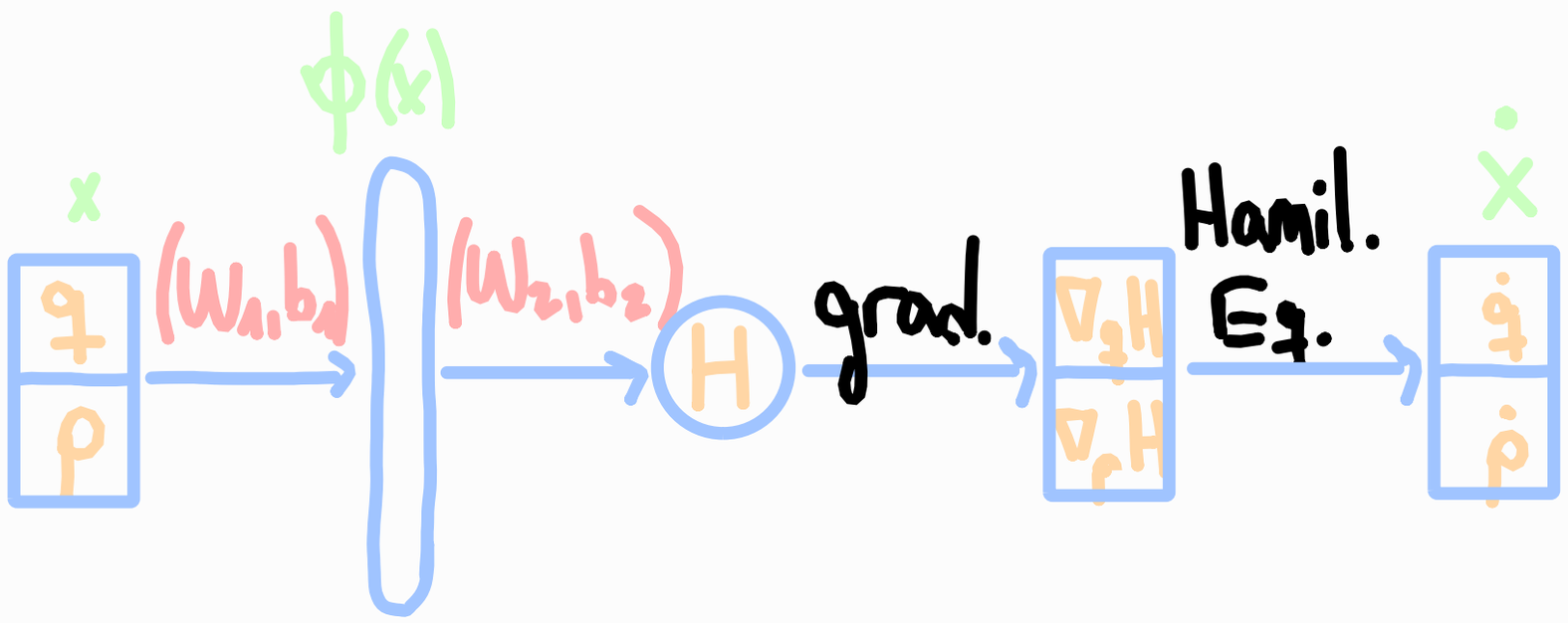
Random Hamiltonian Neural Network (R-HNN)



- Sample (W_1, b_1)
- Solve $(W_2, b_2) = \underset{W,b}{\operatorname{argmin}} \left\| A \cdot \begin{pmatrix} W \\ b \end{pmatrix} - y \right\|$

where $A = \begin{bmatrix} \nabla_p \phi(x) & 0 \\ -\nabla_q \phi(x) & 0 \\ \phi(x_0) & 1 \end{bmatrix}$, $y = \begin{bmatrix} \dot{q} \\ \dot{p} \\ H(x_0) \end{bmatrix}$

$\Rightarrow$ approximates $\dot{x} = [\dot{q}\ \dot{p}]^T$ and learns $H(x)$