1 ISW Position Measurement

A particle in an infinite square well potential has an initial state vector

$$|\Psi(0)\rangle = A\big(\,|\phi_1\rangle - |\phi_2\rangle + i\,|\phi_3\rangle\,\big)$$

where $|\phi_n\rangle$ are the energy eigenstates. You have previously found $|\Psi(t)\rangle$ for this state.

(a) Use a computer to graph the wave function $\Psi(x,t)$ and probability density $\rho(x,t)$. Choose a few interesting values of t to include in your submission.

(b) Use a computer to calculate the probability of measuring the particle to be near the middle of the well (within 1% on either side) as a function of time. Include both your symbolic result and a graph in your submission.

(c) Choose another location in the well, different from the location above. Use a computer to calculate the probability of measuring the particle to be near your chosen location (within 1% on either side) as a function of time. Include both your symbolic result and a graph in your submission.

(d) Are there any locations in the well where the probability is independent of time? Explain how you determined your answer.

(e) The time dependence for a wave function like this is complicated. Write a lengthy description in words about the major features of this wave function and its probability density, how they change in time, and why they change the way they do. Comment on any interesting features you noticed that you have not already discussed in the questions above and describe any additional things you learned from the process of solving this problem.