$$F_t[\chi+\varepsilon\delta(\square-a)]=[\chi+\varepsilon\delta(\square-a)](t)-(\alpha t+\beta)$$

$$=\chi(t)+\varepsilon\delta(t-a)-(\alpha t+\beta)=F_t[\chi]+\varepsilon\delta(t-a)$$

$$F_\tau[\chi+\varepsilon\delta(\square-t)]=F_\tau[\chi]+\varepsilon\delta(\tau-t)$$

$$\int_{-\infty}^{\infty}d\tau\, F_\tau[\chi+\varepsilon\delta(\square-t)]=\varepsilon+\int_{-\infty}^{\infty}d\tau\, F_\tau[\chi] \quad \cdot\cdot\cdot\ (5a)$$

$$[\chi+\varepsilon\delta(\square-t)](b)-[\chi+\varepsilon\delta(\square-t)](a)-\frac{p}{2m}(b-a)$$

$$=[\chi(b)+\varepsilon\delta(b-t)]-[\chi(a)+\varepsilon\delta(a-t)]-\frac{p}{2m}(b-a)$$

$$=\chi(b)-\chi(a)-\frac{p}{2m}(b-a)+\varepsilon[\delta(b-t)-\delta(a-t)]$$

$$\lim_{b\to\infty}\lim_{a\to-\infty}\left\{[\chi+\varepsilon\delta(\square-t)](b)-[\chi+\varepsilon\delta(\square-t)](a)-\frac{p}{2m}(b-a)\right\}$$

$$=\lim_{b\to\infty}\lim_{a\to-\infty}\left\{\chi(b)-\chi(a)-\frac{p}{2m}(b-a)\right\} \quad \cdot\cdot\cdot\ (5b)$$

$$\Phi[\chi+\varepsilon\delta(\square-t)]$$

$$=\delta\left(\lim_{b\to\infty}\lim_{a\to-\infty}\left[\chi(b)-\chi(a)-\frac{p}{2m}(b-a)\right]\right)$$

$$\times\ \exp\left\{\frac{i\alpha}{\hbar}p\varepsilon+\frac{i\alpha}{\hbar}p\int_{-\infty}^{\infty}d\tau\, F_\tau[\chi]\right\} \qquad =\exp\left(\frac{i\alpha}{\hbar}p\varepsilon\right)\Phi[\chi]$$