Math 2210-4
Friday 18 Feb

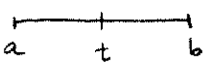
HW for Fri 2/25 (1)

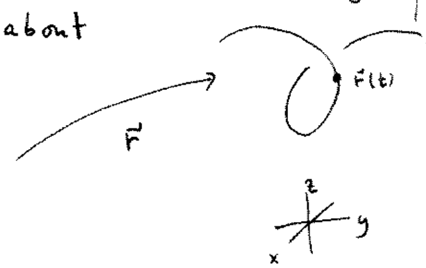
assigned last week
14.7 2a, 3a, 4a, 5a, 6a, 7, 8, 9, 13
15, 17, 23, 27, 35, 36

new today
15.1 1, 9, 10, 11, 17, 18, 23, 24, 25, 27
33, 35, 41
15.2 1, 13, 17, 25, 27, 39, 47

Chapters 13-14 primarily about

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





domain

range.

Chapter 15 is primarily about the "reverse" situation

$$\begin{array}{l} f : D \longrightarrow \mathbb{R} \\ \quad\;\; \cap \\ \quad\;\; \mathbb{R}^n \end{array}$$

(D = domain)

real examples:

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

$T(x,y,t)$ = temperature on earth at time t

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

hybrids

$\vec{E}(x,y,z,t)$ electric field at time t

$\vec{B}$ magnetic

$\vec{F}(x,y,z,t)$ any force field

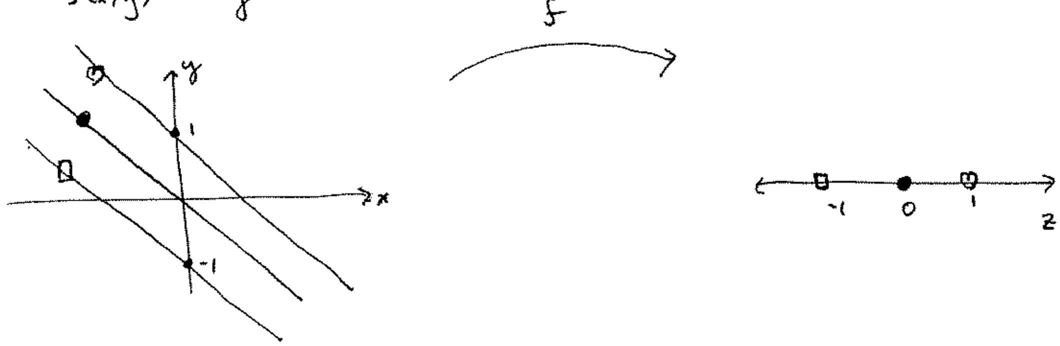
Other courses you will take soon where these ideas come up

$\vec{r}(t)$: Ordinary differential eqtns, Math 2250 (or 2280)

$f(x_1, \dots x_n)$: Partial differential eqtns, Math 3150 (or 2280)

