines, planes, curves, surfaces.

in the explicit case we are saying the object is the range of a certain function

in the implicit case we are saying the object is a level curve, level surface, or intersection of level surfaces in the domain of a function.