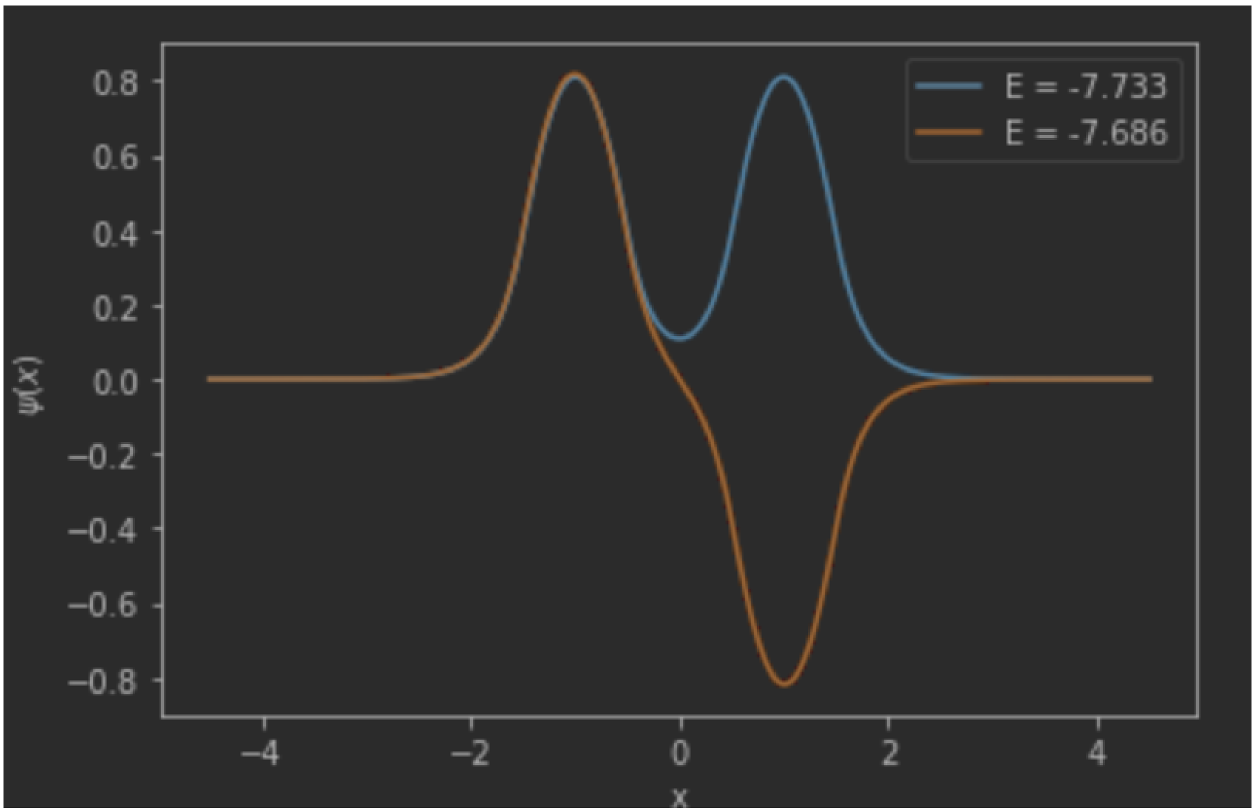
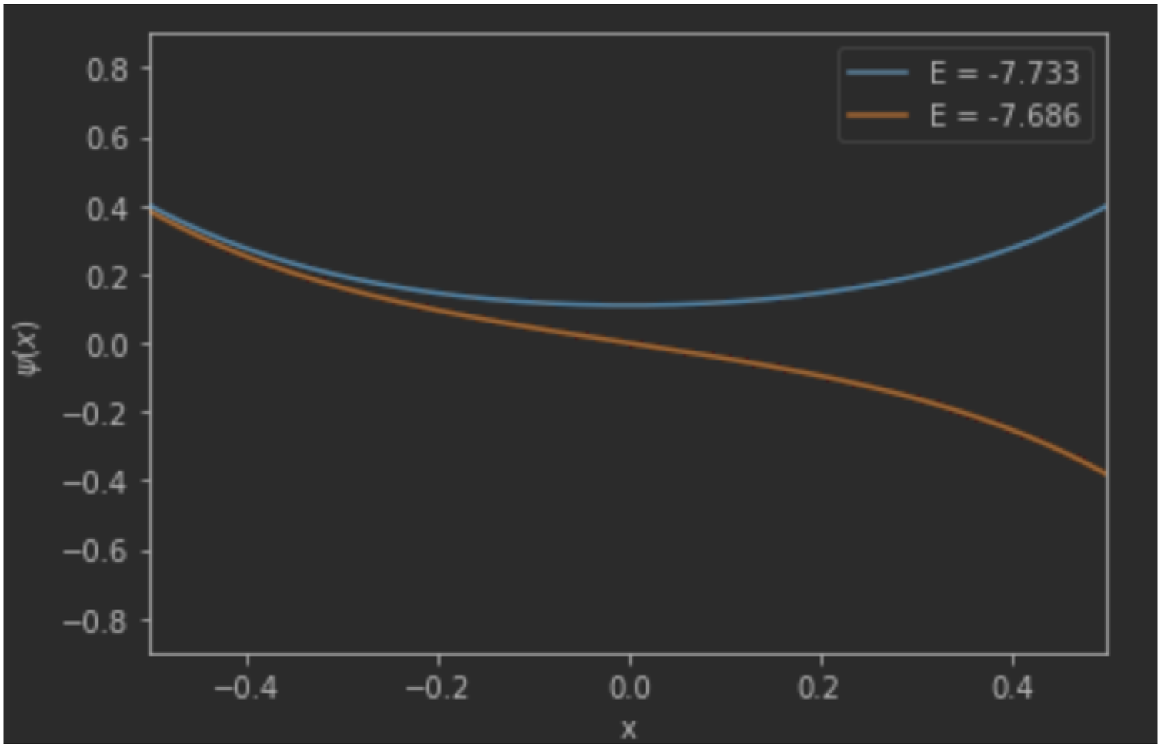
1. Looking at the second python assignment, we can compare those values to the ones derived here.
   a. Assignment 4 values: [-9.18125800e+00 -6.78286481e+00 -3.06154551e+00 ... 8.88440576e+05 8.88443506e+05 8.88443506e+05]
   b. Assignment 2 Values: [-9.18029e+00, -6.77905e+00, …]

