Assignment 4

Math 528L Fall 2021

Due 9/26 (Sunday at 11:59 pm)

1 Adams-Bashforth's Method

(a) Write a program to implement Adams-Bashforth's Method for the general initial value problem $y' = f(t, y)$ with $y(0) = y_0$. It should take in the function, the inital value, the end time, and a step size h.

(b) Try out your program with the ODE $y' = -y^2 \cos(t)$ with $y_0 = \dfrac{1}{2}$. Use a step size $h = 0.1$ and a final time $T = 20$. Plot the solution.

(c) Find the exact solution using Mathematica's DSolve. Plot the solution.

(d) Now vary your step size $h = 0.1, 0.05, 0.025, 0.01, 0.005, 0.0025, 0.001$. Keep track of the absolute error at the final time step (use the analytic solution to find the error).

(e) Verify that the order of the method is indeed second order. To do this, take the log of the errors and the log of the step sizes and plot them. What is the slope of the line?