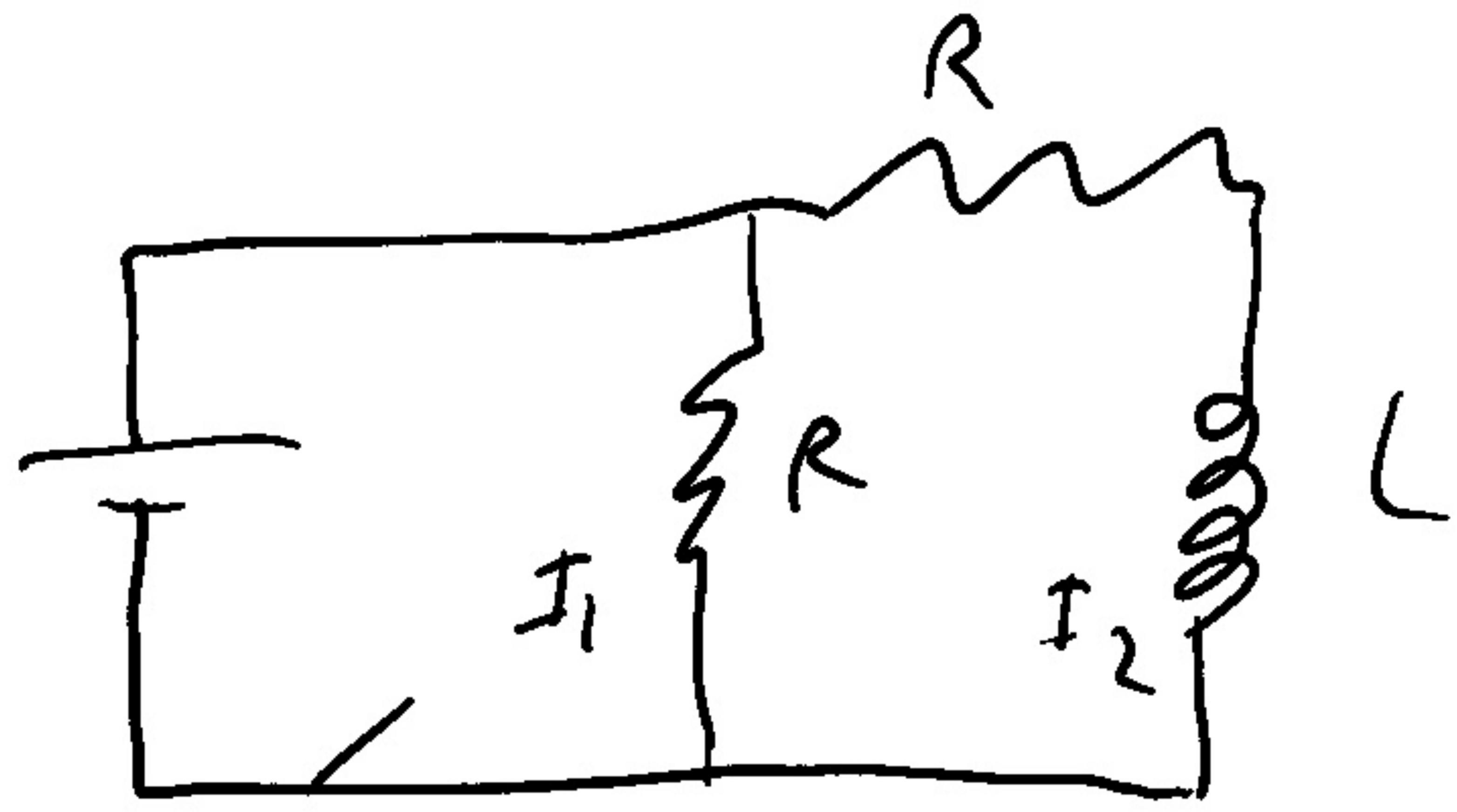
C1:



