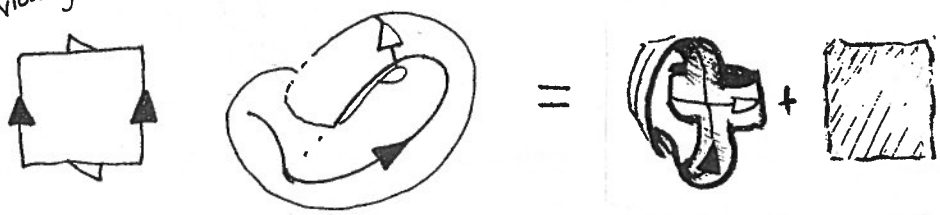
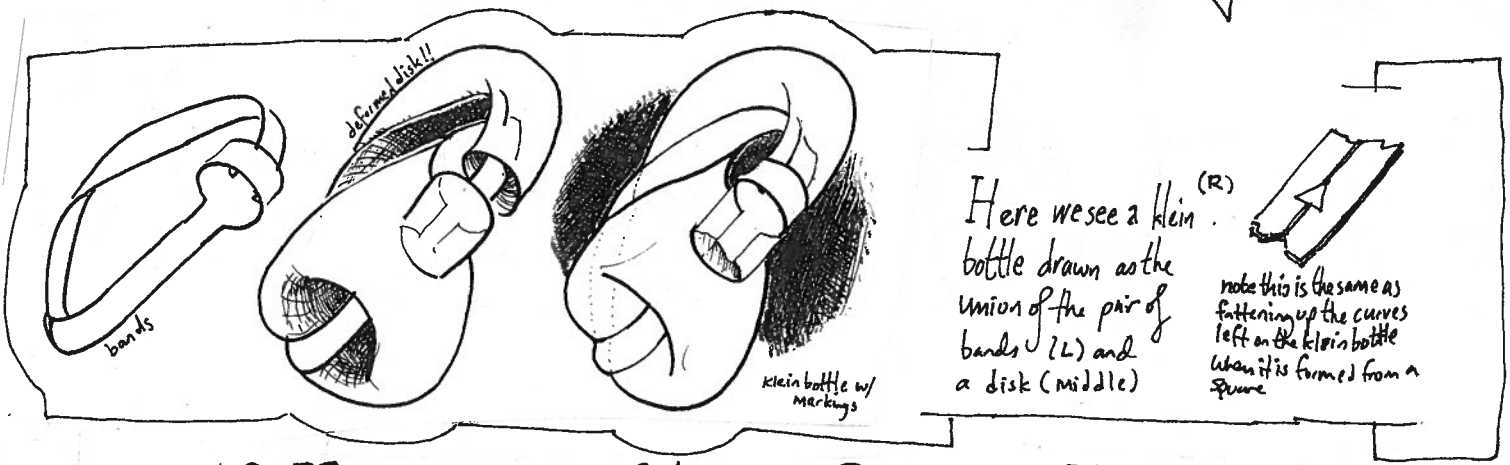
Here are Lots of views of the KLEIN BOTTLE

Previously...



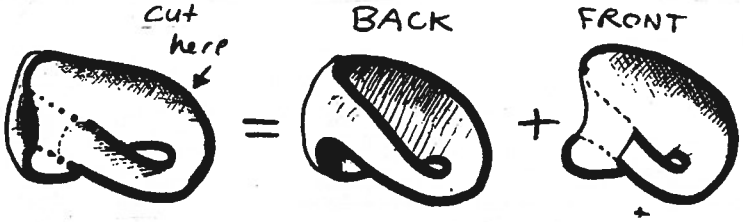
How can the klein bottle be seen as a pair of bands sewn to a square disk along their single edge?



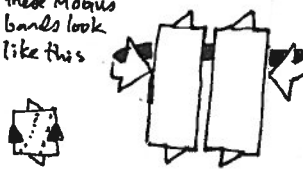
Here we see a klein (R) bottle drawn as the union of the pair of bands (L) and a disk (middle)

note this is the same as flattening up the curves left on the klein bottle when it is formed from a square

A KLEIN BOTTLE is ALSO TWO MOBIUS BANDS STITCHED TOGETHER ALONG THEIR SINGLE EDGE!

