Algebraic Topology, Exercise sheet No 8

1. Let $X = \{pt\}$ be a one-point space. Show that

$$H_n(X) = \begin{cases} \mathbb{Z} & n = 0 \\ 0 & n \geq 1 \end{cases}$$

   (Here 0 denotes the trivial abelian group.)

2. Describe all covering spaces of the 2-torus, up to equivalence.

3. Let X be the union of the unit sphere in 3-space with the straight line segment from the north pole to the south pole. Find $\pi_1(X)$.

4. Let X be the union of the unit sphere in 3-space with the unit disk in the $x - y$ plane. Find $\pi_1(X)$.

5. $\star$ Find all covering spaces with three sheets of the figure eight.