Lab 05 Expectations

Submit Plots: 1, 5, 8.
Submit Code: 6.
t=23 corresponds to year 2020.

1. Plot the data using fplot.
2. Show all work to solve the linear ODE (*) using P(0) = 379, P(1) = 423. Predict the population in 2020.
3. Show all work to solve the exponential ODE(**). Predict the population in 2020.
4. Approximate values of k and r, using h=10, the step size for 10 years. Then state the differential equation with the values you found. Predict the population in 2020 using (C). Please note that the P_0, P_1, and P_2 are for P(0), P(10), and P(20) respectively, since the step size is 10 years. Also both ways of calculating k should come out to be about the same, so there is no need for averaging.
5. Graph all three equations on the same screen as #1 (3 estimates and 1 actual). Label each equation on plot. Which equation seems to be the most accurate? How much faith do you have in your predictions?
6. Using MATLAB find the norms of the data and each of the equations. Provide code. Explain if these error approximations support your empirical observations.
7. Find the solution to ODE using the closest decade to (1830 + seed) as t = 0. Predict the population in 2020. Compare the accuracy of this model to the original exponential model from question 3.
8. Show that P=0 and P=K are equilibrium solutions to (***). Find the limit as t approaches infinity, and discuss the maximum population. Graph the ODE using dField or by hand. Does the graph support your analytical observations?