Lab 8 Expectations

Submit plots: 1, 2, 3, 4, 5, 6, 7, 8, 9

1. Submit graph with the standard settings and the Euler approximation, therefore you should have two solutions on your dfield plot. **Show your work** for calculating the slope of the third segment.
2. Submit graph with the standard settings, the Euler approximation, and the Improved Euler approximation. **Show your work** for calculating the slopes of the first two Euler lines, as well as the slope of the Improved Euler line. Show your work for calculating the next point on the Improved Euler approximation, and comment on whether it agrees with your graph.
3. Submit plot of the Euler approximation with h=0.5. **Show your work** for computing the slopes of the first three line segments of this Euler approximation. Comment on whether your answers agree or disagree with your graph.
4. Submit plot of the Improved Euler approximation with h=0.5. **Show your work** for finding the slopes of the first three line segments. Comment on whether your answers agree or disagree with your graph.
5. Submit graph with the actual solution, the Euler approximation (from question 3), and the Improved Euler approximation (from question 4). Also submit a table that shows the error for the Euler and Improved Euler methods at t=1,2,3. Identify which t of t=1,2,3 has the largest error for the Euler method and the Improved Euler method. Comment on which method (Euler or Improved Euler) is a better approximation.
6. Submit graph of the actual solution and the Euler approximation to the initial value problem. Offer an explanation about why the Euler approximation "zig-zags."
7. Submit graph of the actual solution and the Euler approximations (step sizes = 0.1, 0.5) to the initial value problem. You should have three orbits on your graph. Explain why the Euler method produces a bad approximation when step size = 0.5, and comment on whether decreasing the step size to 0.1 gives a better approximation.
8. Repeat question 7 with step size = 0.5, but instead use the Improved Euler method. Identify a step size that gives a reasonable approximation.
9. Submit a plot of the actual solution, the Euler approximation, the Improved Euler approximation, and the Runge-Kutta 4 approximation. You should use a large interval for the vertical axis (say [-5, 1000] or larger). Also submit a table that shows the error for each approximation at t=1,2,3,4,5. **Note**: If the error is too large, you may state that it is practically infinite. Comment on whether or not these models are good approximations.
10. Discuss how the three methods used in this lab (Euler, Improved Euler, and Runge-Kutta 4) compare to each other. Can we trust these numerical approximations? Can we trust the "actual" solution produced by dField?