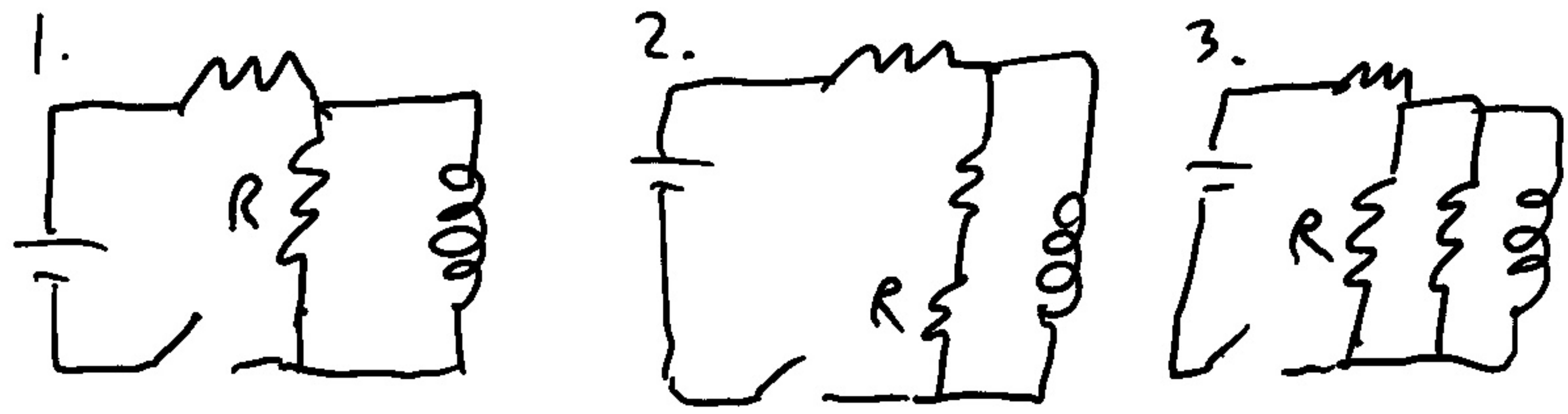
@ $t \sim 0$ $\quad I_1 \gg I_2$

@ $t \sim \infty$ $\quad I_1 = I_2$

after re-opening $\quad I_1 = I_2$

much later $\quad I_1 = I_2 = 0$

C2:

