The problems assigned today are again short, in acknowledgment that many students need time to digest some group theory.

A. Finish reading the Groups tutorial on our course web site. What we need immediately is product groups. Soon we will need quotients.

B. We now have two strategies for computing the fundamental group of $\mathbb{R}^2$. What are they? Do they give the same answer? (This is a short exercise.)

Let

$$\mathbb{B}^n = \overline{B(\vec{0}, 1)} = \{\vec{x} : \|x\| \leq 1\} \subseteq \mathbb{R}^n$$

be the closed unit n-ball. The space $\mathbb{S}^1 \times \mathbb{B}^2$ is called the *solid torus*. Intuitively, the solid torus is a bagel, while the torus is the surface of a bagel. (The solid torus is not a torus that happens to be solid. This kind of logical inconsistency is unfortunately common in language. Later we might study the concept of *manifold with boundary*, which is not a manifold that has a boundary. A hot dog is not a dog that is hot. Language is complicated.)

C. Compute the fundamental group of the solid torus. (This is a short exercise.)