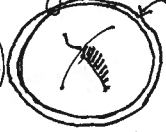


IN THE GLUING-UP-THE-SQUARE DIAGRAM, these Mobius bands look like this

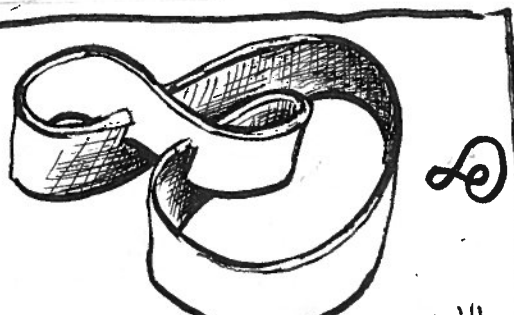


This is a very useful view of things:

If you understand this picture of the mobius band (a disk with a funny pucker)



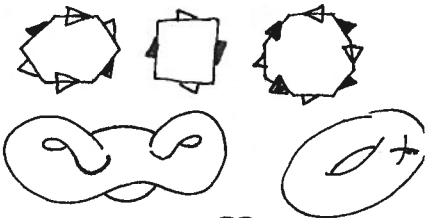
Then you see the klein bottle as a sphere with 2 of those funny puckers.



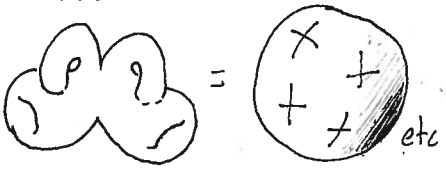
Find this band in the klein bottle. Is it one or two sided? What are the remaining pieces of the klein bottle once this has been removed?

WOW! After you cut a mobius band down the middle, arrange the result to look like the above!!

So WHAT SURFACES ARE THESE?



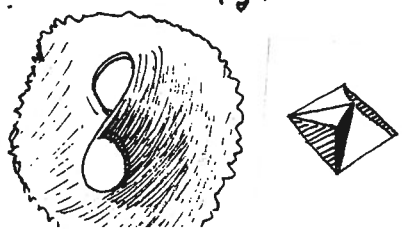
More over:



CLASSIFY ALL SURFACES

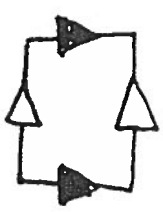
BONUS

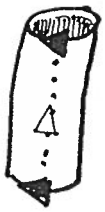
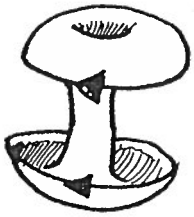
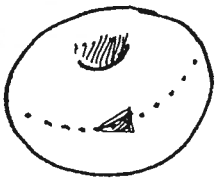
They can all be obtained by gluing together fundamental pieces



THE FLAT SURFACES

Both the TORUS and the KLEIN BOTTLE can be obtained by Rolling up a square into a tube and fastening the ends

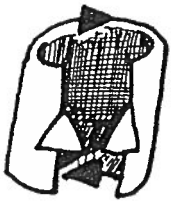


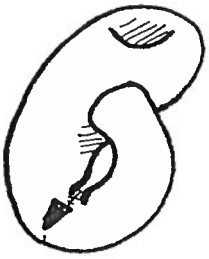




TORUS

KLEIN Bottle

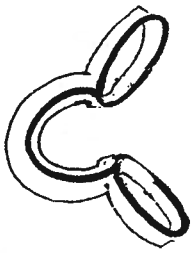
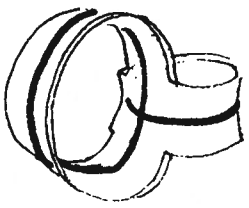
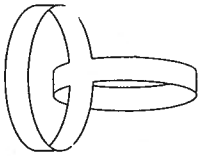
IMPORTANT: THE ARROWS SHOW HOW TO GLUE THE SIDES

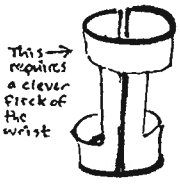



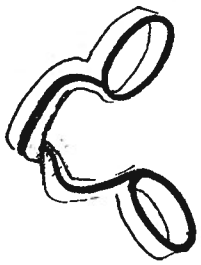
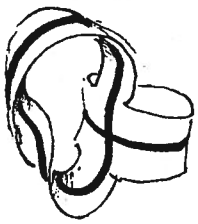
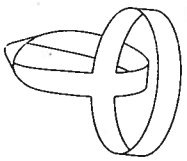



HOWEVER:



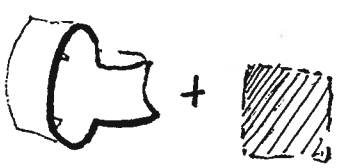




If we remove the centers of the square before gluing, we can perform the band trick IN REVERSE.

THUS

A torus = 

And a kleinbottle =