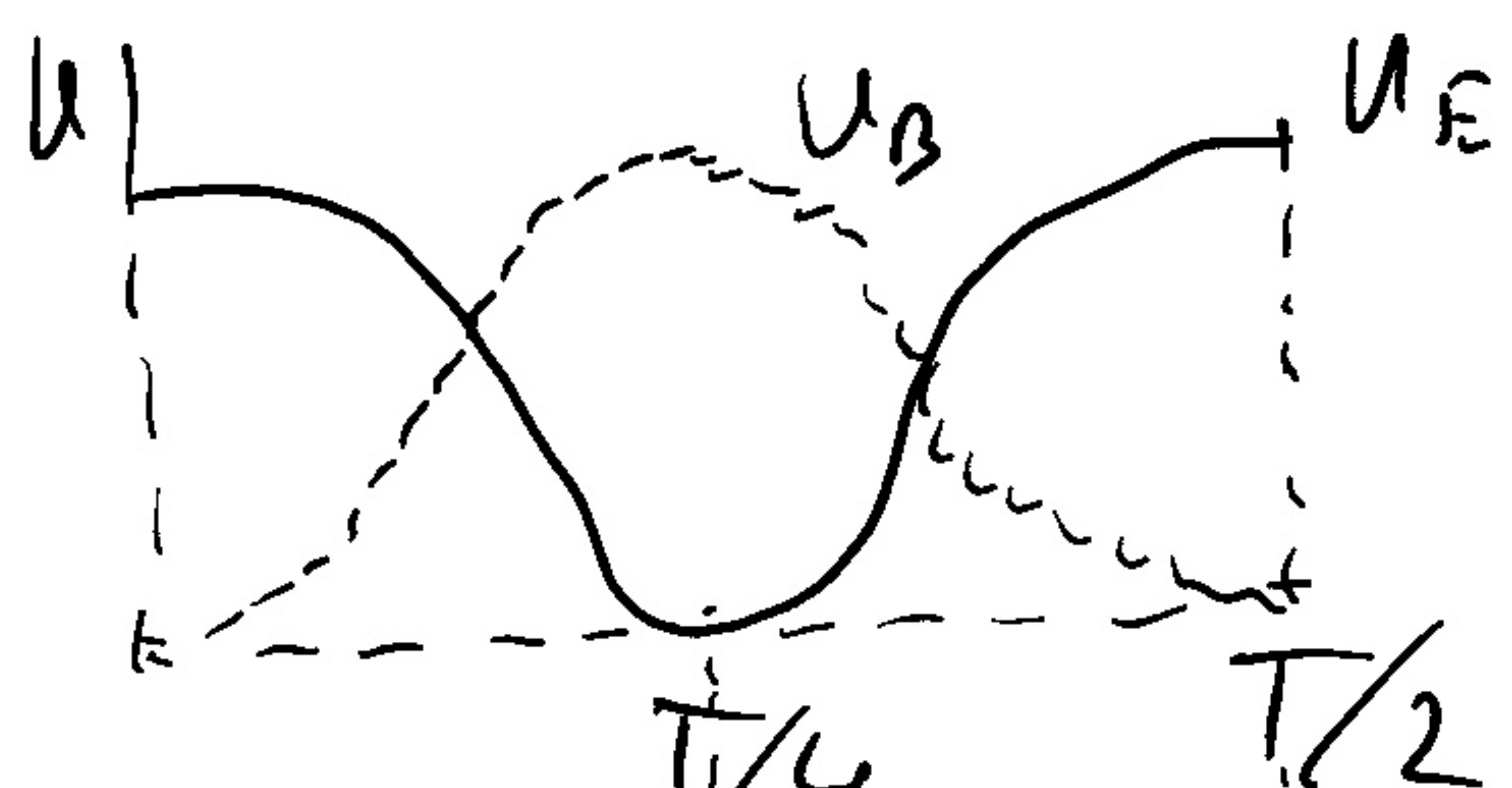


@ $t = \infty$, $\quad I_1 = I_2 = I_3 = 0$

after re-opening $\quad I_1 = I_2 > I_3$

@ $t = \infty$, $\quad I_1 = I_2 = I_3 = 0$

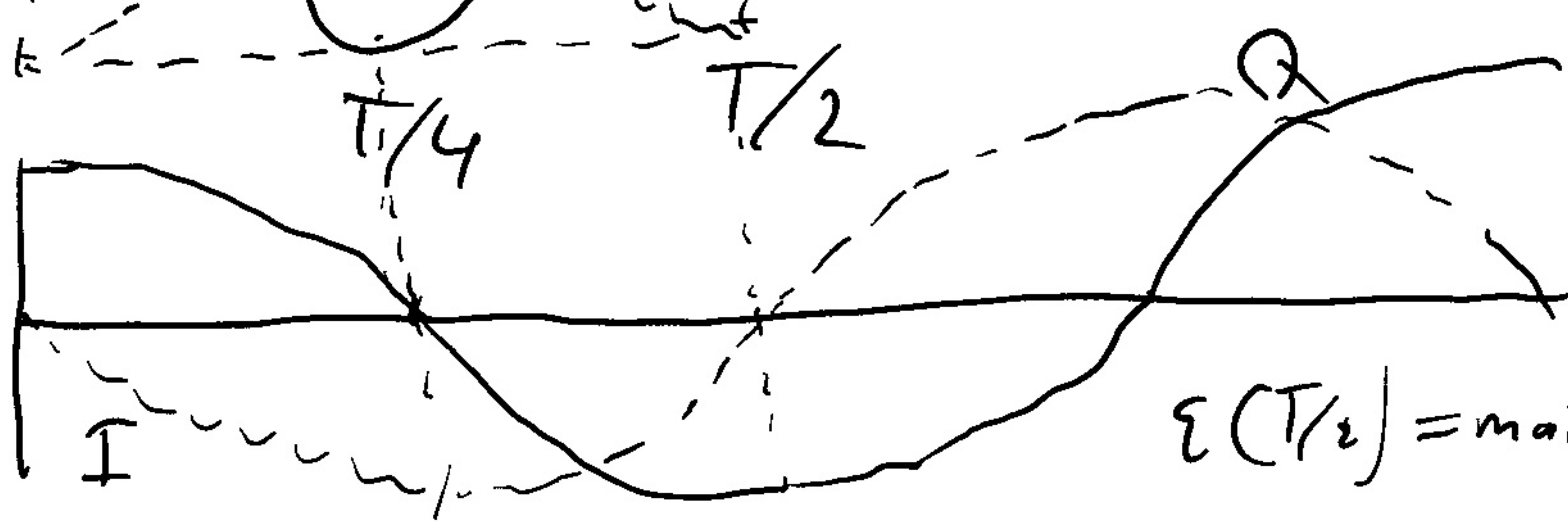
C3: $Q(0) = Q_{max}$



$U_B(T/4) = max$

$\varphi_B(T/4) = max$

$di/dt\,(T/2) = max$



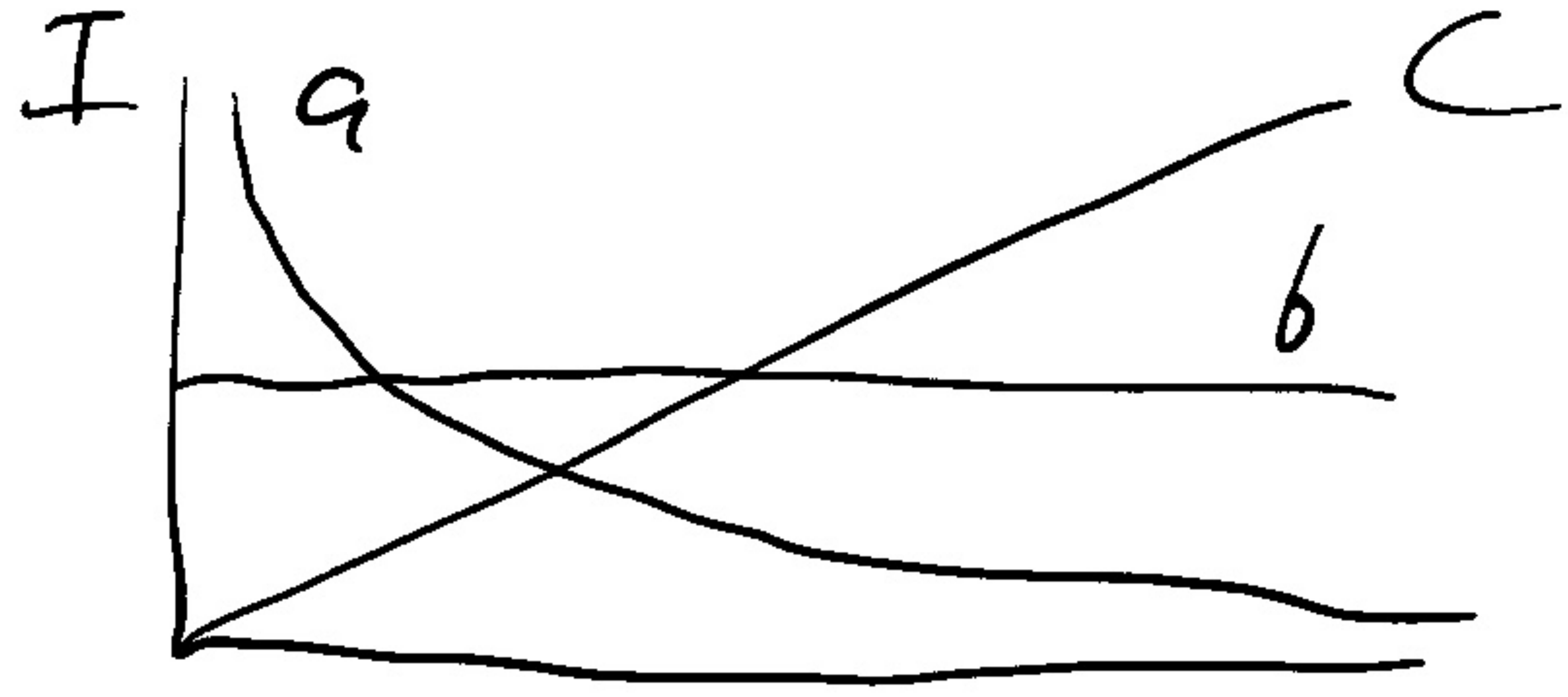
$\mathcal{E}(T/2) = max$

CL1. $q_1 = 2\cos(4t)$
$q_2 = 4\cos t$
$q_3 = 3\cos(4t)$

$i = dq/dt$
$I_3 > I_1 > I_2$

$T = 2\pi/\omega$
$T_2 > T_1 = T_3$

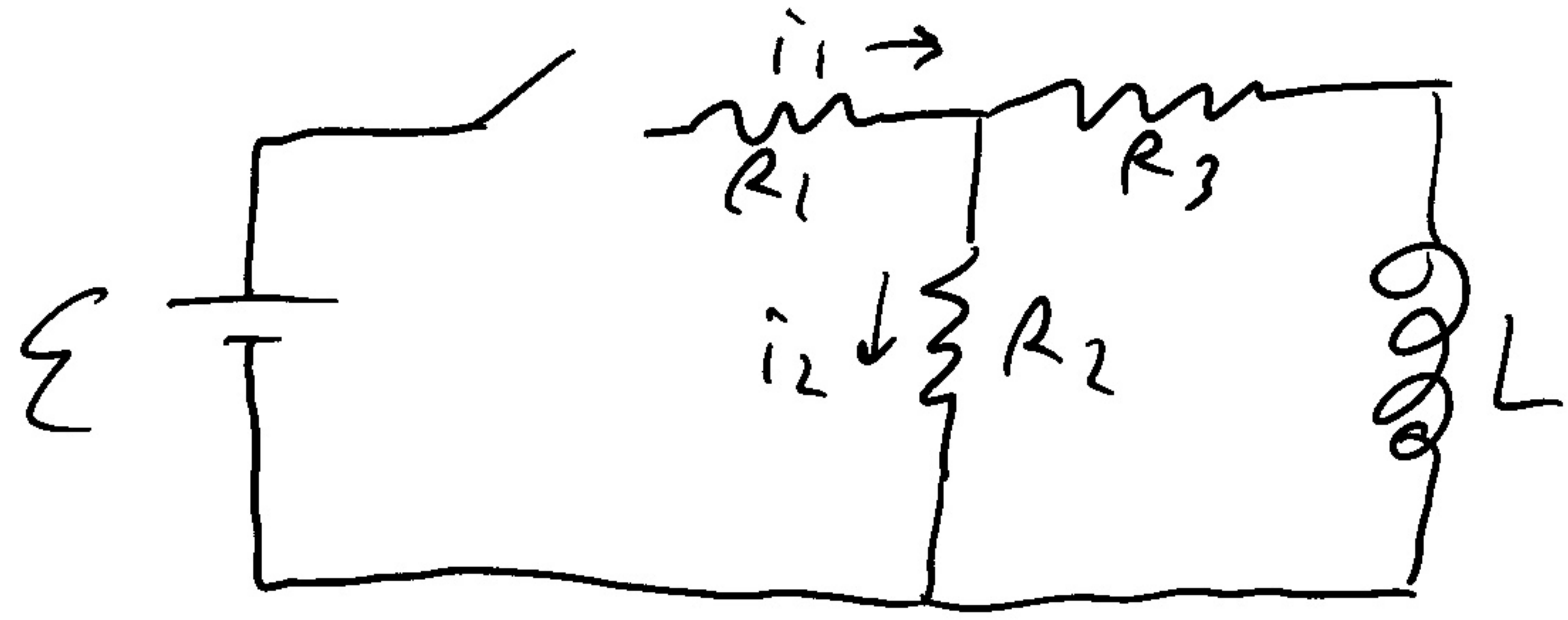
