Problem 1. Prove that every homeomorphism $h : T^n \to T^n$ is stable, where $T^n$ denotes the $n$-torus $S^1 \times \cdots \times S^1$.

Hints:
- Easy mode: Apply $SH_n$.
- Expert mode: The result can be proved independently of $SH_n$, and was the key step in Kirby’s proof of $SH_n$. (We sidestepped it by using a slightly stronger result about PL homotopy tori.) First prove the case where the induced map on fundamental groups is the identity. Then show that for any $n \times n$ matrix $A$ with integer entries and determinant one, there exists a diffeomorphism $h : T^n \to T^n$ such that $h_\ast = A$ where $h_\ast : \pi_1(T^n, x) \to \pi_1(T^n, x)$. Prove that diffeomorphisms of $T^n$ are stable.

Problem 2. Use the torus trick to show that a homeomorphism of $\mathbb{R}^n$ is stable if and only if it is isotopic to the identity.

Hints:
1. It suffices to show that the space of stable homeomorphisms of $\mathbb{R}^n$, denoted $\text{SHomeo}(\mathbb{R}^n)$, is both open and closed in $\text{Homeo}(\mathbb{R}^n)$.
2. Use the torus trick from our proof of local contractibility of $\text{Homeo}(\mathbb{R}^n)$ to show that an open neighbourhood of the identity in $\text{Homeo}(\mathbb{R}^n)$ consists of stable homeomorphisms. Conclude that every stable homeomorphism of $\mathbb{R}^n$ has an open neighbourhood consisting of stable homeomorphisms.
3. Every coset of $\text{SHomeo}(\mathbb{R}^n)$ in $\text{Homeo}(\mathbb{R}^n)$ is open since $\text{Homeo}(\mathbb{R}^n)$ is a topological group. Conclude that $\text{SHomeo}(\mathbb{R}^n)$ is closed in $\text{Homeo}(\mathbb{R}^n)$. 