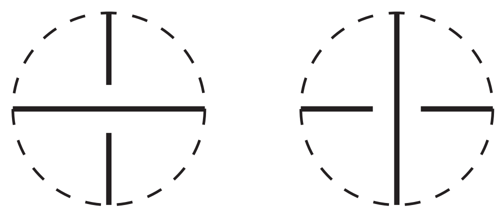
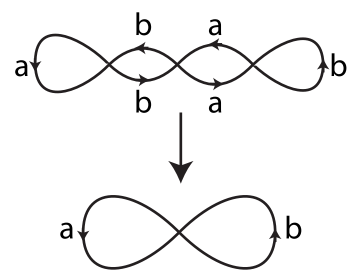
MATH W4052 PROBLEM SET 8
DUE APRIL 4, 2011.

INSTRUCTOR: ROBERT LIPSHITZ

(1) Lickorish, Exercise 6.3.
(2) Let M be a finitely presented module over a ring R. Prove that the r^{th} elementary ideal of M, $\mathcal{E}_r$, is independent of the choice of presentation matrix used to define it.
(3) Let Γ_1 and Γ_2 be embedded graphs in $\mathbb{R}^3$. Suppose that there is a ball B in $\mathbb{R}^3$ so that $\Gamma_1 \cap (\mathbb{R}^3 \setminus B) = \Gamma_2 \cap (\mathbb{R}^3 \setminus B)$, and that $\Gamma_1 \cap B$ and $\Gamma_2 \cap B$ consist of two arcs each, and look like this (in the style of knot diagrams):



Prove: for any such Γ_1, Γ_2, $H_1(\mathbb{R}^3 \setminus \Gamma_1) \cong H_1(\mathbb{R}^3 \setminus \Gamma_2)$. Is the same true with H_1 replaced by π_1?
(4) In class, we considered the following covering space of the figure 8:



What subgroup of π_1 of the figure 8 does this correspond to? Show that this subgroup is not normal. (This may take some work.)

E-mail address: rl2327@columbia.edu