

$$A(\beta) \leq A(\alpha)$$

$$\beta(t) = \alpha(t) - r n_\alpha(t).$$

Diffeomorfismos:

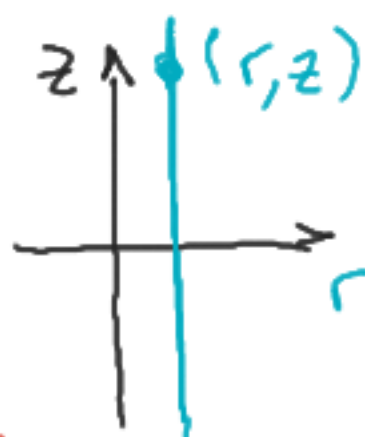
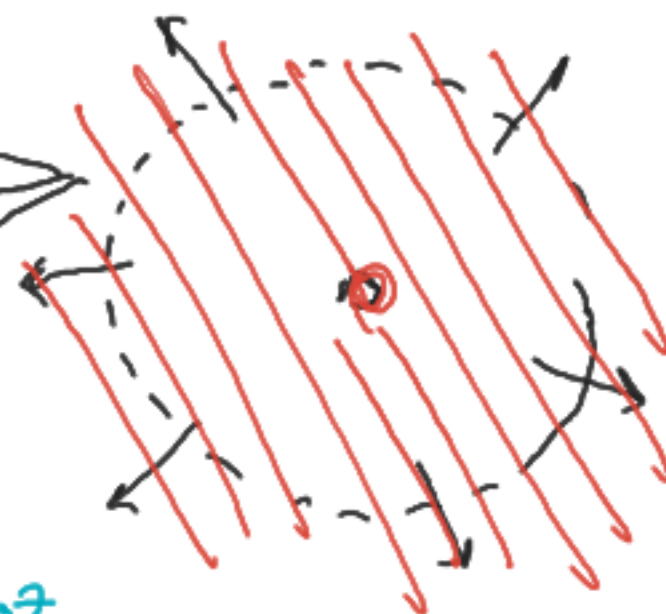


$\cong$



$S^1 \times \mathbb{R}$

$(\mathbb{R}^2)^*$



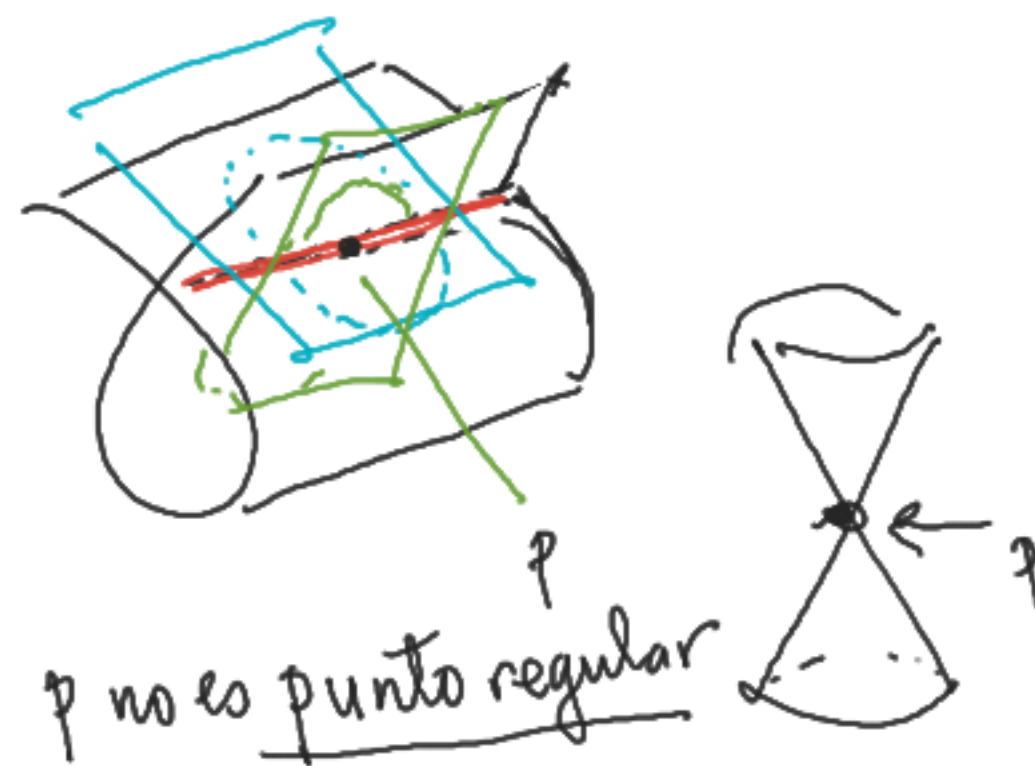
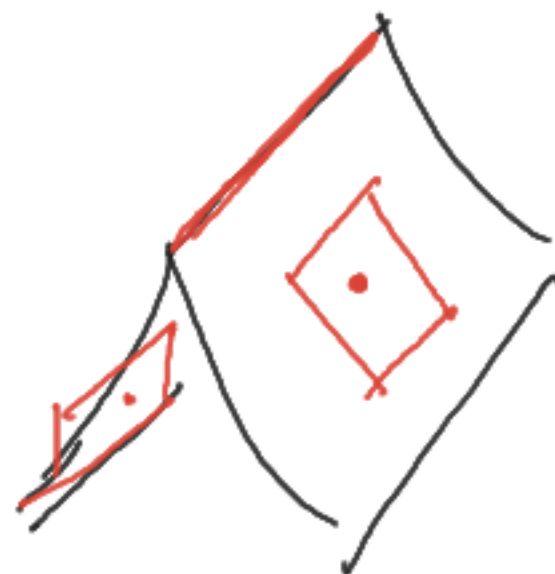
$$(r \cos \varphi, r \sin \varphi, z) \rightarrow (e^z \cos \varphi, e^z \sin \varphi, z) \rightarrow (e^z \cos \varphi, e^z \sin \varphi).$$

