Homework 8
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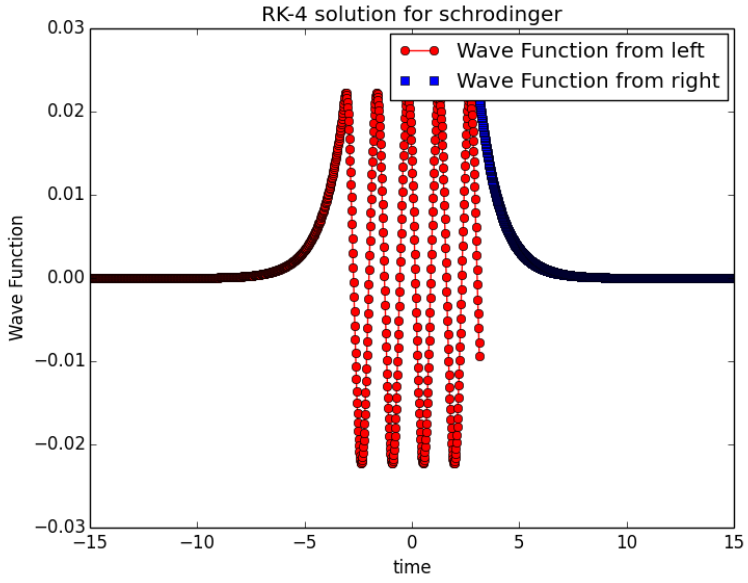
Computational Physics

Problems:

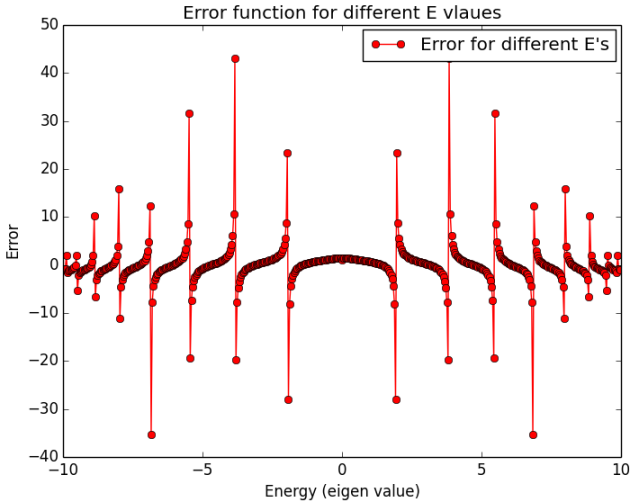
- 9.2.2 Quantum well
- depth = -10.
- Width = 4.

For my simulation, I took m =1.0, and also hbar (planck's constant) = 1.0, so to get physical results, the solution should be scaled appropriately – but this reduces errors from underflow and overflow)

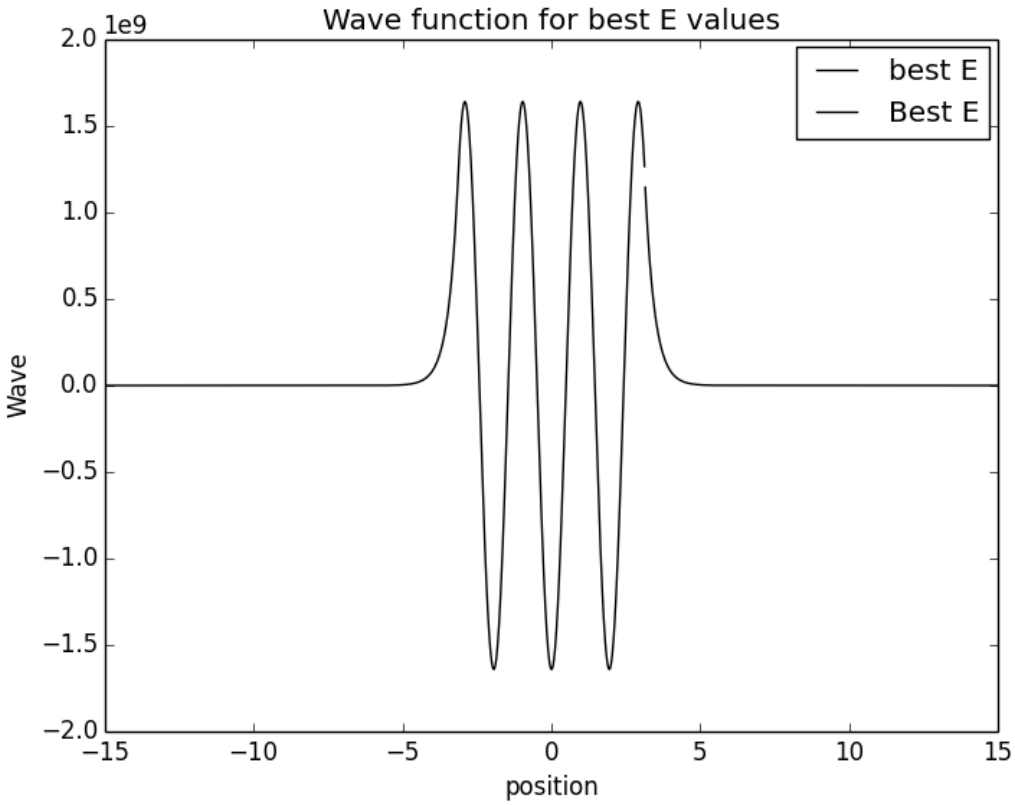
Solving from the left and right :



