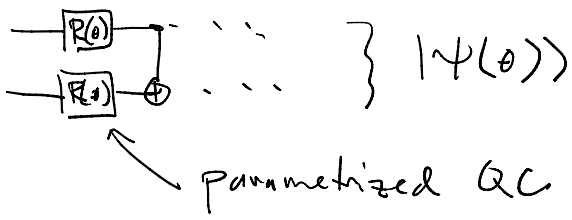
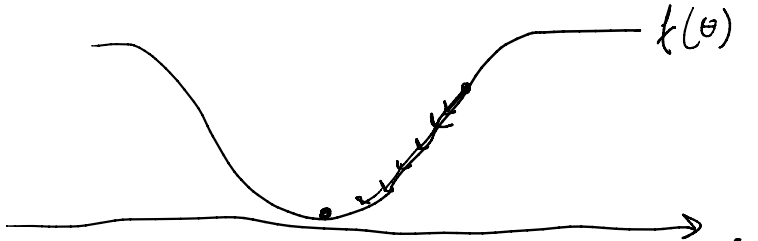
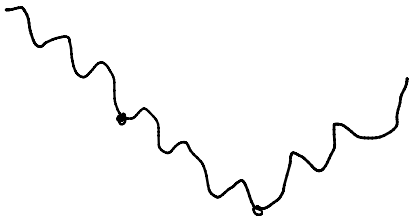
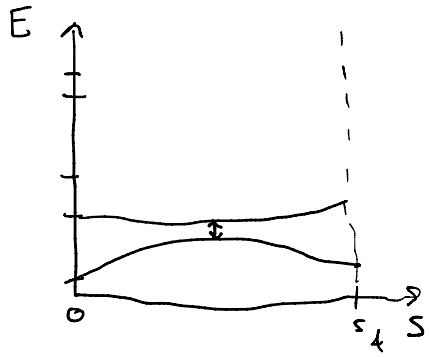


$\langle O \rangle_\theta = \langle \psi(\theta) | O | \psi(\theta) \rangle = f(\theta)$





Quantum adiabatic theorem:



$|\psi_0\rangle$ ground state H_0

change hamiltonian $H(s)$, $s \in [0, s_f]$

s.t. $H(0) = H_0$

If the change is slow enough, then the final state will be the ground state of $H(s_f)$

$H(s_f)$

$$H(s) = \left(1 - \frac{s}{s_f}\right) H_0 + \frac{s}{s_f} H_f$$

$$e^{-i\Delta s\, H(s)} \sim e^{i\Delta s \left(1 - \frac{s}{s_f}\right) H_0}\, e^{i \Delta s \frac{s}{s_f} H_f} + O(\Delta s^2)$$