

Written HW4 – MATH 3504 Spring 2021

**Due by 10 February for timely completion credit**

In the 5 February class, we derived the RC circuit equation (for charge)

$$RQ' + \frac{1}{C}Q = E(t),$$

and the RC circuit equation (for current)

$$RI' + \frac{1}{C}I = E'(t),$$

where  $Q$  denotes the charge of the capacitor at time  $t$  (in coulombs),  $I$  denotes the current at time  $t$  (in amps),  $R$  denotes the resistance of the resistor (in ohms  $\Omega$ ),  $C$  denotes the capacitance (in farads), and  $E(t)$  denotes the electromotive force at time  $t$  (think: battery or power from the wall).

1. A 9 volt battery (*hint: this is the  $E(t)$* ) is attached to an RC circuit with resistance  $2\Omega$  and capacitance 1 farad. Write the differential equation in this case. If the initial charge in the circuit is 2, then find the equation for the charge in this circuit.
2. An old battery generating an electromotive force  $E(t) = 200e^{-0.2t}$  is attached to an RC circuit with resistance  $3\Omega$  and capacitance 4 farads. Write the differential equation in this case. If the initial current is 0, find the formula for the current in the circuit at time  $t$ .