

## Math 525: Problem Set 5

**Due date:** In class on Wednesday, Oct 7.

**Course Web Page:** <http://dunfield.info/525>

**Office hours:** Mondays from 11-12, Tuesdays from 11:15 - 12:15, and by appointment. For an appointment, just talk to me after class, or email me at [nmd@illinois.edu](mailto:nmd@illinois.edu).

**Required Text:** Allen Hatcher, *Algebraic Topology*,  
<http://www.math.cornell.edu/~hatcher/AT/ATpage.html>

1. Find all 2-sheeted covering spaces of  $S^1 \vee S^1$ , up to isomorphism without basepoints.
2. (Delayed until HW #6) Hatcher, Section 1.3, Problem 12.
3. Hatcher, Section 1.3, Problem 14.
4. Hatcher, Section 1.3, Problem 21.
5. Hatcher, Section 1.A, Problem 3.
6. Let  $F$  be a finitely generated free group of rank  $k$ . If  $H \leq F$  has finite index  $n = [F : H]$ , prove that  $H$  is also finitely generated and compute its rank in terms of  $k$  and  $n$ .

