

March 15, 2015

Oriental - number of handles

Non-oriental - number of crosscaps

This is really a sphere with a handle (a torus)

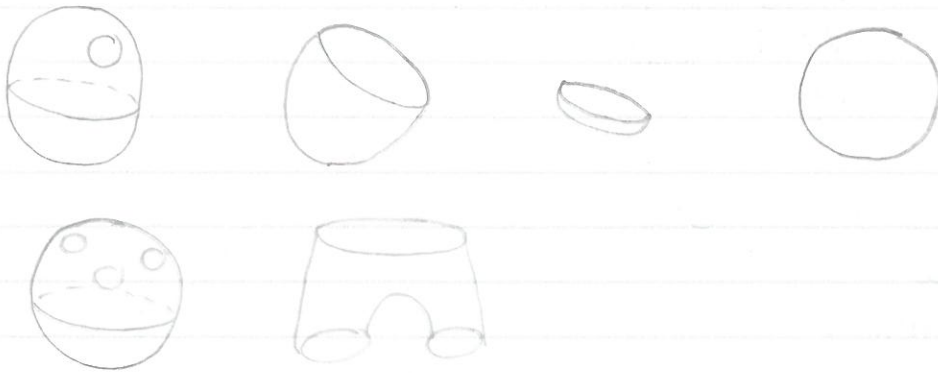
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Non-orientable \rightarrow handles

Oriental \rightarrow crosscaps

In the presence of a crosscap a handle can become a crosscap.

(non-orientable) \rightarrow Only non-orientable have crosscaps



1. banana



Euler Characteristic

$$F = 1 \text{ (square)}$$

$$E = 3 \text{ (3 letters) (b, a, n)}$$

$$V = 1 \text{ (P)}$$

$$X(s) = V - E + F$$

the twist tells you $= 1 - 3 + 1 = -1$

your surface is non-orientable

Non-orientable surface of genus

boundary = 1

$$X(s) = 2 - g - b$$

2w/1 boundary component

$$g = 2 - b - X(s)$$



$$= 2 - 1 - (-1)$$

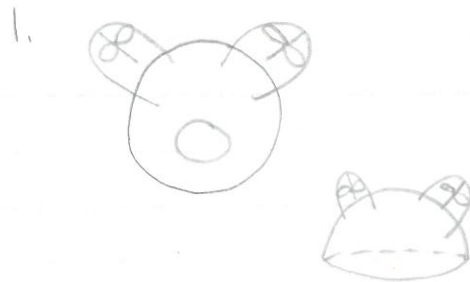
= 2 crosscaps of a non-orientable surface

look at the letters that repeat one time

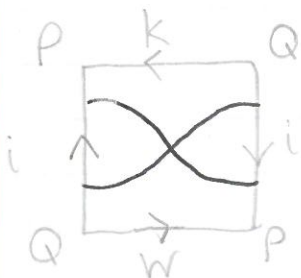
with 1 boundary component

bantana

1. Sphere w/ 2 crosscaps + 1 hole
2. Klein bottle w/ a hole



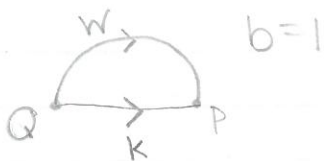
2. $k^{-1} i w^{-1} i$



$$\begin{aligned}
 F &= 1 \text{ (}\square\text{)} \\
 E &= 3 \text{ (}k, i, w\text{)} \\
 V &= 2 \text{ (}P, Q\text{)} \\
 \chi(S) &= V - E + F \\
 &= 2 - 3 + 1 \\
 &= 0
 \end{aligned}$$

non-orientable
due to the twist with i

boundary component (use the non-repeating letters)



Solving for genus

since it's non-orientable, use:

$$\chi(S) = 2 - g - b$$

$$g = 2 - \chi(S) - b$$

$$g = 2 - 0 - 1 = 1$$

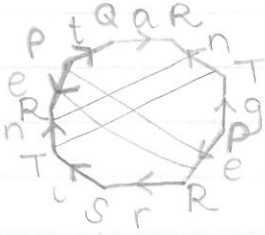
*genus should never be negative

description: non-orientable surface of genus 1 with 1 boundary component.

↳ Sphere with 1 crosscap + one hole → Möbius Band

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3. t a n' g' l e r i n e'



$$V=5$$

$$E=7$$

$$F=1$$

$$\chi(S) = 5 - 7 + 1 = -1$$

Orientable surface

Genus:

$$\chi(S) = 2 - 2g - b$$

$$2g = 2 - b - \chi(S)$$

$$g = \frac{2 - b - \chi(S)}{2} = \frac{2 - 1 - (-1)}{2} = 1$$

Boundary Component



Description: orientable surface of genus 1 with 1 boundary component.

↳ sphere with one handle and one hole, or torus with hole

1 boundary component

