



UNIVERSITY
OF HULL

Differential Geometry (661955)

Trimester 1

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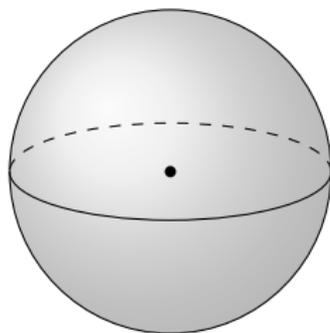
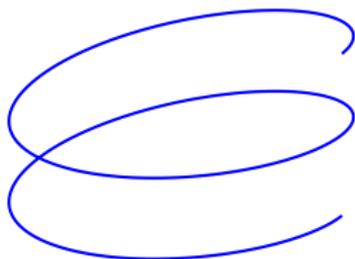
Topology and Differential Geometry

- ▶ Both deal with the study of shape:
 - Topology from a continuous POV
 - Differential geometry from a differentiable POV
- ▶ Are the languages of lots of modern mathematics and physics
 - Functional Analysis (*notions of weak convergence*)
 - PDEs on manifolds (*surfaces*)
 - Mechanics of solids
 - General relativity



Divided in 3 parts:

- ▶ Curves
- ▶ Surfaces
- ▶ General topology



- ▶ Curves are 1D and Surfaces 2D (*helix – sphere*)
- ▶ Diff Geometry: Study C & S from differentiable POV

Take some derivatives \rightsquigarrow define some scalars: **Curvatures**

- ▶ Curvatures measure how much an object deviates from being **flat**

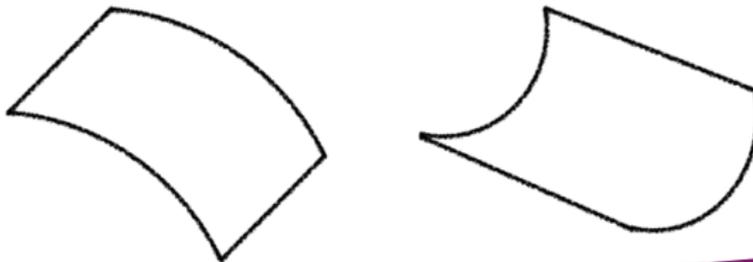
Important Theorem we study

Theorema Egregium: Take a surface

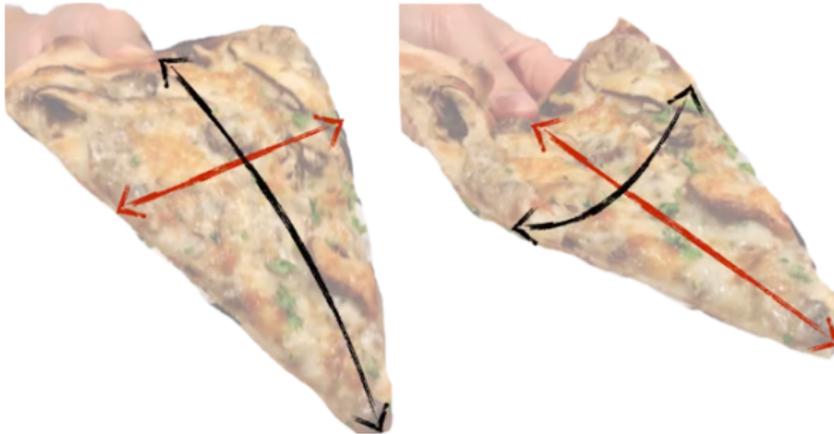
- ▶ Bend it in any way
 - ▶ Don't stretch, shrink or tear it
- ⇒ Gaussian curvature stays the same

Example: Piece of Paper is flat ⇒ 0 Gauss curvature

- ▶ Bend it ⇒ 1 direction must stay **flat** to preserve 0 curvature



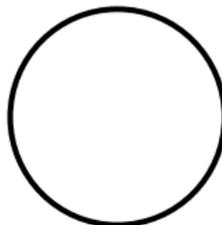
Important Application



Goal: Eating pizza

- ▶ Slice of pizza on plate is flat \implies Zero Gaussian curvature
- ▶ Lift pizza slice \implies one direction stays flat to preserve 0 curvature
- ▶ Bend crust \implies opposite direction flattens to preserve 0 curvature

- ▶ Study shapes from continuous POV
- ▶ 2 shapes are topologically the same:
 - If you can deform one into the other
 - You can bend, stretch, shrink
 - You cannot tear!
- ▶ **Question:** Are the shapes below topologically the same?



Teaching: Each week we have

- ▶ 2 lectures of 2 hours
- ▶ 1 tutorial of 1 hour

Assessment:

- ▶ 5 problem sheets (accounts for 30% of final mark)
- ▶ Exam (accounts for 70% of final mark)

Get in touch for more information:

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