1 Day 2: Foundational Postulates of Quantum Mechanics

1. The momenumt operator is defined as:

$$\hat{p} = -i\hbar \frac{\partial}{\partial x} \tag{1}$$

   Find the eigenstates and eigenvalues for this operator.
2. The displacement operator is defined as:

$$\hat{D}\psi(x) = \psi(x + \xi) \tag{2}$$

   Confirm that

$$\psi(x) = e^{\beta x} g(x) \tag{3}$$

   where

$$g(x) = g(x + \xi) \tag{4}$$

   is an eigenfunction of the displacement operator. What is the eigenvalue associated with this eigenfunction?