$$x = \phi^* x' = \Lambda^{-1} x'$$

$$\phi_* \frac{\partial}{\partial x^\mu} = \Lambda_\mu{}^\nu \frac{\partial}{\partial x^\nu} = \frac{\partial}{\partial x'^\mu} \text{ or } \eta \Lambda \eta \frac{\partial}{\partial x} = \frac{\partial}{\partial x'}$$

$$\phi^* dx'^\mu = \Lambda_\nu{}^\mu dx'^\nu = dx^\mu \text{ or } \Lambda^{-1} dx' = dx$$

e.g. $A'^\mu(\Lambda x(p)) = \Lambda^\mu{}_\nu A^\nu(x(p))$

$q = \phi(p)$

p

$x'(q) = x(p)$

$\Longleftrightarrow$

p

x'

x

$x'(p) = \Lambda x(p)$