<u>Example</u>

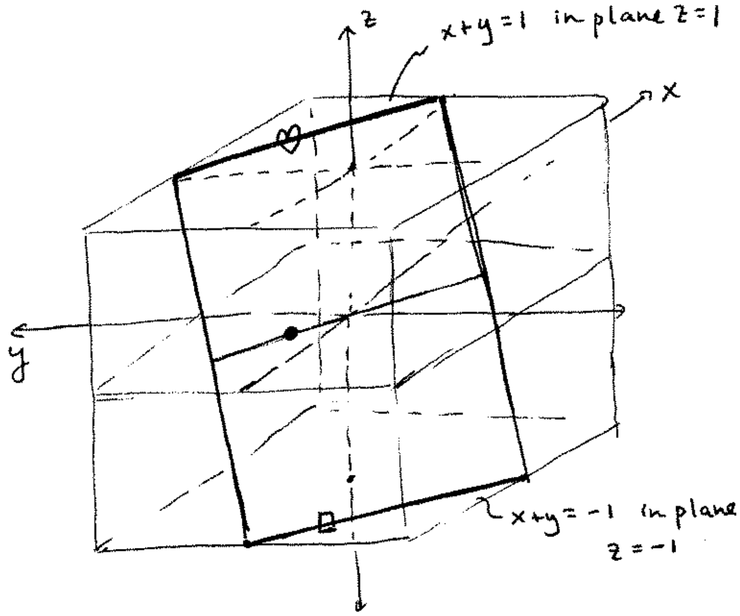
$f(x,y) = x+y$



If the domain D is in $\mathbb{R}^2$
then you visualize the function f
by drawing the graph $z = f(x,y)$ in $\mathbb{R}^3$

Can you draw the graph

$$z = x+y \, ?$$

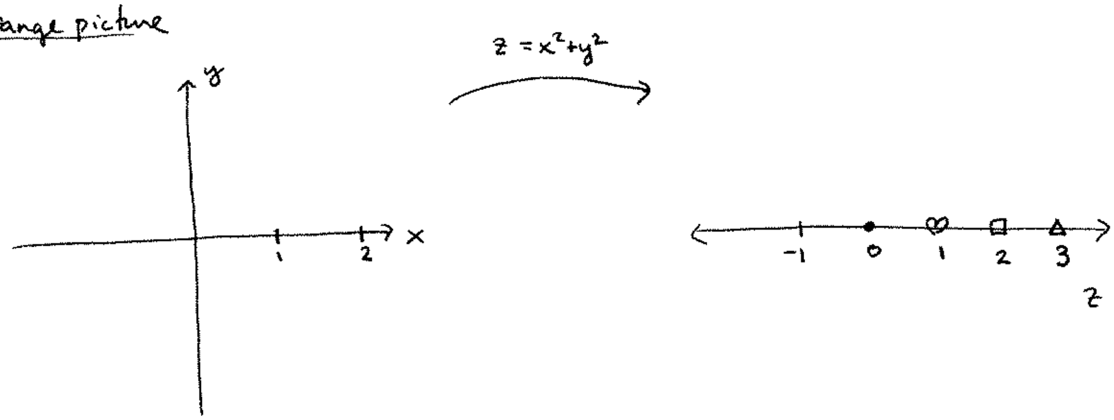


Intersections of a graph with horizontal planes ($z=\text{const}$) are called <u>contours</u>

The projections of contours of a graph $z=f(x,y)$ back to the domain in the x-y plane are called <u>level curves</u>

<u>Example</u> $g(x,y) = x^2+y^2$

<u>domain-~~range~~ picture</u>



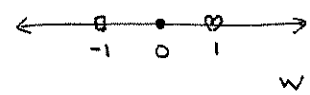
<u>graph $z = x^2+y^2$</u> in $\mathbb{R}^3$

example

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

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

domain picture for ♡, •, □ :



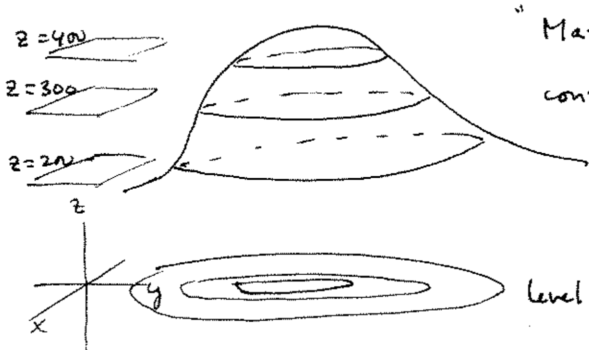
range

graph?

<u>Def</u>: If $f: D \to \mathbb{R}$, $D \subset \mathbb{R}^2$

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?

<u>Def</u>: If $f: D \to \mathbb{R}$, $D \subset \mathbb{R}^3$, 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.