Pre-class Warm-up

Consider the problem:

Find the entry in row 2 column 3 of the matrix product

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \begin{bmatrix} 1 & 0 & -1 \\ -1 & 2 & 1 \end{bmatrix}$$

Here's the question I shall ask you today:
Find someone else who you can interview about this.
Is that person able to do this calculation?

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Answer:

a. Yes

b. No

- There is a 10 minute quiz tomorrow in your discussion session. You may use a single sheet of handwritten notes.
- Have you had problems getting the Canvas site to work? What doesn't work?

2.1

How to understand functions of several variables

or $f : D \longrightarrow \mathbb{R}^m$

We learn: $D \subseteq \mathbb{R}^n$ is an "open" subset.

- How to recognize n and m for a function f : R^n -> R^m
- Domain, range, target or codomain
- Describing a function by its graph
- Describing a function by its level sets, = contour lines.
- Describing a function by sections
- What some standard functions look like: paraboloids, saddle points.

D → f(D) → $\mathbb{R}^m$

What are n and m in the following functions f : R^n -> R^m ?
What are the domain and range?

a. f(s,t) = (1,2,3) + s(0,-1,1) + t(1,0,2)

n = 2 m = 3

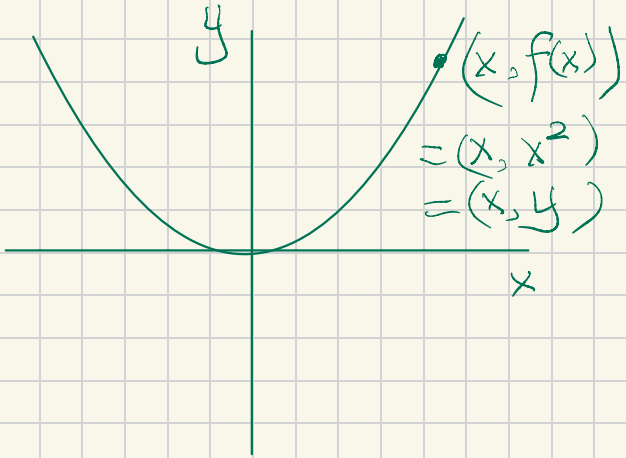
b. f(s) = (1,2,3) + s(0,-1,1)

- ? n = 1 and m = 1
- ? n = 3 and m = 1
- ? n = 1 and m = 3

✓

The range of f is the line in $\mathbb{R}^3$ passing through (1,2,3) in direction (0,-1,1)

The graph of f(x) = x^2.



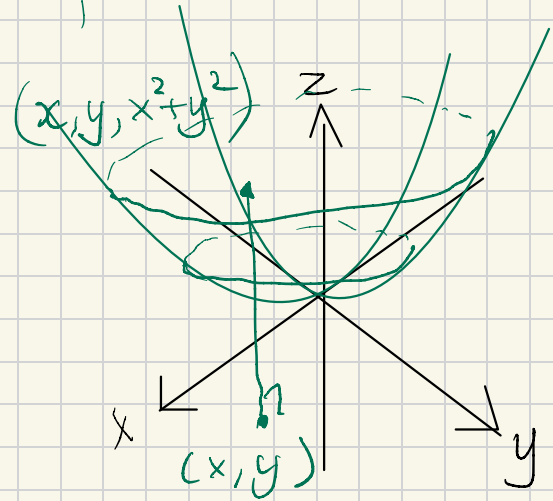
The graph of f(x,y) = x^2 + y^2 : $\mathbb{R}^2 \to \mathbb{R}$

is the set of points $(x, y, f(x,y))$ in $\mathbb{R}^3$

When $y = 0$, we get $(x, 0, x^2)$

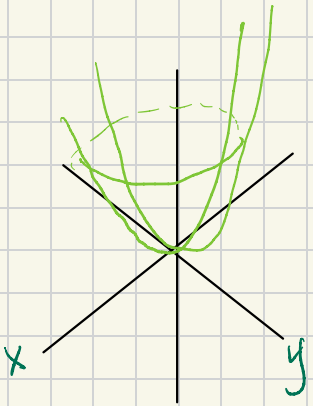
When $x = 0$ we get $(0, y, y^2)$

A parabolic dish:

