

From problem 6-10

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

Let  $p = |\check{\mathbf{p}}|$  and  $d = |\mathbf{d}|$ . Then

$$\cos \left( \frac{\check{\mathbf{p}} \cdot \mathbf{d}}{\hbar} \right) = \cos \left( \frac{pd \cos \theta}{\hbar} \right)$$

By the definite integral

$$\int_0^{\frac{\pi}{2}} \cos(a \cos \theta) \sin \theta \, d\theta = \frac{\sin a}{a}$$

we have

$$\int_0^{\frac{\pi}{2}} 2f_A f_B \cos \left( \frac{pd \cos \theta}{\hbar} \right) \sin \theta \, d\theta = 2f_A f_B \frac{\sin(pd/\hbar)}{pd/\hbar}$$