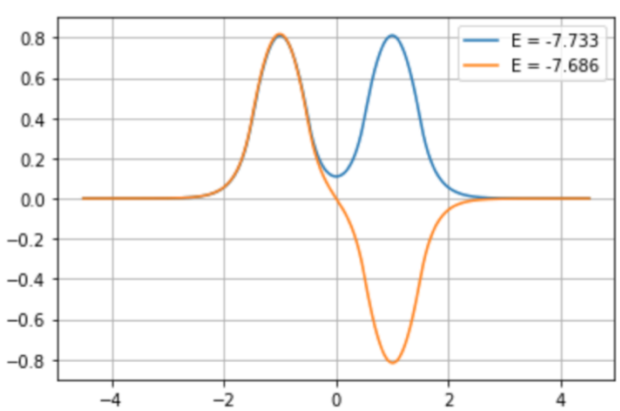
Question 1:

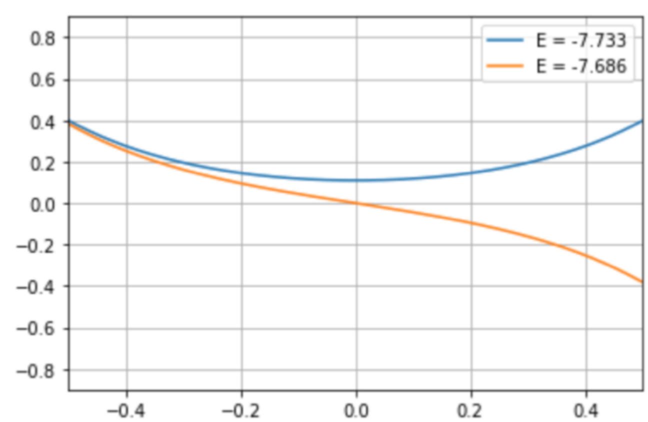
The eigenvalues for the double finite well are:

```
 -9.1812580
 -6.7828648
 -3.0615455
  0.5311149
  1.2251737
  2.2078179
  4.3337274
  5.6686171
  8.3481857
 10.8035887
```

When studying the finite well (Jupyter Assignment 2), the first two eigenvalues were found to be -9.1802599 and -6.7790593.
The eigenvalues obtained for the double finite well, though varying slightly, agree with those values obtained for the finite well. The variance is likely due to differing calculation methods. We expect these values to agree considering that there is no space between the wells, so this is a finite well.

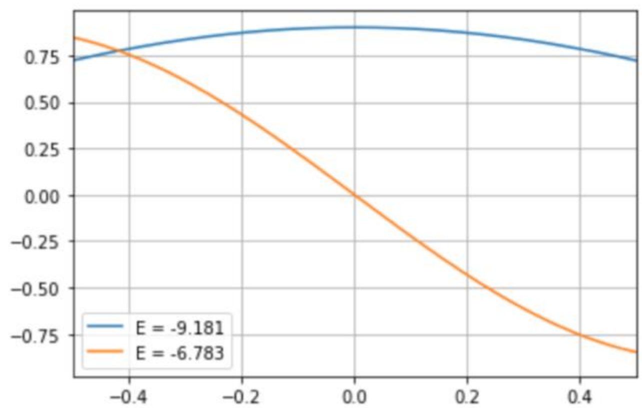
Question 2:





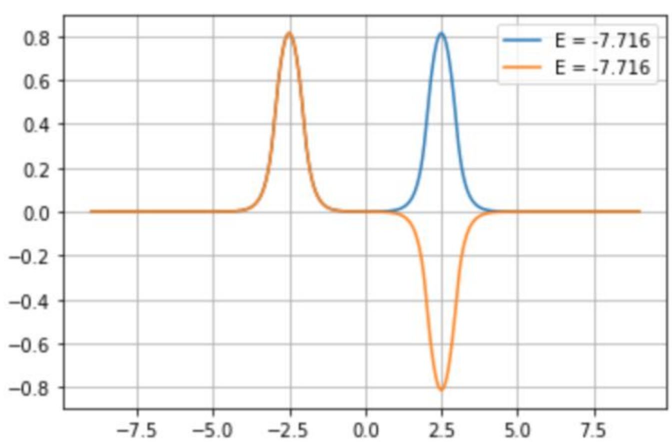
Blue = ground state
Orange = first excited state
Here, the spacing between the wells is 1 unit.

