MATH 221 - Differential Equations

Lecture 10 Worksheet

Fall 2020 | **Subhadip Chowdhury** | **Sep 9**

Title: ODEINT

Summary: We will learn another numerical technique to find approximate solution to first order ODEs using Python.

§A. ODEINT

Note that I suggest using the Anaconda distribution and Jupyter Notebook if you are not already familiar with Python. If you have used Python before, you can use other IDEs but I may not be able to help you if it is unfamiliar to me. I will provide a `.py` file but you may need to modify it yourself.

Question 1.

- Download the `ODE_Example.ipynb` file from Moodle. Open it using Jupyter Notebook.
- Read the comments in the file. It uses a fancy numerical technique called `ODEINT` to approximate a solution to the IVP
$$\frac{dy}{dx} + y = x, \qquad y(0) = 1.$$
- Execute the script. What is the approximate value of $y(10)$?
- When closing a notebook, remember to `save and checkpoint`. Then `close and halt`. Do not close the browser window directly.

Question 2.

1. Create a new Jupyter notebook. Write code that uses the `ODEINT` routine to approximate solution to the IVP
$$\frac{dy}{dt} = e^{-y^2}(1-y) \quad y(0) = 0$$
for $t = 0, 0.01, 0.02, \ldots, 2.99, 3$. Plot the curve.
2. Suppose $y(t)$ is the solution to the IVP considered in the previous problem. What is the approximate value of $y(3)$ found using `ODEINT`?