   We can say there is a high degree of agreement between both methods. The different method of calculation is likely a contributing factor in the slight differences. Since this ‘double’ finite well has two walls at the same spot (x = 0), it is analogous to the single double well experiment, so this step is a good method to validate model performance independent of scenario.

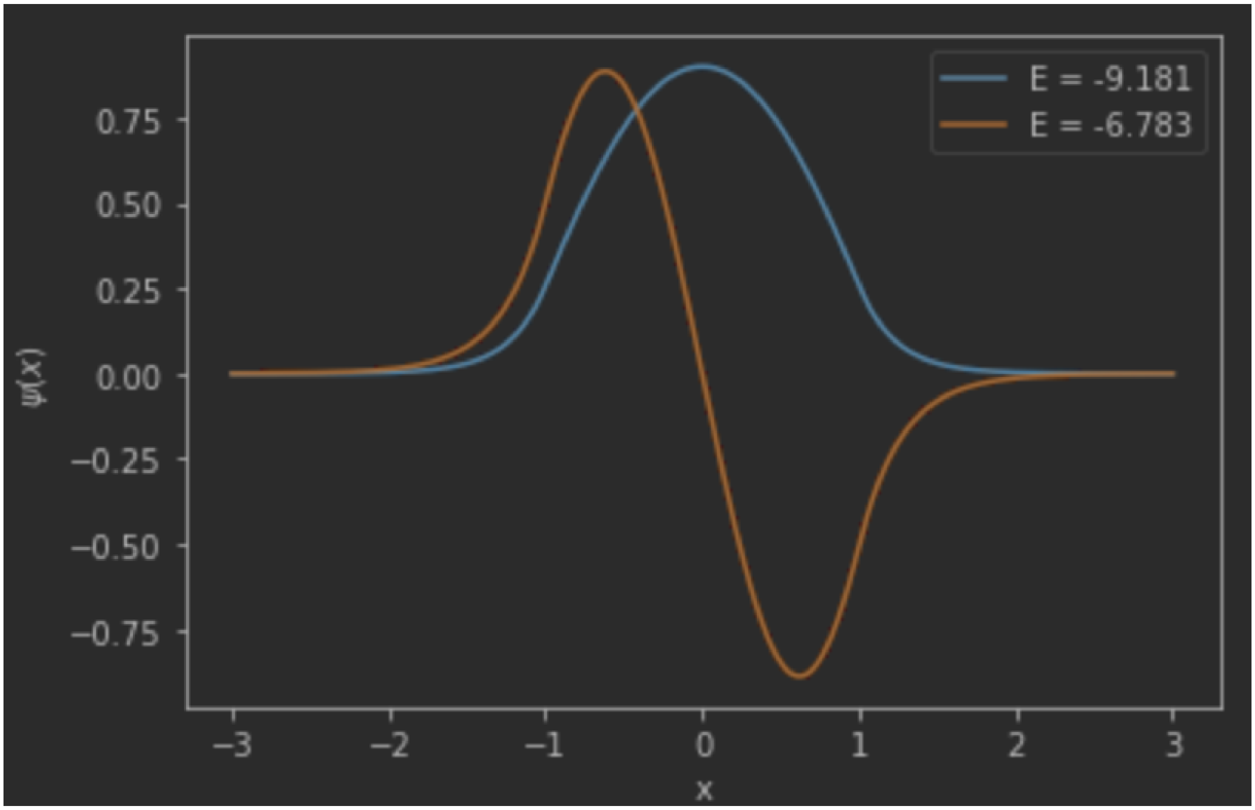
2.



