Reflective Homework

(1) Consider the following statement (where \( A \) is a normalization constant):
At time \( t = 0 \), \( \Psi(x, t = 0) = A \sin^3(\frac{n \pi x}{a}) \) is not a possible solution to the Time-independent
Schroedinger equation for a 1D infinite square well \( (0 \leq x \leq a) \) because this function is not linear and
hence cannot be written as a linear superposition of stationary states.
Explain why you agree or disagree with this statement.

(2) A person says that any possible wave function of a system should satisfy \( \hat{H}\psi(x) = E\psi(x) \) where \( \hat{H} \)
is the Hamiltonian for the system. Explain why you agree or disagree with the person.

(3) Explain why the following statement is correct or incorrect:
\( \hat{p} = d\hat{x}/dt \) where \( \hat{p} \) is the momentum operator and \( \hat{x} \) is the position operator.

(4) Consider the following statement:
At time \( t = 0 \), any normalized function that is continuous and smooth (continuous derivative) and satisfies
the boundary conditions for a given system is a possible wave function for that system because it can be
written as a linear superposition of stationary states for that system.
Explain why you agree or disagree with this statement.