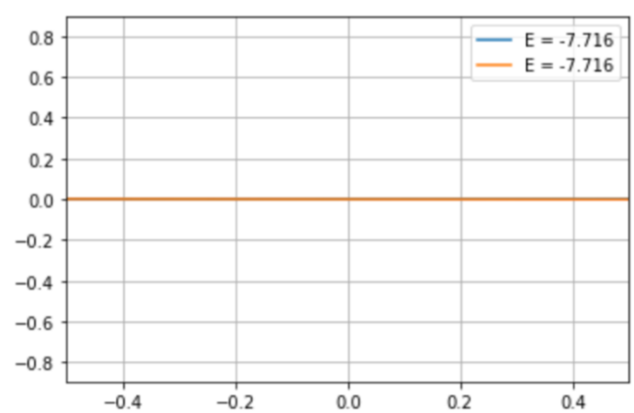
Compare to the first scenario, where there is no spacing in between the wells:



Upon comparison, we can observe that by creating a space between the wells, we decrease the likelihood that a particle will be found in that space. In these regions, the wavefunction dies exponentially. As we continue to increase the spacing between the wells, we would expect that the wavefunction would eventually be zero in this region.

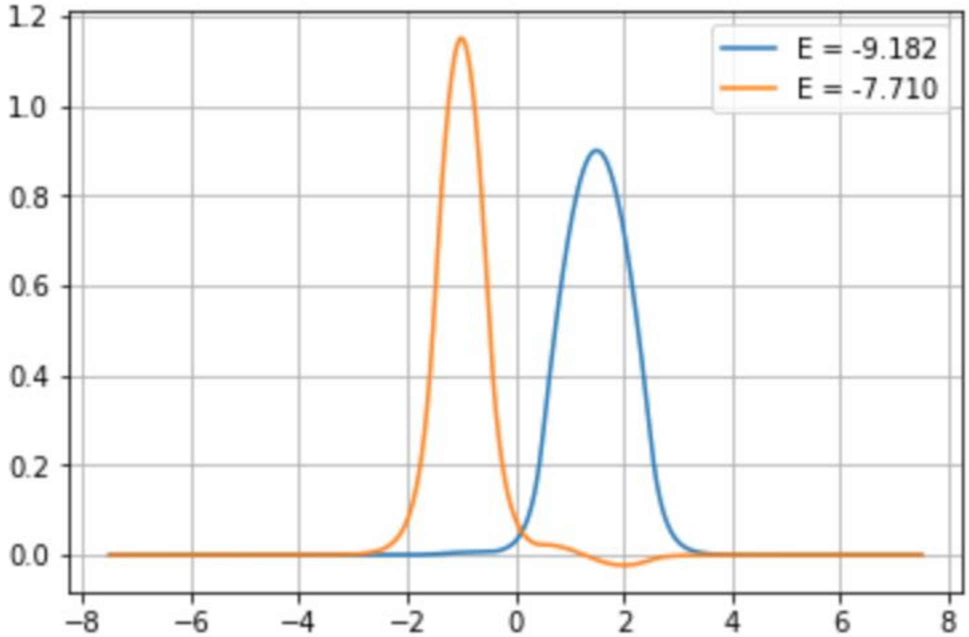
Question 3:





When we increase the distance between the two wells, as expected, we decrease the likelihood of finding a particle in the space between the wells. By separating the two wells by a distance of this magnitude, we essentially obtain two single finite wells (which explains why the ground state and first excited state have the same energy), and the probability of tunneling into the other well approaches zero.

Question 4:



Blue = Ground state
Orange = First excited state

In the ground-state, the wavefunction is most likely to be found in the larger well (from c to d). The ground state possesses the lowest energy, leading to a smaller amplitude and larger distribution. Therefore, the wider well is more favourable for the ground-state as it is the least confining.
In the first excited state, the wavefunction is most likely to be found in the smaller well (from a to b). In contrast to the ground state, the first excited state is higher in energy, and therefore has a high amplitude and less broad distribution. The narrower well allows for this state to be more localized than if it were in the wider well.

I literally do not know how to explain this