Problemas Primer Parcial - Taller

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1. Problem 1

When a voltage source is connected across a resistor and inductor in series, the voltage across the inductor $V_i(t)$ is predicted to obey the equation:

$$V(t) = V_0 e^{\Gamma t} \tag{1}$$

where t is the time and the decay rate $\Gamma = R/L$ is the ratio of the resistance R to the inductance L of the circuit. Use the above equation to fit the data below.

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Data for decay of voltage across an inductor
in an RL circuit


time (ns)   voltage (volts)
    0.0        5.08e+00
   32.8        3.29e+00
   65.6        2.23e+00
   98.4        1.48e+00
  131.2        1.11e+00
  164.0        6.44e-01
  196.8        4.76e-01
  229.6        2.73e-01
  262.4        1.88e-01
  295.2        1.41e-01
  328.0        9.42e-02
  360.8        7.68e-02
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393.6        3.22e-02
426.4        3.22e-02
459.2        1.98e-02
492.0        1.98e-02
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Asnwer the following questions:

- Find the best values of Γ and V_0.
- Make a semi-log (Y-axis in log scale) plot of the data and obtained fit.
- If the resistor has a value of 10.0 $k\Omega$, what is the value of the inductance?

2. Problem 2

Using Euler, improved Euler and odeint scipy methods, solve the following ODEs. Determine if each methods converge in the given range. Make a plot of the numerical soutioncs and truncate errors. It is up to you to determine the step size.

2.1. Problem 2.1

$$\frac{dy(t)}{dt} = -y(t) + 1;\ y(0) = 0;\ t = [0, 10] \tag{2}$$

2.2. Problem 2.2

$$5\frac{dy(t)}{dt} = -y(t) + t;\ y(0) = 0;\ t = [0, 10] \tag{3}$$

2.3. Problem 2.3

$$3\frac{dy(t)}{dt} = -y(t) + t^2;\ y(0) = 0;\ t = [0, 10] \tag{4}$$