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Numerical Methods in Physics
Wave Packet Dynamics

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1 Free Evolution

1.1 Selection of Time Step

In order to find the biggest possible time steps we could use we simply started with reducing increasing the timestep until it we saw significant error. But we went so far that the the time step got so large that it went through the solution space ($x = [0, 1]$) after just a few steps. Thus the smallest time step we used was $3.45 \cdot 10^{-4}$. The smallest spacial step we used before the solution started to get jaggy was 0.01. Since the solution took such a small time to solve for we will use significantly smaller time steps and spacial time steps for the rest of the exercises.

1.2 Behavior at the end of the Solution Space

looking at figure **??** we can clearly see the periodic behavior of the numerical solution. This is in a stark contrast against the numerical solution. This probably lies in the fast fourier transform package used. This because the discrete fourier transform can only be done on periodic problems. Thus as soon we are outside of our spacial solutions space of $x = [0, 1]$ we will get significant error. This is highlighted in figure **??**.

2 Potential Well