

Name: _____

Section: _____

Date: _____

R·I·T SCHOOL OF MATHEMATICAL SCIENCES

Kirchhoff's Law

MATH 211 - 01

Consider the RLC circuit with an inductance of 1 H, a resistance of $100\ \Omega$, a capacitance of $400\ \mu\text{F}$ and a voltage source of 30 V. The initial current is 2 A and the initial charge is 0 C.

1. Set up the differential equation whose solution models the charge in the circuit at time t .
2. Find the transient solution.
3. State the linearly independent solutions from the transient solution and verify that they satisfy the differential equation.
4. Is the transient solution considered to be overdamped, critically damped or underdamped?
5. Find the steady-state solution.
6. Write the general solution to the differential equation.
7. Find the charge as a function of time.
8. Find current as a function of time.
9. Find the limiting factor of the charge as a function of time.
10. Now, consider the voltage source of $E(t) = 30e^{-50t}$. What would the steady state solution be here?
11. Write the new general solution to the differential equation.
12. Now, find charge and current as functions of time.
13. Find the limiting factor of the current in the circuit.