1) Munkres, Exercise 58.2.

1) Munkres, Exercise 58.9 (a),(b),(c),(d).

3) Munkres, Exercise 67.2.

4) Let $X \subset \mathbb{R}^n$ be a subspace which equals

$$X = \bigcup_{i=1}^{N} U_i,$$

where $U_i \subset \mathbb{R}^n$ are open and convex for all $i$, and the intersections $U_i \cap U_j$ and $U_i \cap U_j \cap U_k$ are all nonempty. Show that $X$ is simply connected.