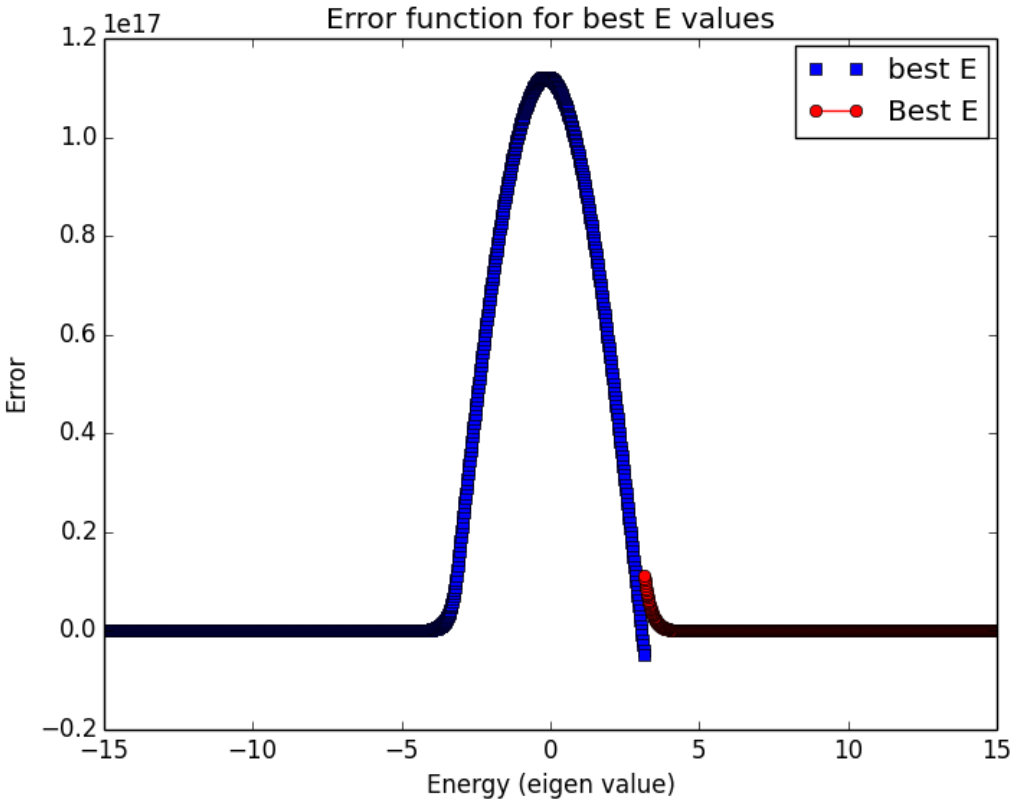
Evaluating the error to be a difference of the logarithmic derivative (which is defined as the wave function's derivative divided by the wave function) :



Then I solve for a good eigenvalue, by minimizing Error:



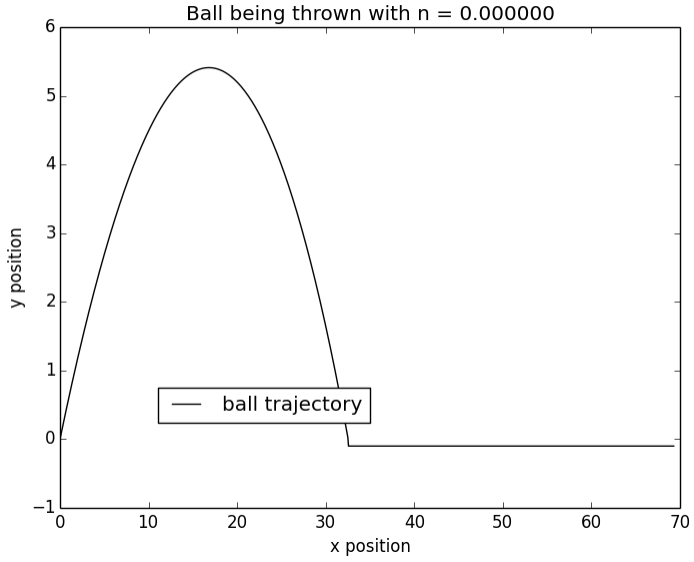
In this case the Energy is : 4.68
Here is the solution for the ground state:

