Physics 142 - October 9, 2008

- Presentation topic list

  Return to me next Tuesday

Last Time —

- Resistance

$$\boxed{V = IR}$$

Ohm's Law

Resistance ⤳ unit ohm $\equiv \Omega$

Impedes elections "Looking" for love

Pass current thru resistor — Energy lost as heat or light

Mostly

Power dissipated $\equiv P = iV = iiR = i^2R$

$$P = i^2R$$

$$V = iR$$

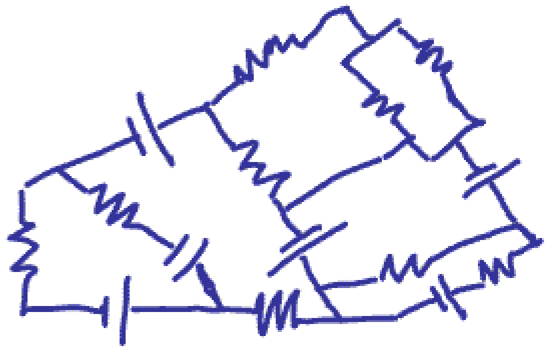
$$i = V/R$$

$$P = \frac{V^2}{R}$$

Resistors in series $\quad R = \sum_i r_i$

Resistors in parallel $\quad \frac{1}{R} = \sum_i \frac{1}{r_i}$

Last Time



suppose you meet a circuit in a dark Alley one night...

... And the electrons Are NOT looking For love...

Kirchoff's Rules:

1. $\Sigma V = 0$ around closed Loop in circuit
2. Current is conserved at any Branch point in circuit

- use these rules to create N independent equations to solve for N unknowns

- Choose independent loops
- Use Sign conventions consistently + with care

Convention [told this is opposite that of ECE 210]

↳ no matter if consistent

Choose currents in each branch (arbitrary)

Sum ΔV across each circuit component as you go around an imaginary closed loop in the circuit

