Freie Universität Berlin WiSe 18/19
Institut für Mathematik
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Differential Geometry III – Homework 03

Submission: November 14, 2018, 12:15 am

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1. Exercise (4 points)

Let X, Y be two topological spaces and let $\pi : X \to Y$ be a covering such that for $x_0 \in X$ and $y_0 \in Y$, $\pi(x_0) = y_0$. Show:

1.) If $\gamma' : [0,1] \to Y$ is a closed path such that $\gamma'(0) = \gamma'(1) = y_0$ then there exists a unique lifting $\gamma : [0,1] \to X$ such that $\gamma(0) = x_0$.

2.) A homotopy h' of two closed paths γ'_1, γ'_2 in Y which fixes the endpoints y_0 lifts to a unique homotopy h of the lifted curves γ_1, γ_2.

2. Exercise (4 points)

Let X be a simply connected topological space and Y a topological space. Then the covering $\pi : X \to Y$ induces a group isomorphism from the group of deck transformations into the fundamental group. Justify why X being simply connected is a necessary requirement.

Total: 8