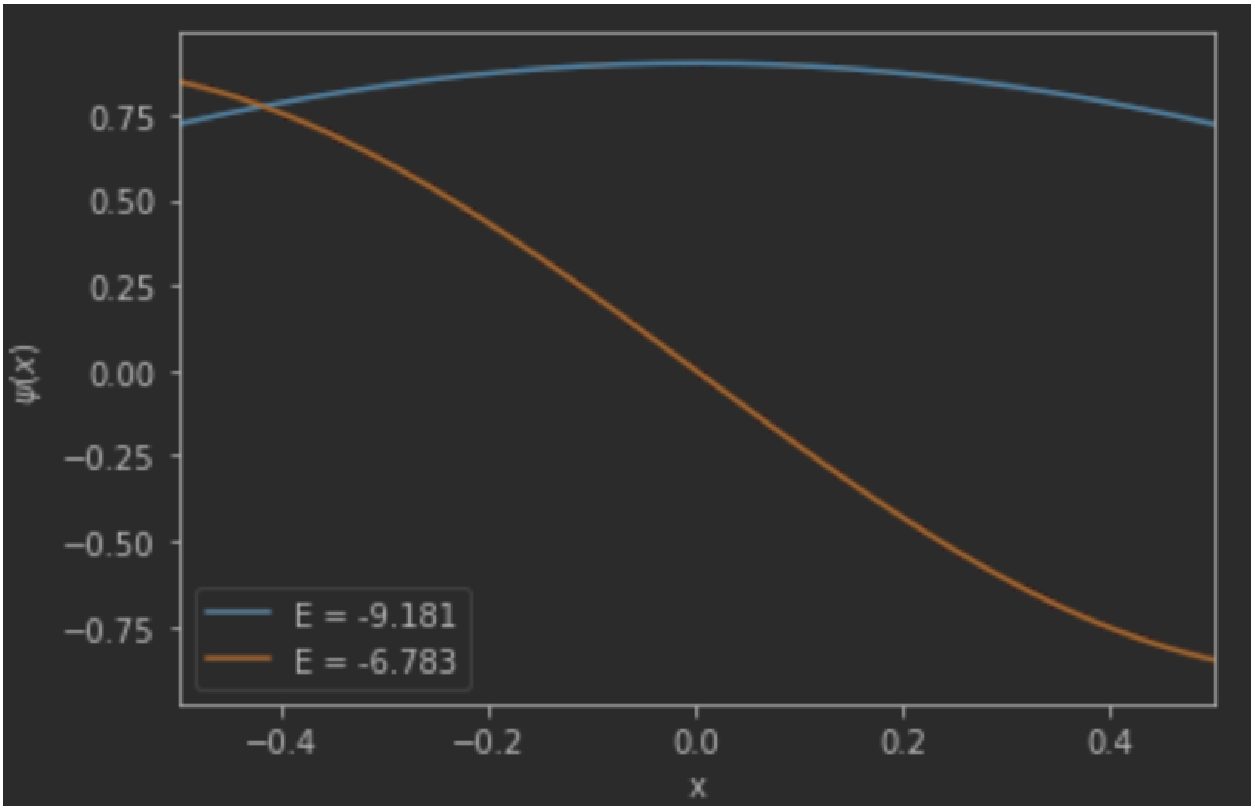
Graph showing ground state (blue) and first excited state (orange) looking at independently space walls on the entire interval



