Assignment 1

Math 528L Fall 2021

Due 8/29 (Sunday at 11:59 pm)

1 Mathematica Introduction

Mathematica is a powerful tool in math. You can both program and solve equations in one seamless environment with tons of documentation. It is living document meaning you can execute code as you work! Using the various tools we learned today in class, demonstrate your knowledge of some of these features by completing the tasks below in a single Mathematica notebook (with comments and sections):

(a) Solve for the solution to the following system:

$$\begin{cases} 4x + 3z = & 2y + 1 \\ -4x + 3y = & -7 - x \\ 3x - 5 = -2z - y \end{cases}$$

(b) Solve the differential equation:
$$y'(x) = cx + y(x)$$

where $y(2) = 0$.

2 Matlab Introduction

MATrix LABoratory (Matlab) is a intuitive tool for coding with a focus on mathematical modeling and applications. Great for anything involving linear algebra (which is what a lot of upper level math ends up simplifying into). With it, you can solve nearly any differential equation numerically! Using the various tools we learned today in class, in particular a "for loop" and an "if then statement", demonstrate your knowledge of some of these features by completing the tasks below in a single matlab script (with comments and sections):

(a) Write a function that calculates the nth number of the fibonacci sequence: $y_{n+2} = y_{n+1} + y_n$, $y_1 = 1$, $y_2 = 1$

(b) Show that the ratio $L_n = \dfrac{y_{n+1}}{y_n}$ converges. To show this, produce a code that for any user given tolerance (difference between consecutive L_n terms) the code will run until that tolerance is satisfied.

(c) What is the name of this number that your sequence converged to?