Chapter 4. Exercises

1. If ψ happens to be an eigenfunction of an operator $\hat{A}$ with the eigenvalue a, evaluate the expectation value $\langle A \rangle$.

2. Discuss why the noncommutativity of observables is not generally significant in everyday life. For example, why can we simultaneously measure the instantaneous position and momentum of a pitched baseball with confidence?

3. Evaluate the commutator $[x, p_x]$ used to derive the Heisenberg uncertainty principle. Hint: First compute the quantity $x\hat{p}_x f(x) - \hat{p}_x x f(x)$, where $f(x)$ is a arbitrary function.

4. Convince yourself of the correctness of the commutation relation

$$[L_x, L_y] = i\hbar L_z$$

5. Can you measure simultaneously a particle's y position coordinate and x-component of momentum?