

Reflective Homework

(1) What is the difference between vectors and linear operators in a given Hilbert space? Give a concrete example to illustrate the difference.

(2) Consider the following statements:

Statement 1: “In the formalism of quantum mechanics we learned, the wave function is represented by a Hermitian operator”.

Statement 2: “In quantum mechanics, the eigenstates of any Hermitian operator corresponding to a physical observable are called stationary states”.

Explain clearly why you agree or disagree with each statement.

(3) Consider the following statement: “In quantum mechanics, position and momentum are NOT “variables” but “operators”. The measurement of position or momentum yields definite values of position or momentum which are *eigenstates* of the corresponding operator.” Do you agree or disagree? Explain.

(4) Three people have different opinions about whether “ $|\alpha\rangle\langle\beta|$ ” represents an operator, a state vector, or a complex number within the Dirac formalism. How would you convince them which of these it actually is?

(5) Consider the following statement: “If an electron interacting with a one-dimensional finite square well is initially in a state where the position has a definite value, the expectation value of position will be time-independent”. Explain why you agree or disagree with the statement.