Assignment 3 - Scientific Computing by MnP

Submission deadline : 11:59 pm 28th July 2020

Question 1

Solve the differential equation using odeint on python and plot the graph of y vs x.

$dy/dx = \cos(x) + x^2$

Take y(0) = 0 and x = linspace(0,10,1000)

Question 2

Time for a bit of SciFi in the SciComp course!
We'll be modelling a Zombie apocalypse. The system is modelled by the following equations

$$\begin{aligned} dS/dt &= P - BSZ - nS \\ dZ/dt &= BSZ + GR - ASZ \\ dR/dt &= nS + ASZ - GR \end{aligned}$$

- S: the number of susceptible victims
- Z: the number of zombies
- R: the number of people "killed"
- P: the population birth rate
- n: the chance of a natural death
- B: the chance the "zombie disease" is transmitted (an alive person becomes a zombie)
- G: the chance a dead person is resurrected into a zombie
- A: the chance a zombie is totally destroyed

Take the following values for the constants:

- P = 0
- n = 0.0001
- B = 0.0095
- G = 0.0001
- A = 0.0001

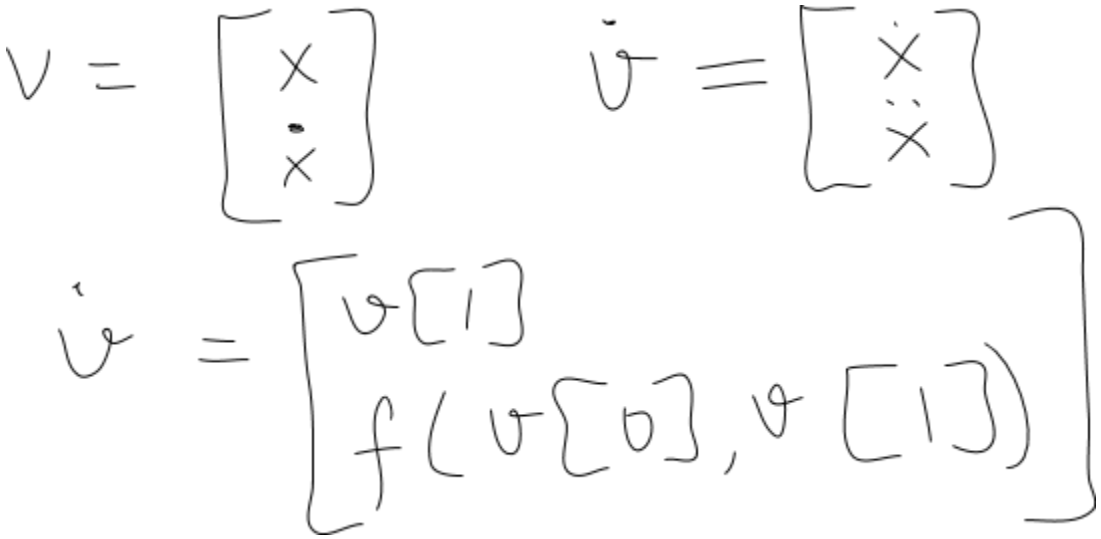
Take the initial populations as: S = 500, Z = 0 and R = 0
Plot for the first 5 days after the zombie apocalypse starts: t = np.linspace(0, 5, 1000)

Question 3:

Model a simple vertical spring-mass system and plot its position and velocity as a function of time.

The time should span from 0 to 10 with 10000 sample points in between.
Take k = 2.5, m = 1.5, g = 9.8 (all in SI units) and the initial position and velocity to both be 0.

Hint:
You will be solving a second order differential equation. To do this consider the following:



Write the function to integrate the differential equation for this vector v.