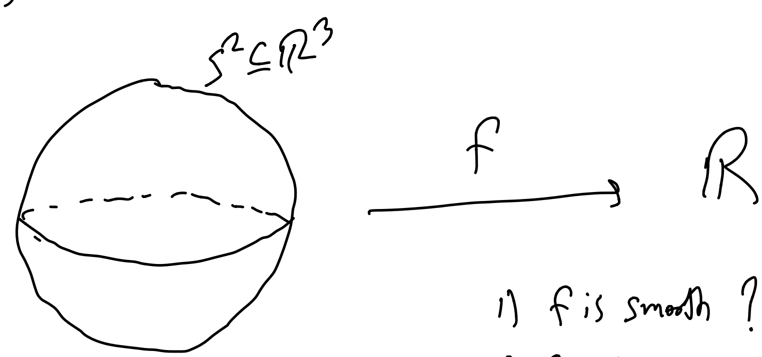
(Laithy)

Logistics

1) Course website & lectures
2) OH
3) Prerequisites
4) Book
5) Marking scheme.
6) Piazza
7) Lecture style:

Informal Introduction

1] developed Calculus on $\mathbb{R}^n$ ✓



1) f is smooth ?
2) $\int_{S^2} f$?
3) Tensors or diff forms on S^2 ?

2) develop Calculus on particular subsets of $\mathbb{R}^n$

manifolds (gen of Euclidean spaces)

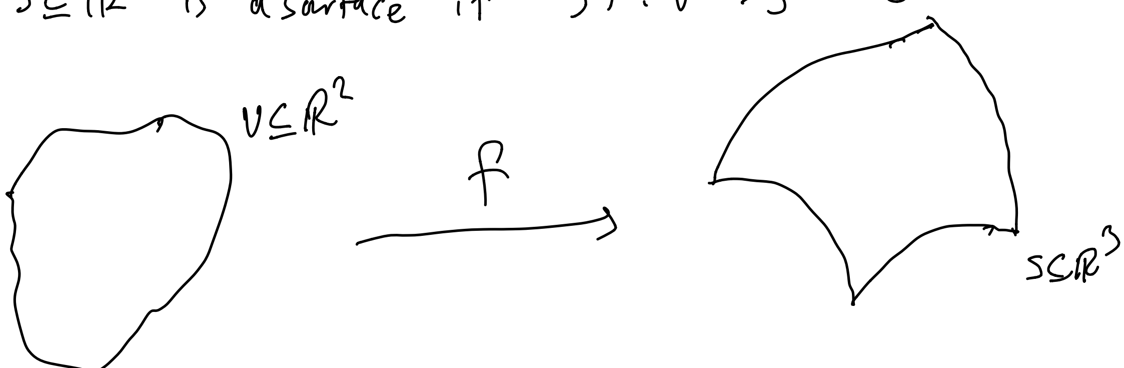
what is a surface in $\mathbb{R}^3$?

Attempt #1: Any $S \subseteq \mathbb{R}^3$ is a surface. Too general.

Attempt #2: Vaguely, a surface is $\mathbb{R}^2$ (or an open subset of the plane) that is deformed in some way.

More precisely:

$S \subseteq \mathbb{R}^3$ is a surface if $\exists f : V \to S$ bij



f is smooth

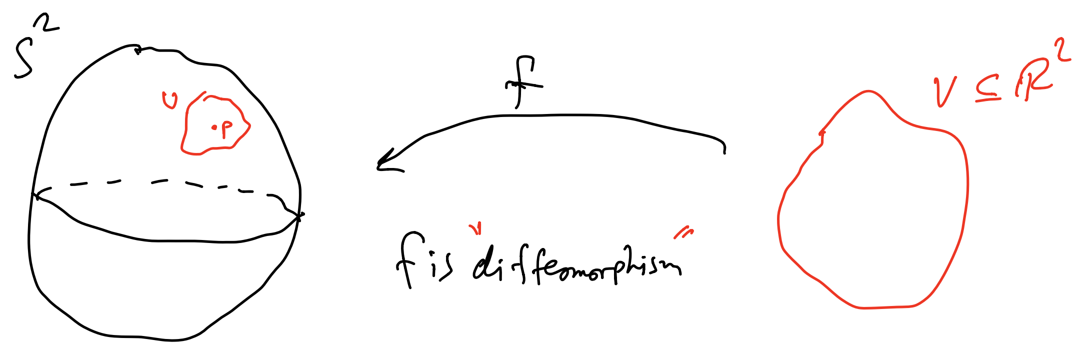
f^{-1} is "smooth"

(f is a "diffeomorphism") Too specific

S^2 doesn't satisfy this. why?

Why is this definition not precise?

Attempt #3: Vaguely, $S \subseteq \mathbb{R}^3$ is a surface if it's many "Attempt #2 surfaces" stitched together.



if $\forall p \in S$, $\exists\, U$ neighbhd of p in S and open subset $V \subseteq \mathbb{R}^2$ and a "diffeomorphism" $f : V \to U$

More precisely

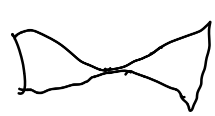
1) f is smooth
2) f is a homeomorphism
3) Df is 1-1

$\Rightarrow$ define what it means for $g : S \to \mathbb{R}$ to be C^∞.

$\Downarrow$

Prove f^{-1} is smooth in the above def.

exc why #3?



$\Rightarrow$ f is a diffeomorph.

$\# \mathbb{R}^{n^2}$

$\not\cong \mathbb{R}^{n^2} \to \not\cong \mathbb{R}^m$ for any m.

3) $MAT_{n \times n}(\mathbb{R})$, $\mathbb{RP}^n$, Grassmanians, Lie Group, spacetime

Develop Calculus on "Abstract Manifolds"

differential Topology

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differential geometry
