

ENGR 232 Lab Assignment Week # 2

Growth of biological samples can be modeled using an autonomous first order differential equation

$$\frac{dy}{dt} = y \left(1 - \frac{y}{3} \right), y(0) = 1$$

Obtain a solution to this DE using (a) Euler's method using $\Delta t = 0.2$ and (b) ODE with $\Delta t = 0.2$. The analytical solution is given as

$$y(t) = 3 - \frac{6}{\exp(t) + 2}$$

Estimate the MSE in each case. Use a time window from $t=0$ to $t=6$.

1. Plot the Euler's solutions, ODE solution and analytical solution on a single plot, annotated. The MSE values must also be displayed.
2. Use Matlab to get the EQUILIBRIUM value and determine the time instant when it is reached.
3. Find how long does it take the growth to double from 1.2 to 2.4?
Provide answers to part (2) and (3) as comments or display them on the plot.

Note: You must create an .m file as **lastname_initials_lab2.m** and a function named **ode_eulerf.m**. The published document must include the function. All figures must be annotated (labels, legends, markers, title, display of MSE values, and if possible answers to part (2) and part (3)).