Graph showing ground state (blue) and first excited state (orange) looking at independently space walls on the interval -0.5 to 0.5



Graph showing ground state (blue) and first excited state (orange) looking at superposed walls on the entire interval

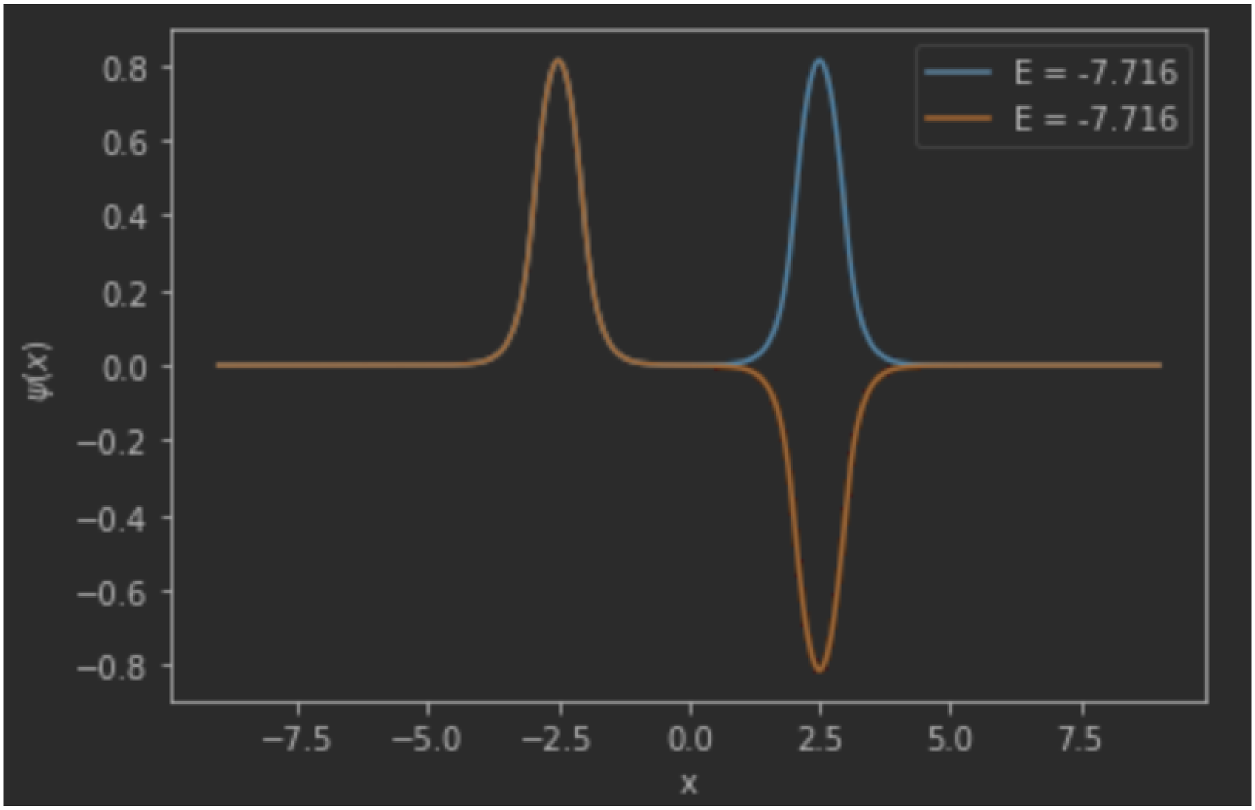


Graph showing ground state (blue) and first excited state (orange) looking at superposed walls on the interval -0.5 to 0.5

