

$$\begin{aligned}
\frac{\delta}{\delta\chi(t)} \Phi[\chi] &= \lim_{\varepsilon \rightarrow 0} \frac{\Phi[\chi + \varepsilon \delta(\square - t)] - \Phi[\chi]}{\varepsilon} \\
&= \lim_{\varepsilon \rightarrow 0} \frac{\exp\left(\frac{i\alpha}{\hbar} p \varepsilon\right) - 1}{\varepsilon} \Phi[\chi] \\
&= \frac{i\alpha}{\hbar} p \Phi[\chi]
\end{aligned}$$

$$\frac{i\hbar}{\alpha} \cdot \frac{\delta}{\delta\chi(t)} \Phi[\chi] = -p \Phi[\chi], \quad \left[-\frac{i\hbar}{\alpha} \cdot \frac{\delta}{\delta\chi(t)}\right]^2 \Phi[\chi] = p^2 \Phi[\chi]$$

$$\begin{aligned}
&\int_{-\infty}^{\infty} dt \left\{ \frac{1}{2m} \left[-\frac{i\hbar}{\alpha} \cdot \frac{\delta}{\delta\chi(t)}\right]^2 + \frac{i\hbar}{\alpha} \cdot \frac{d\chi(t)}{dt} \cdot \frac{\delta}{\delta\chi(t)} \right\} \Phi[\chi] \\
&= \int_{-\infty}^{\infty} dt \left\{ \frac{1}{2m} p^2 - p \frac{d\chi(t)}{dt} \right\} \Phi[\chi] \\
&= -p \int_{-\infty}^{\infty} dt \left\{ \frac{d\chi(t)}{dt} - \frac{p}{2m} \right\} \Phi[\chi] \\
&= -p \left(\lim_{b \rightarrow \infty} \lim_{a \rightarrow -\infty} \left[\chi(b) - \chi(a) - \frac{p}{2m} (b-a) \right] \right) \Phi[\chi]
\end{aligned}$$