Surface Classification

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June 2019

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How many vertices?

How many edges?

How many faces?

Cube

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A D > <
A P >
A



How many vertices?

How many edges?

How many faces?

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How many vertices?

How many edges?

How many faces?

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Pentagonal Prism

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Octahedron

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Topology of Surfaces

Not a big deal:

- translating
- rotating
- stretching
- shrinking
- wiggling

Big deal: cutting gluing

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If we can transform one surface into another, using only the kinds of transformations on the left, then these two surfaces are **topologically** equivalent or homeomorphic.

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Topology of Surfaces



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Theorem (Classification of Surfaces)

Let *S* be a closed, orientable surface. Then *S* is topologically equivalent to one and only one of the genus g surfaces shown below (g = 0, 1, 2, ...):



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What is that??



This is an example of a translation surface.

But what is it topologically?

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What is that??



This is an example of a translation surface.

It's a genus-2 surface!

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Further reading (ie, internet search terms)

- Mobius band
- Klein bottle
- Diana Davis math (Prof. Davis is an expert on polygonal billiards who has created many expository materials on the subject for a variety of audiences)

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