ΔV − if 

$\mathcal{E}$ + if 

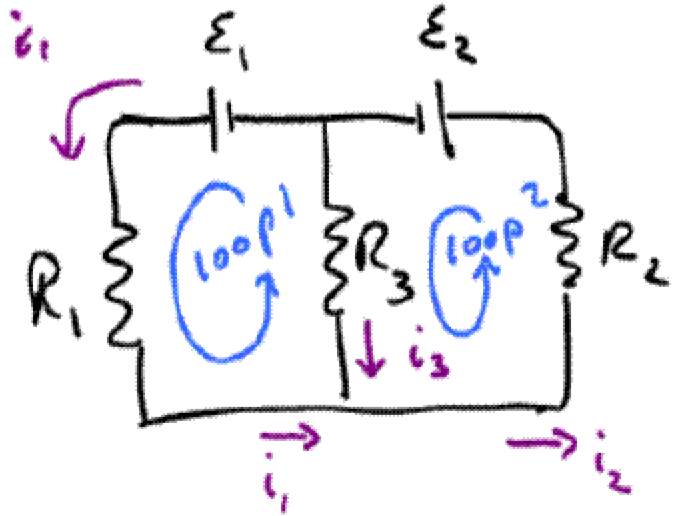
ΔV + if 

$\mathcal{E}$ − if 

Get N eqns, N unknowns and solve

Tedious ⟶ must be careful and consistent w/ conventions and signs

Use only independent loops



Know $\mathcal{E}_1, \mathcal{E}_2$

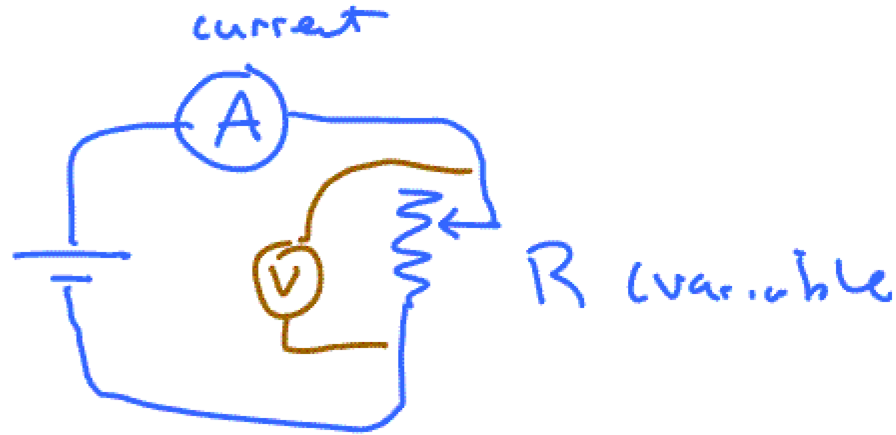
R_1, R_2, R_3

Solve for current throuout circuit

Kirchoff's 2ND rule $\quad i_1 + i_3 = i_2 \quad$ I

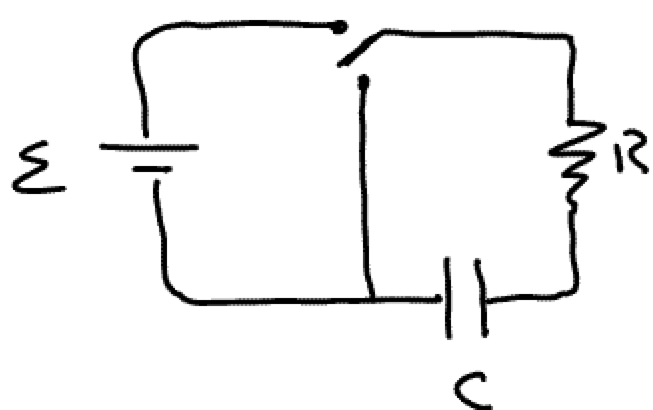
$$\mathcal{E}_1 - i_1 R_1 + i_3 R_3 = 0 \quad \text{II}$$

