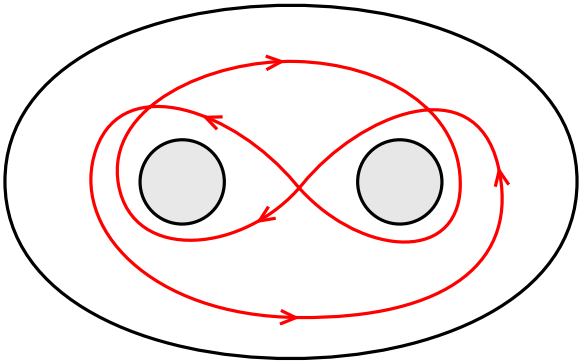
Reading: Hatcher §2.1 and 2.2.

Exercise 1. Let X be the complement of two disjoint discs in a larger disc, as shown below, and let γ be an immersed circle in X as shown below.



1. Choose generators for the fundamental group of X and express $[\gamma]$ in terms of these generators. Show explicitly the homotopy which justifies your claim.
2. Choose generators for the first homology of X, and express $[\gamma]$ in terms of these generators. Show explicitly why γ is cohomologous to the combination of generators you claim it is.

Exercise 2. Let X be the closed unit disc in $\mathbb{C}$ and let

$$A_k = \{z \ : \ z^k = 1\},$$

for a fixed $k \in \mathbb{N}$. Compute the relative homology groups $H^i(X, A_k; \mathbb{Z})$ for all i, k, and provide representatives of generators for these groups.

Exercise 3. Hatcher, Section 2.1, exercise 7, 12, 15.

Exercise 4. Section 2.2, exercise 2, 3, 4, 10.