Physics 115B First Problem Set

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1. Consider the 2-dimensional Hamiltonian:

$$\mathbf{H} = \frac{\mathbf{p}_x^2}{2m} + \frac{\mathbf{p}_y^2}{2m} + V(\mathbf{r})$$

Where $\mathbf{r}^2 = \mathbf{x}^2 + \mathbf{y}^2$. The only non-zero commutators are $[\mathbf{x}, \mathbf{p}_x] = i\hbar$ and $[\mathbf{y}, \mathbf{p}_y] = i\hbar$.
Consider the operator $\mathbf{L}_z$:

$$\mathbf{L}_z = \mathbf{x}\mathbf{p}_y - \mathbf{y}\mathbf{p}_x$$

and use Ehrenfest's theorem to evaluate the time derivative of the expectation value of $\mathbf{L}_z$.
Interpret the result.

2. Exercise 7.3.1 on page 196 of your text.

3. Exercise 7.3.4 on page 196 of your text.

4. Exercise 7.3.6 on page 197 of your text.

5. Exercise 7.3.7 on page 202 of your text.