Start with equation (6.1).

$$K_V(b,a) = \int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \left(\tfrac{1}{2}m\dot{x}^2 - V(x,t)\right)\,dt\right)\mathcal{D}x(t) \tag{6.1}$$

Partition the integral.

$$K_V(b,a) = \int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt - \frac{i}{\hbar}\int_{t_a}^{t_b} V(x,t)\,dt\right)\mathcal{D}x(t)$$

Factor the exponential.

$$K_V(b,a) = \int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\exp\left(-\frac{i}{\hbar}\int_{t_a}^{t_b} V(x,t)\,dt\right)\mathcal{D}x(t)$$

Make the second exponential a power series.

$$\begin{aligned}K_V(b,a) = &\int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\\ &\times\left(1 - \frac{i}{\hbar}\int_{t_a}^{t_b} V(x,t)\,dt + \frac{1}{2}\left(-\frac{i}{\hbar}\int_{t_a}^{t_b} V(x,t)\,dt\right)^2 + \cdots\right)\mathcal{D}x(t)\end{aligned}$$

Hence

$$\begin{aligned}K_V(b,a) &= \int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\mathcal{D}x(t)\\ &- \frac{i}{\hbar}\int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\left(\int_{t_a}^{t_b} V(x,t)\,dt\right)\mathcal{D}x(t)\\ &- \frac{1}{2\hbar^2}\int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\left(\int_{t_a}^{t_b} V(x,t)\,dt\right)^2\mathcal{D}x(t) + \cdots\end{aligned}$$

Let

$$\begin{aligned}K_0(b,a) &= \int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\mathcal{D}x(t)\\ K^{(1)}(b,a) &= -\frac{i}{\hbar}\int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\left(\int_{t_a}^{t_b} V(x,t)\,dt\right)\mathcal{D}x(t)\\ K^{(2)}(b,a) &= -\frac{1}{2\hbar^2}\int_a^b \exp\left(\frac{i}{\hbar}\int_{t_a}^{t_b} \tfrac{1}{2}m\dot{x}^2\,dt\right)\left(\int_{t_a}^{t_b} V(x,t)\,dt\right)^2\mathcal{D}x(t)\end{aligned}$$

Then equation (6.4) follows.

$$K_V(b,a) = K_0(b,a) + K^{(1)}(b,a) + K^{(2)}(b,a) + \cdots \tag{6.4}$$