1) Let $q : S^1 \to S^1$ be the map given by $q(z) = z^2$ (using the identification $\mathbb{R}^2 = \mathbb{C}$, and embedding as usual $S^1 \subset \mathbb{R}^2$ as the unit circle).

(a) Prove that $q$ is a covering space.

(b) Let $x = (1, 0) \in S^2$. Prove that the induced homomorphism

$$q_* : \pi_1(S^1, x) \to \pi_1(S^1, x),$$

is given by multiplication by 2, under the usual isomorphism $\pi_1(S^1, x) \cong \mathbb{Z}$.

2) Munkres, Exercise 55.1.

3) Munkres, Exercise 55.2.

4) Munkres, Exercise 57.2.