$$-i_3 R_3 - i_2 R_2 - \mathcal{E}_2 = 0 \quad \text{III}$$

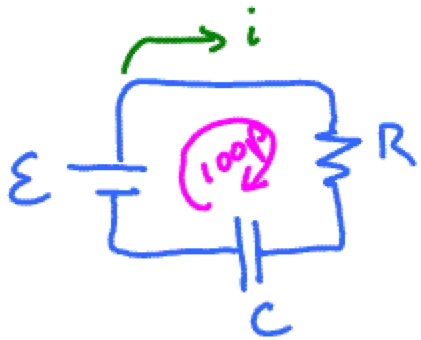


DC circuits — RC circuit

Direct Current



Switch up — charging RC circuit



$$\Sigma V = 0$$

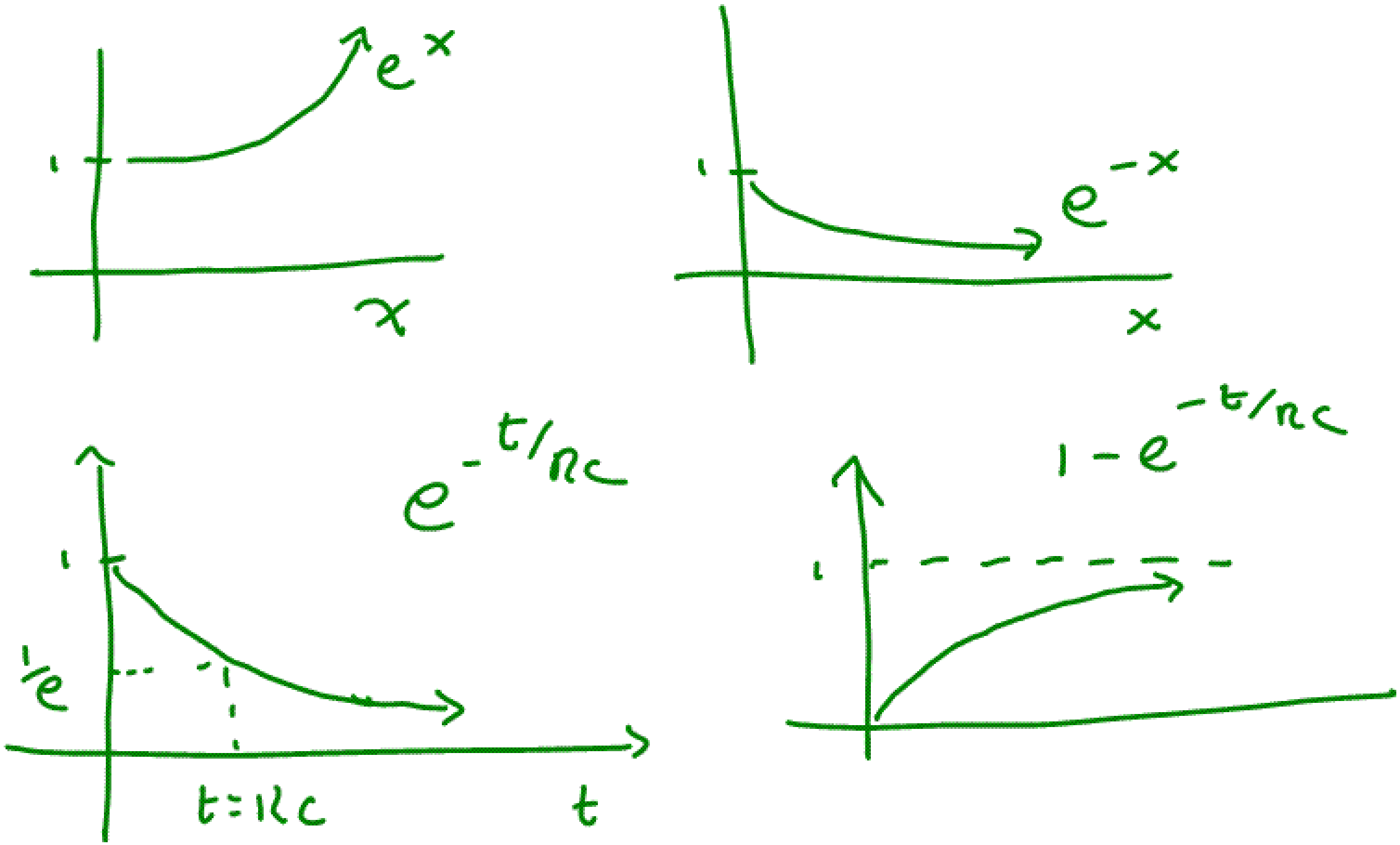
$$\mathcal{E} - iR - \frac{q}{C} = 0$$

differential equation

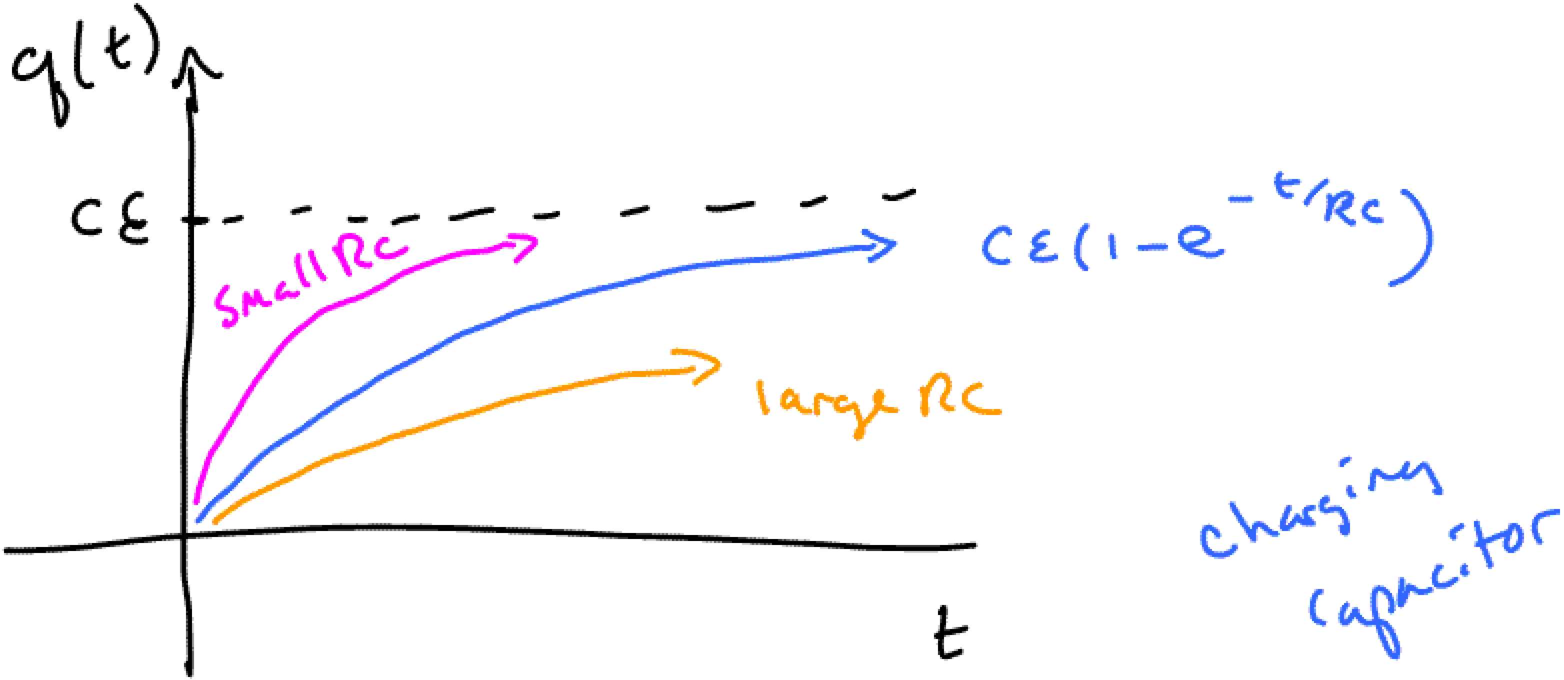
$$\mathcal{E} = \frac{dq}{dt}R + \frac{q}{C}$$

