Assignment #3

Please show all work to get the full points.
Show your conclusion clearly.

1. Use Deepxde or write a PINN code to solve the ODE system

$$\begin{aligned}\frac{dy_1}{dx} &= \sin(x) + x,\\ \frac{dy_2}{dx} &= \cos(x) + x,\\ \frac{dy_3}{dx} &= x^2 + y_1 - y_2,\end{aligned}$$

Time interval: $[0, 1]$.

Initial values: $y_1(0) = 0, y_2(0) = 1, y_3(0) = 2$.

In NN, the residual points are taken as 100.

Consider 3 hidden layers, the total number of neurons: 32 in each hidden layer.

Activation function: tahn

initializer = "Glorot normal"

The true solution is given by

$$\begin{aligned}y_1 &= -\cos(x) + \frac{1}{2}x^2 + 1\\ y_2 &= \sin(x) + \frac{1}{2}x^2 + 1\\ y_3 &= \frac{1}{3}x^3 - \sin(x) + \cos(x) + 1\end{aligned}$$

1. Derive the loss function of this problem.
2. Show the training loss
3. Compare the difference of your solution and the true solution in a figure.
4. attach your code or file.