

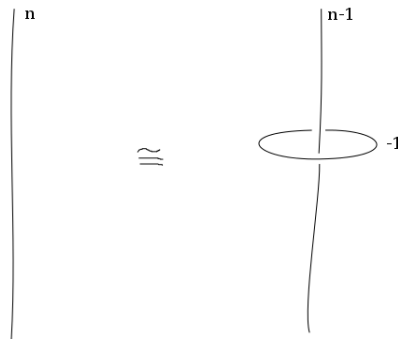
## Kirby Calculus

**Exercise 1.** Show that the blackboard framing of a knot depends on the way the knot is drawn on the blackboard – i.e. show that it is not an isotopy invariant.

**Exercise 2.** Prove that 1-surgery applied to  $S^3$  along the unknot with the canonical framing yields  $S^1 \times S^2$ .

**Exercise 3.** Prove that 1-surgery applied to  $S^3$  along the unknot with either framing  $+1$  or  $-1$  gives back  $S^3$ . Think about how you could define a diffeomorphism between two manifolds, each of which is described as a gluing of pieces.

**Exercise 4.** Show how to use Kirby 1 and Kirby 2 to prove that the following link surgeries give equivalent 3-manifolds. The vertical curve represents a part of a link component which continues outside our field of view.



**Exercise 5.** Show how to use Kirby 1 and Kirby 2 to prove that the following link surgeries give equivalent 3-manifolds. In this case, we have two vertical curves – we do not specify the framing of these since it does not change.