$$q(t) = C\mathcal{E}\left(1 - e^{-t/RC}\right)$$

$$q(t) = C\mathcal{E}\left(1 - e^{-t/RC}\right)$$

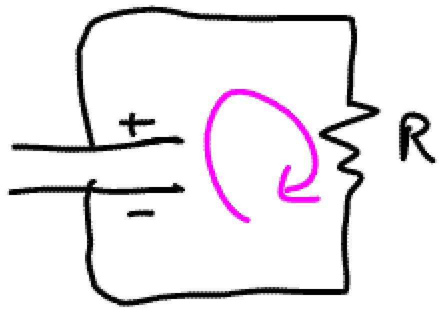


$$q(t) = C\mathcal{E}\left(1 - e^{-t/RC}\right)$$



$RC \equiv$ time constant of circuit

discharging RC circuit



$\sum V = 0$

$$-\frac{dq(t)}{dt}R - \frac{q(t)}{C} = 0$$

$$-\frac{dq(t)}{dt}R = \frac{q(t)}{C}$$

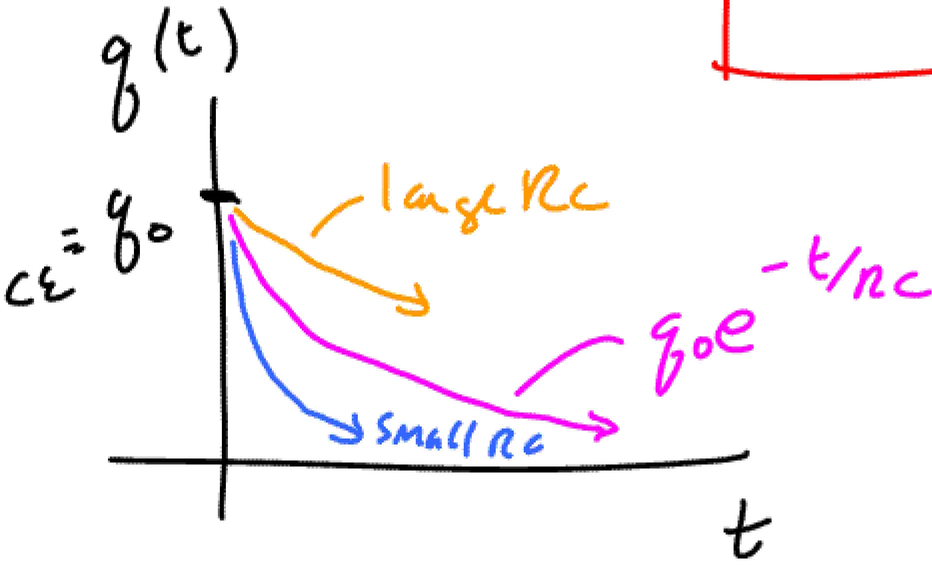
$$\int_0^t \frac{dt}{RC} = -\int_{q_0}^{q} \frac{dq}{q}$$

$$\frac{t}{RC} = -\ln q/q_0$$

$$-t/RC = \ln q/q_0$$

$$e^{-t/RC} = q/q_0$$

$$\boxed{q(t) = \underbrace{q_0}_{C\mathcal{E}} e^{-t/RC}}$$



Began chatting about the Special

Theory of Relativity