Please let me know if any of the problems are unclear or have typos.

Exercise 3.1. Suppose that $\alpha \subset F^2$ is a simple closed curve. Show that $\alpha = \mathbb{1} \in \pi_1(F)$ if and only if α bounds a disk in F.

Exercise 3.2. [Medium] Suppose that $F^2 \subset S^3$ is smoothly embedded, connected and without boundary. Prove that if F is not a sphere then F compresses. [Idea: rewrite the proof of Alexander's theorem.]

Exercise 3.3. [Jordan-Brouwer separation] Suppose that $F^2 \subset S^3$ is smoothly embedded, connected and without boundary. Show that F separates S^3. Deduce that F is two-sided. Deduce that F is orientable.

Exercise 3.4. Prove that every smoothly embedded two-torus $T^2 \subset S^3$ bounds a solid torus ($D^2 \times S^1$) on at least one side. Find an embedded S_2 in S^3 that does not bound a handlebody on either side.

Exercise 3.5. Suppose that $\rho\colon M' \to M^3$ is a covering map. Show that if M' is irreducible then M is as well.

Exercise 3.6. Suppose that $\rho\colon M' \to M^3$ is a covering map. Suppose that $F \subset M$ is an properly embedded surface. Show that if $F' = \rho^{-1}(F)$ is incompressible then F is as well.

Exercise 3.7. [Hard] Show that all I–bundles over S^2 are equivalent. Find infinitely many inequivalent S^1–bundles over S^2.