12.1.

1. Define $F : \mathbb{R}^n \times I \to \mathbb{R}^n$ by $F(x,t) = (1-t)x$.

Then $F(x,0) = x$, $F(x,1) = 0$ and $F(0,t) = 0$ for all t.

2. Define $F : (\mathbb{C} \setminus \{0\}) \times I \to \mathbb{C} \setminus \{0\}$ by

$$F(z,t) = z(1-t) + \frac{z}{|z|} t.$$

Then $F(z,0) = z$, $F(z,1) = \frac{z}{|z|} \in S^1$ and

if $|z| = 1$, $F(z,t) = z$ for all t.

12.2. For $n = 2$, the sets U and V are homeomorphic to open discs. For the open disc $D^2 = \{ x \in \mathbb{R}^2 : |x| < 1 \}$ there is a deformation retraction to $\{0\} \subseteq D^2$, and therefore $\pi(D^2, 0) = 1$. Hence, if $x_0 = (1,0,0) \in S^2$, $\pi(U, x_0) = 1 = \pi(V, x_0)$.

Now, U and V are open subsets of S^2, and $U \cap V$ is homeomorphic to an annulus, hence it is path connected. By the Seifert - van Kampen theorem (2), since $\pi(V, x_0) = 1$,

$$\pi(S^2, x_0) \cong \pi(U, x_0)/_N = 1.$$

The above argument can be adapted for any sphere S^n, for $n \geq 2$. Why not for $n = 1$?