1. Refresh your memory of quantum mechanics: For the simple harmonic oscillator, show that 

\[ [a, a^\dagger] = 1 \quad \text{and that} \quad [x, p_x] = i\hbar. \]

Finally, show that 

\[ \hat{H} = \hbar \omega \left( \hat{N} + \frac{1}{2} \right), \]

where \( \hat{N} = a^\dagger a \).

2. Peskin and Schroeder problem 2.1

3. Peskin and Schroeder problem 2.2

4. Peskin and Schroeder problem 2.3