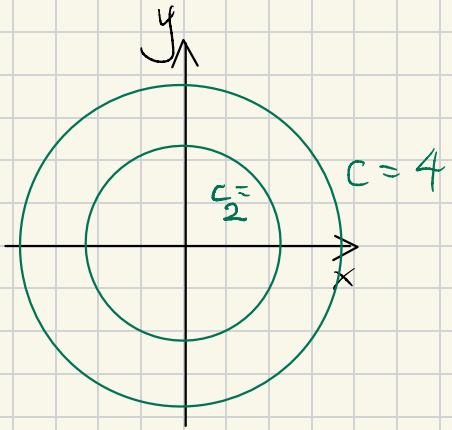


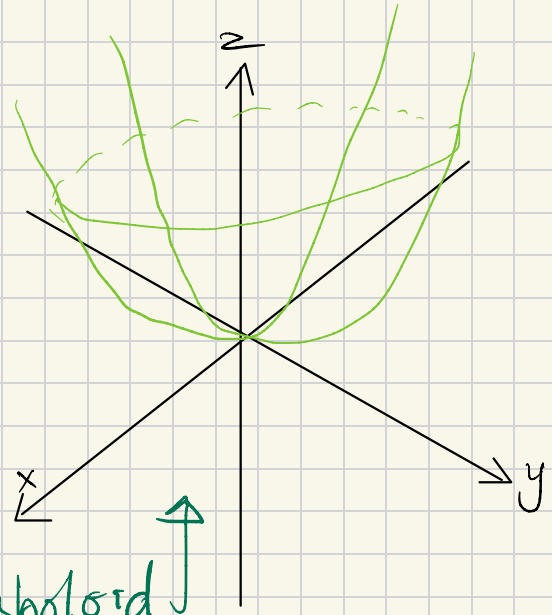
The level sets of f(x,y) = x^2 + y^2 are sets in the domain, of points (x,y) where f(x,y) = c is some constant.

Sections of f(x,y) = x^2 + y^2 are intersections of the graph with vertical planes.



Level sets



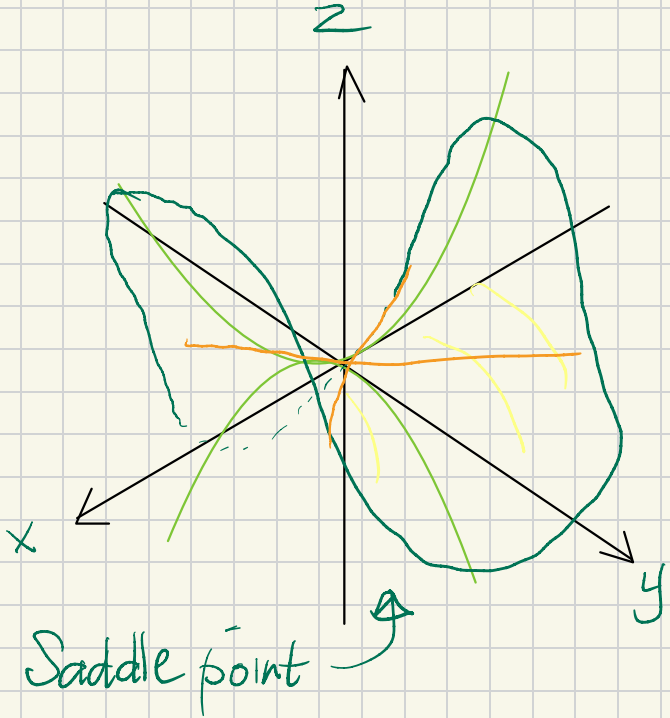


Paraboloid

$f(x,y) = ~~xy~~ \; x^2 - y^2$

Sections: parabola pointing up in x-z plane

parabola pointing down in y-z plane



Saddle point

Level sets