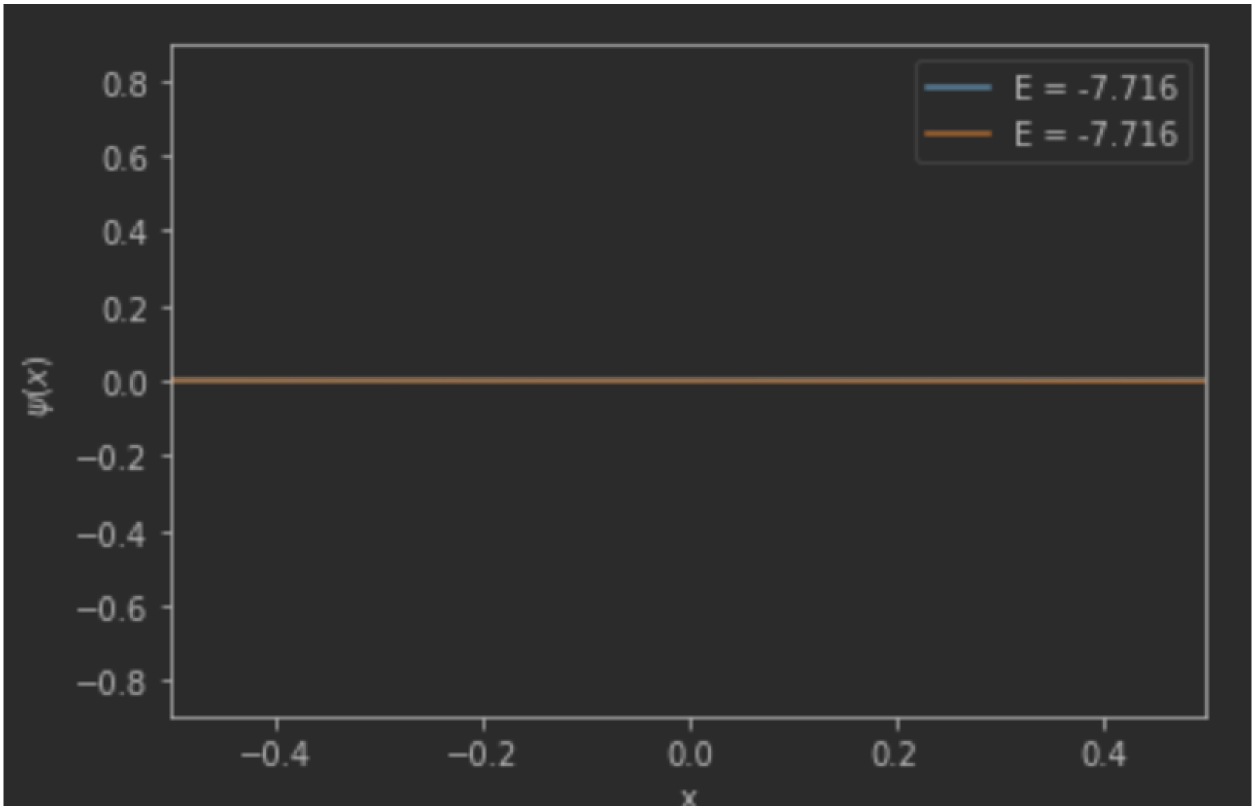
Increasing the distance between the walls means the exponential decay in probability of the particle in that regio is plainly visible. It is therefore reasonable to assume that with enough distance in between both walls, that the probability will approach zero within the walls.

3.

Working with the case of very spaced out walls should further bolster these claims, we can see the corresponding graphs here below.



