

behind the second.

$$a a b^{-1} b^{-1} c c^{-1} = 1 \quad (\text{as } S \cong 3\mathbb{R}P^2).$$

OR Compose the front LHS with dd^{-1} to give $dd^{-1} a a b^{-1} b^{-1} c c^{-1} = 1$
Which is the edge equation of a sphere with three crosscaps.
 $S \cong S^2 \# 3\mathbb{R}P^2$

ii) Since the edges are identified in pairs, we must have $E=3$, and there is one face $\therefore F=1$. Whatever the surface the no. of vertices is at least one.

$$\therefore X = F - E + V$$
$$X \geq 1 - 3 + 1 = -1$$

iii) The edges a occur in the same sense. If the other pairs of edges occur in the same sense, we cannot so manipulate the equations to reverse sense of one of each pairs of edges. This process would leave a last crosscap we cannot use to reverse the sense of one of its own edges. If the other pairs of edges have one pair in the same sense, and one in opposite senses or both in opposite senses, then the same argument applies. In the first case we can change one pair from same to opposite senses but cannot rid the equation of the last crosscap, and in the latter we just cannot rid the equation of its only crosscap.