Reflective Homework

(1) Choose all of the following situations in which it is useful to expand the wave function $\Psi(x, t = 0) = Asin^5(7\pi x/a)$ at time $t = 0$ for a one-dimensional infinite square well ($0 < x < a$) in terms of a linear superposition of stationary states (A is a normalization constant that you need NOT calculate):

(I) If we have to find the wave function after a time t

(II) If we have to find the probability of measuring different energies at time $t = 0$

(III) If we have to find the probability of measuring positions between x and $x + dx$ at time $t = 0$

(IV) If we have to find the probability of measuring different energies at time $t > 0$

(V) If we have to find the probability of measuring positions between x and $x + dx$ at time $t > 0$

Explain your reasoning for your answer in each case.

(2) Consider the following statements from two people about a particle in a non-stationary state of an infinite square well at time t=0 given by $\Psi(x, t = 0) = Asin^5(7\pi x/a)$:

Person 1: "The wave function will evolve according to the Time-Dependent Schroedinger Equation and the wave function will periodically revive back to the initial wave function $Asin^5(7\pi x/a)$ after a certain time T."

Person 2: "If we perform the measurement of energy, the wave function will instantaneously collapse into a stationary state wave function which will never go back to the initial wave function $Asin^5(7\pi x/a)$."

Explain why you agree or disagree with each person.

(3) For which of the following potential energies will a non-stationary state wave function periodically revive back after a finite time-period T? Explain your reasoning.

(I) Infinite square well

(II) Simple Harmonic Oscillator

(III) Free particle