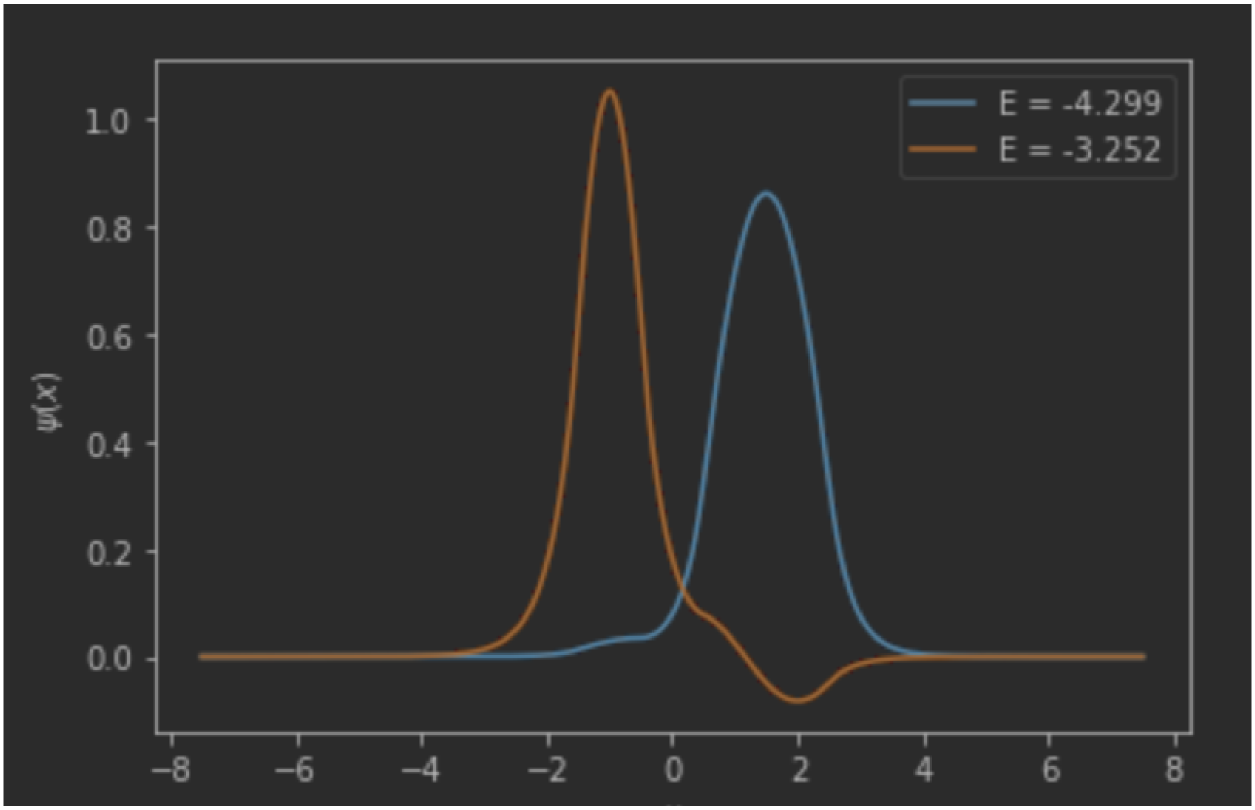
Graph showing ground state (blue) and first excited state (orange) looking at very spaced out walls on the entire interval



Graph showing ground state (blue) and first excited state (orange) looking at very spaced out walls on the interval -0.5 to 0.5

This graph supports our claims made in 3 wherein the probability approaches 0 within the walls as the spacing gets farther and farther apart.

4.



Graph showing ground state (blue) and first excited state (orange) looking at newly made walls on the entire interval

E = -4.299
Maxima at x = 1.498
Minima at x = -7.500
E = -3.252
Maxima at x = -1.000
Minima at x = 2.001

We can attempt to explain this as follows.

For the ground state, the wave-function is most likely to be located in the center of the double finite well. This is because in the ground state, the particle has the lowest energy and is most stable. The wave-function in this state is symmetric and has a maximum in the middle of the well.

For the first excited state, the wave-function is most likely to be located in the two outer wells. In this state, the particle has higher energy. The wave-function in the first excited state is antisymmetric, with a node at the center of the well, and maxima in the two outer wells.

In simpler terms, we can say that in the ground state, the particles probability peaks on the right, i.e. 1.498, within the bounds [c,d], which, being the wider of the two wells would be the least confining and therefore most favorable spot for the lower energy ground state

Similarly, looking at the excited state, we observe the peak at -1, i.e. within the smaller well. This is favorable for this higher energy state because the localization is naturally much more ‘peaky’ and centered within the [a,b] domain.