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By Lemma 1.15 (Hatcher), every loop in  $X$  based at  $x_0$  is homotopic to a product of loops, where each loop is either contained in  $e$  or  $A$ . Since  $n \geq 2$ , a loop contained in  $e$  is nullhomotopic, so every loop in  $X$  is homotopic to a loop in  $A$ . Thus if  $[f] \in \pi_1(X; x_0)$ , there is a loop  $f_0$  such that  $[f_0] = [f]$ . We have  $f_0 = f_0$ , so  $[f_0] = [f_0] = [f_0] = [f]$

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topology and  $H^1(U)$  is the union of open sets of the form  $W \times W \cap I$  containing  $x \in I$ . Since  $I$  is compact, by Tube Lemma  $W \times W \cap I$  contains a tube  $V \cap I$  about  $x \in I$  where  $V$  is a neighborhood of  $x$ . So the restriction of  $\text{Hom } V \cap I$  is a map from  $V \cap I$  to  $U$ . 2. Let  $i: V \hookrightarrow U$  be an inclusion. Then  $i^*c = x$

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