MATH 550B, HOMEWORK 4

COVERING SPACES

Due by midnight, Thursday, 10/9

Reading. Read §54 of Munkres.
Problems (to turn in).

(1) Show that the map $p : \mathbb{R}^2 \to S^1 \times S^1$ given by $p(\theta, \phi) = (e^{2\pi i\theta}, e^{2\pi i\phi})$ is a covering map where we think of S^1 as a subspace of the complex plane $\mathbb{C}$.
(2) Use the covering map you found in problem (1) and Theorem 54.4 to show that $\pi_1(S^1 \times S^1, (1, 1)) \cong (\mathbb{Z} \times \mathbb{Z}, +)$. Hint: Model your proof on the proof of theorem 54.5.
(3) Munkres §54 exercise 3.
(4) Munkres §54 exercise 6.