


HW 7 . Please submit Nov. 27th

① Consider  $\Delta: \mathbb{D}^2 \amalg \mathbb{D}^2 \hookrightarrow \mathbb{D}^4$  with

$\partial \Delta =$   and  $\Delta_i: \mathbb{D}^2 \hookrightarrow \mathbb{D}^4$  obtained by the movie in class (2 intersections).

Draw a movie of an embedded Whitney disk  $W$  for  $\{\pi_1^+\} = \Delta_1 \# \Delta_2$  with  $W \cap \Delta_i = \emptyset$  &  $|t(W)| = 1$ .

② Consider the 2-torus  $T := S^1 \times S^1$ . Show that  $(p, q) \in \mathbb{Z}^2 \cong \pi_1 T$  is represented by an embedding iff  $p$  &  $q$  are coprime.

③ Consider a braid  $b$  with  $r$  strands and let  $L_b \subseteq \mathbb{R}^3$  be its link closure:

Give a presentation of

$\pi_1(\mathbb{R}^3 \setminus L_b)$  with

$r$  generators and

$r$  relations. Describe

the relations as precisely as possible

in terms of the braid  $b$ .