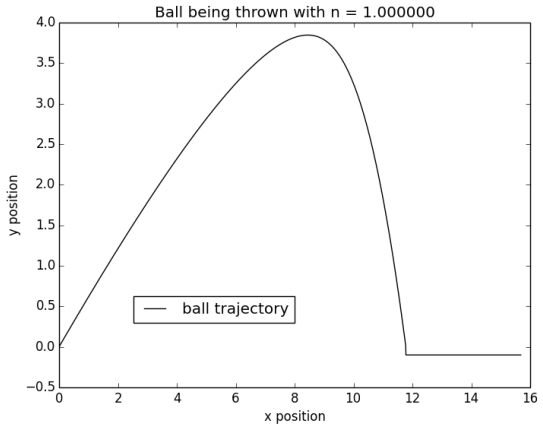


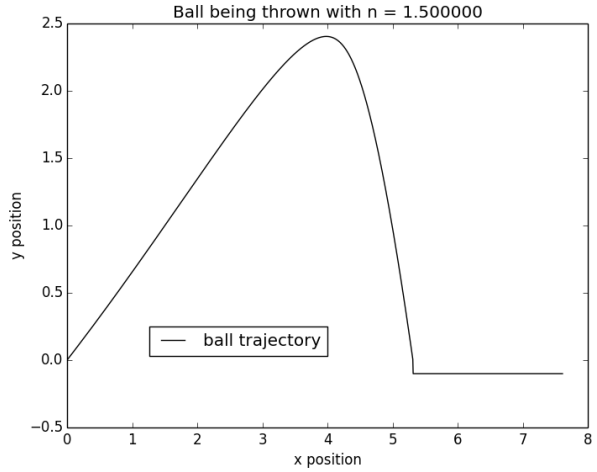
With eigenvalue E = -9.92

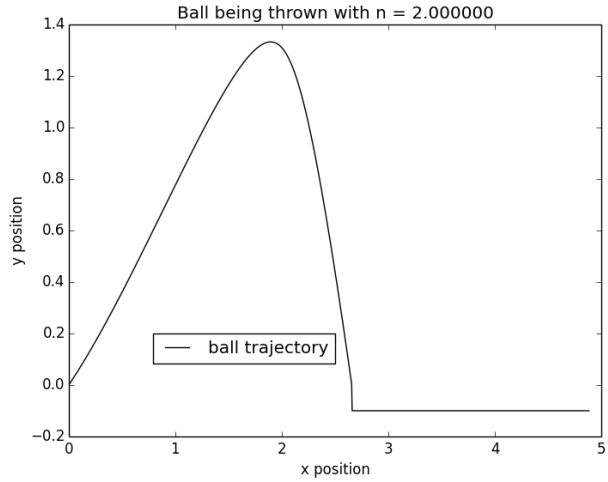
Balls falling with Drag!

