$$f_A(\breve{\mathbf{p}}) = C_A \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_A(\mathbf{r})\, d^3\mathbf{r}$$
$$f_B(\breve{\mathbf{p}}) = C_B \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_B(\mathbf{r})\, d^3\mathbf{r}$$

This is the combined potential.

$$V(\mathbf{r}) = V_A(\mathbf{r}-\mathbf{a}) + V_B(\mathbf{r}-\mathbf{b})$$

Hence

$$K^{(1)} = C_A \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_A(\mathbf{r}-\mathbf{a})\, d^3\mathbf{r} + C_B \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_B(\mathbf{r}-\mathbf{b})\, d^3\mathbf{r}$$

Substitute $\mathbf{r}+\mathbf{a}$ for $\mathbf{r}$ in the first integral and $\mathbf{r}+\mathbf{b}$ for $\mathbf{r}$ in the second integral.

$$K^{(1)} = C_A \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot(\mathbf{r}+\mathbf{a})}{\hbar}\right) V_A(\mathbf{r})\, d^3\mathbf{r} + C_B \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot(\mathbf{r}+\mathbf{b})}{\hbar}\right) V_B(\mathbf{r})\, d^3\mathbf{r}$$

Factor the exponentials.

$$\begin{aligned} K^{(1)} = C_A \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{a}}{\hbar}\right) \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_A(\mathbf{r})\, d^3\mathbf{r} \\ + C_B \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{b}}{\hbar}\right) \int \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{r}}{\hbar}\right) V_B(\mathbf{r})\, d^3\mathbf{r} \end{aligned}$$

Hence

$$K^{(1)} = \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{a}}{\hbar}\right) f_A(\breve{\mathbf{p}}) + \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{b}}{\hbar}\right) f_B(\breve{\mathbf{p}})$$

The probability of scattering is

$$\left|K^{(1)}\right|^2 = f_A^2 + f_B^2 + f_A f_B \exp\left(\frac{i\breve{\mathbf{p}}\cdot(\mathbf{a}-\mathbf{b})}{\hbar}\right) + f_A f_B \exp\left(\frac{i\breve{\mathbf{p}}\cdot(\mathbf{b}-\mathbf{a})}{\hbar}\right)$$

Substitute $\mathbf{d}$ for $\mathbf{a}-\mathbf{b}$.

$$\left|K^{(1)}\right|^2 = f_A^2 + f_B^2 + f_A f_B \exp\left(\frac{i\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right) + f_A f_B \exp\left(-\frac{i\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right)$$

Change complex exponentials to rectangular form.

$$\begin{aligned} \left|K^{(1)}\right|^2 = f_A^2 + f_B^2 + f_A f_B \left[\cos\left(\frac{\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right) + i\sin\left(\frac{\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right)\right] \\ + f_A f_B \left[\cos\left(\frac{\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right) - i\sin\left(\frac{\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right)\right] \end{aligned}$$

The sine functions cancel.

$$\left|K^{(1)}\right|^2 = f_A^2 + f_B^2 + 2 f_A f_B \cos\left(\frac{\breve{\mathbf{p}}\cdot\mathbf{d}}{\hbar}\right)$$