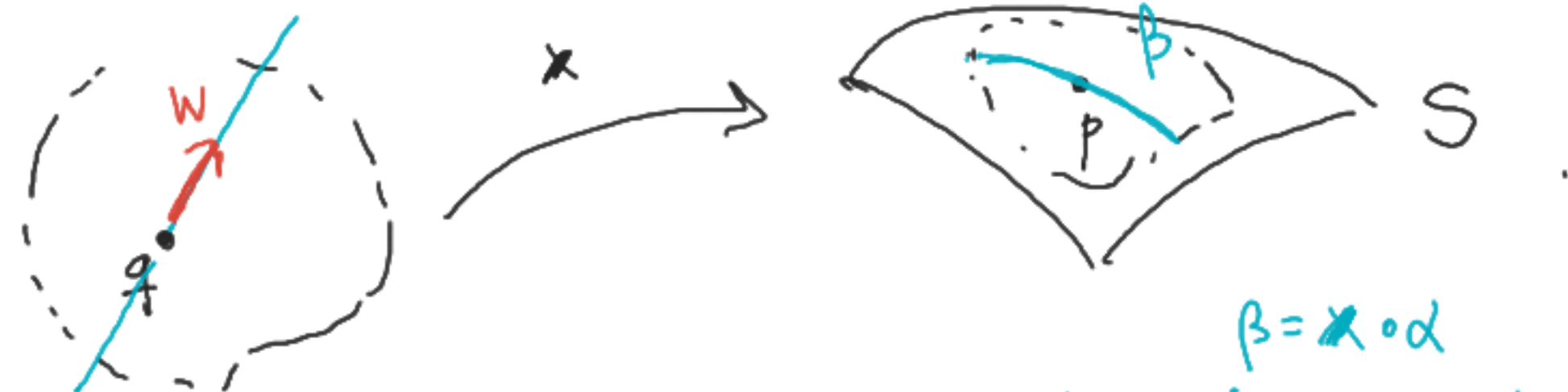
El mapa  $f: S^1 \times \mathbb{R} \longrightarrow \mathbb{R}^2 - \{(0,0)\}$

$$(r \cos \varphi, r \sin \varphi, z) \longrightarrow (e^z \cos \varphi, e^z \sin \varphi, 0)$$

es un difeomorfismo! (ejercicio!).

$$\Rightarrow S^1 \times \mathbb{R} \simeq \mathbb{R}^2 - \{(0,0)\}.$$





$$\alpha(t) = q + tw$$

$$\beta = x \circ \alpha$$

$$\beta(t) = (x(\alpha(t)), y(\alpha(t)), z(\alpha(t)))$$