9.6.2







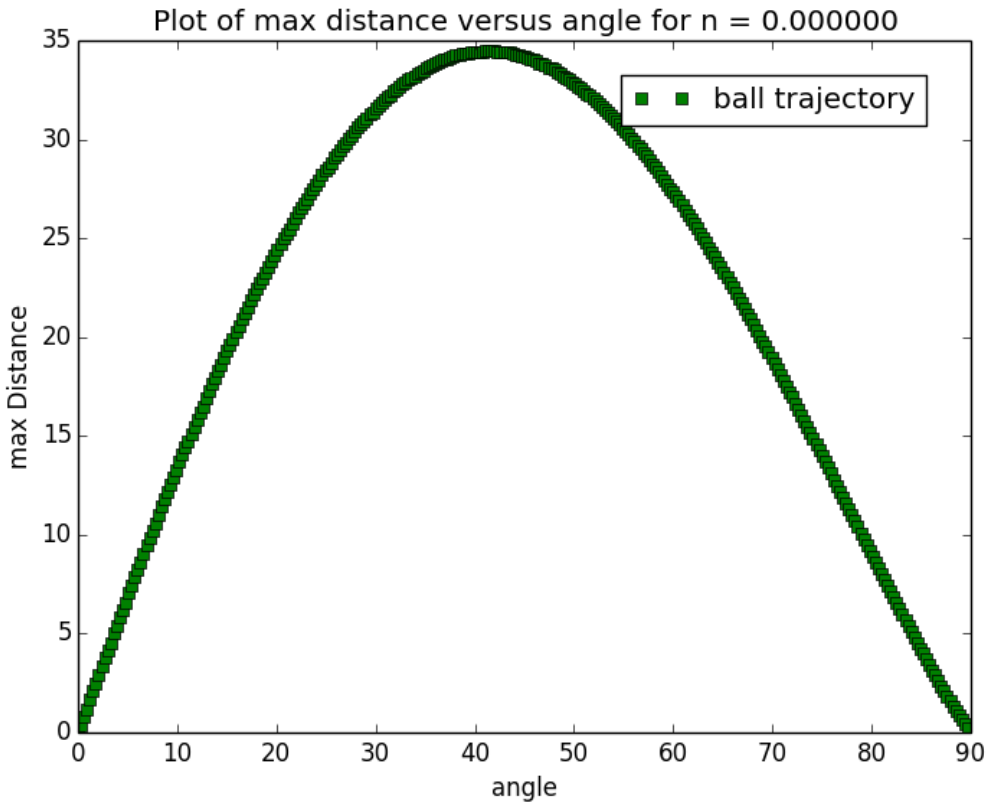


- 9.6.2 Ball thrown in air with friction
- what's the best angle to throw at to maximize distance?

Note: I am unsure about the terminal velocity calculations that I made – I threw the ball with only vertical velocity, and viewed the velocity at the last step

downwards – this is only accurate if it indeed reached terminal velocity. (It's certainly easy enough to do this calculation better, by letting the 'fall' run for a relatively long period of time)

For k = 0.



We know this is 45 degrees

There is no terminal velocity – it is the same as how you shot it upwards

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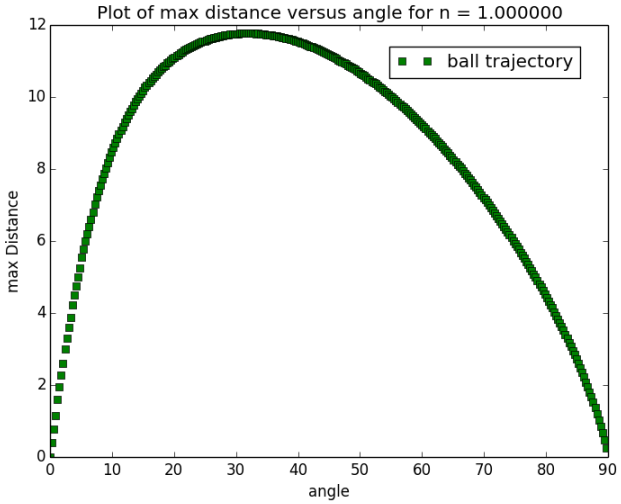
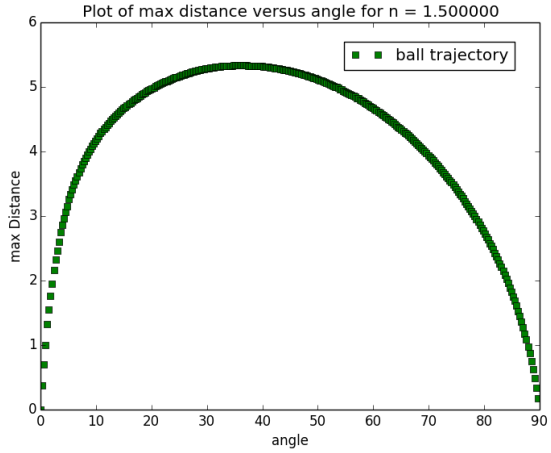
For k =1

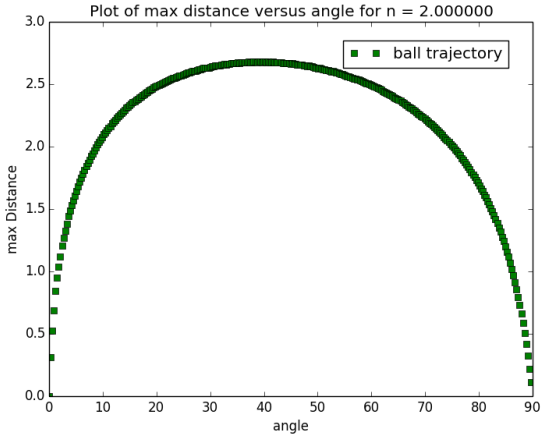


Terminal velocity for the angle 89.7: 6.539 m/s
roughly 20degrees

For k =1.5
Max distance roughly 33 degrees
the terminal velocity for: 89.7 degres : 3.497 m/s



For k = 2.
There was a problem, due to the fact that the numbers were getting to large



max roughly 40 degrees