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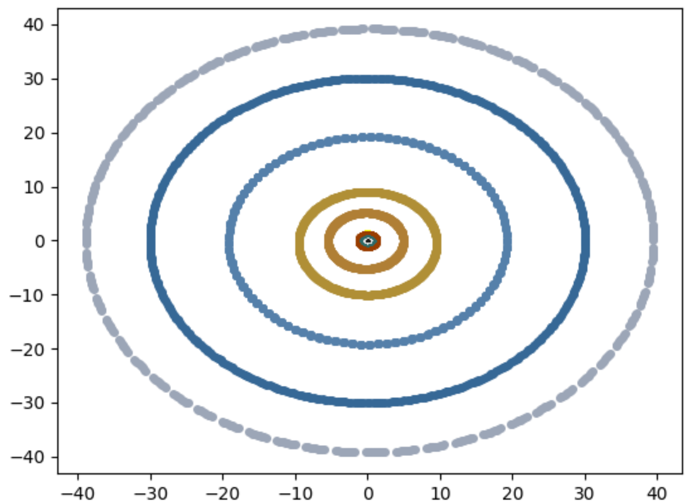
Physics 141
Homework 1 Report - Corrections

Problem 1
My answers for all parts matched the output given in the solutions. No corrections were needed.

Problem 2

While I’m using a different set of acceleration equations than the code given, they’re equivalent to them. Thus the difference is within acceptable margins. My Jupiter and Saturn had an overlapping orbit due to bad starting conditions, so I swapped them for the starting conditions given in the initial conditions of the solution. This corrected that problem, producing an graph the same as the one in the solutions, but in 2D instead of 3D.

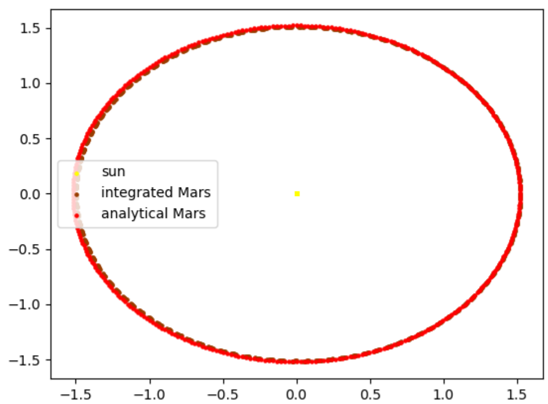


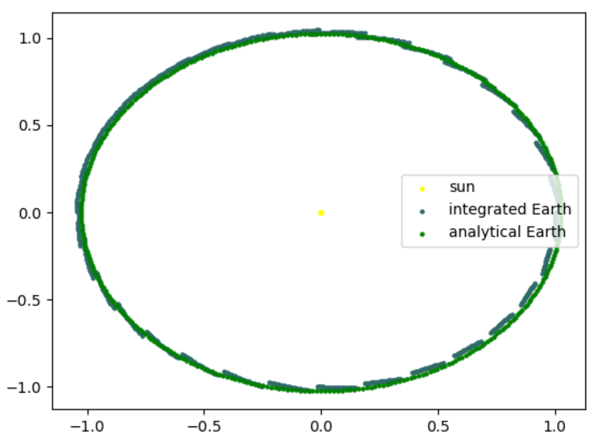
(Fixed 2a)

Problem 3

My solution for this problem is roughly equivalent. However instead of calculating the acceleration and eccentricity individually for the problem, I decided to more or less look them up, and input the values separately. While this isn't the best solution, it does produce a roughly equivalent solution, though far less elegant in most ways. There is a greater margin of error in not calculating the acceleration and eccentricity as done in the solution however. I recomputed it using the equations provided, and that solution is provided in my code as well.

These are the graphs for the analytical orbits of Mars and Earth if I were to calculate acceleration and eccentricity instead of hard coding the values.





Problem 4

I didn't get around to this problem originally due to the time spent on problem 2. My suggested possible solution however was incorrect. The actual solution for this is that the kepler orbit in this case is being taken as the acceleration, and not as velocity or radius, like I thought and suggested. From there the solution compares the momentum at time t and t+dt where dt is some infinitesimally small quantity. Then calculating momentum from those two values at two different time steps. Since leapfrog/verlet has two possible methods, you can take the velocity before the time step and after the time step dt. While both arguably have the time step, you can do it so that in the first velocity step, the time step is effectively 0, while in the second it's not. Then you subtract the post time step momentum from the pre-time step momentum, and try to make it go to 0. As if it's 0 then there is no change in momentum, and momentum doesn't change, proving that the verlet-leapfrog algorithm is symmetric for momentum.

I would do it myself on paper, but since I didn't do it the first time, I don't particularly think me doing it now will prove any actual substantial understanding of this problem, since I could just be copying from the solution set.