CS;



$I = \mathcal{E}/Z$
$Z_R = R$
$Z_C = 1/\omega C$
$Z_L = \omega L$

$\Rightarrow$ a. L
b. R
c. C

M1:



@ $t=0$ no current through L

$i_1 = i_2 = \mathcal{E}/(R_1+R_2)$

@ $t=\infty$ L is a wire

$i_1 = \mathcal{E}\Big/\left(R_1 + \frac{R_2R_3}{R_2+R_3}\right)$

$i_2 = i_1 \cdot \frac{R_2R_3}{R_2+R_3} \cdot {}^1/_{R_2} = \frac{\mathcal{E}R_3}{R_1(R_2+R_3)+R_2R_3}$

after opening switch

$i_1 = 0$

$i_2 = -\mathcal{E}R_2\Big/\left(R_1(R_2+R_3)+R_2R_3\right)$

long time later

$i_1 = i_2 = 0$

M2: $i = \mathcal{E}/R\,(1 - e^{-t/\tau_L})$

a. $P_{battery} = \mathcal{E} i$

$= \frac{\mathcal{E}^2}{R}\left(1 - e^{-t/\tau_L}\right)$

$U_{battery} = \int P\,dt$

$= \mathcal{E}^2/R\, t + \mathcal{E}^2\tau_L/R\; e^{-t/\tau_L} \Big|_0^6$

$= 6\,\mathcal{E}^2/R + \frac{\mathcal{E}^2 L}{R^2}\left[e^{-6/\tau_L} - 1\right]$

b. $U_{inductor} = \frac{1}{2} L I^2$

$= \frac{1}{2} L \cdot \left[\mathcal{E}/R\,(1 - e^{-t/\tau_L})\right]^2$

$= \frac{1}{2} L \cdot \mathcal{E}^2/R^2 \cdot \left(1 - 2e^{-6/\tau_L} + e^{-12/\tau_L}\right)$

c. $U_{resistor} = \int i^2 R\,dt$

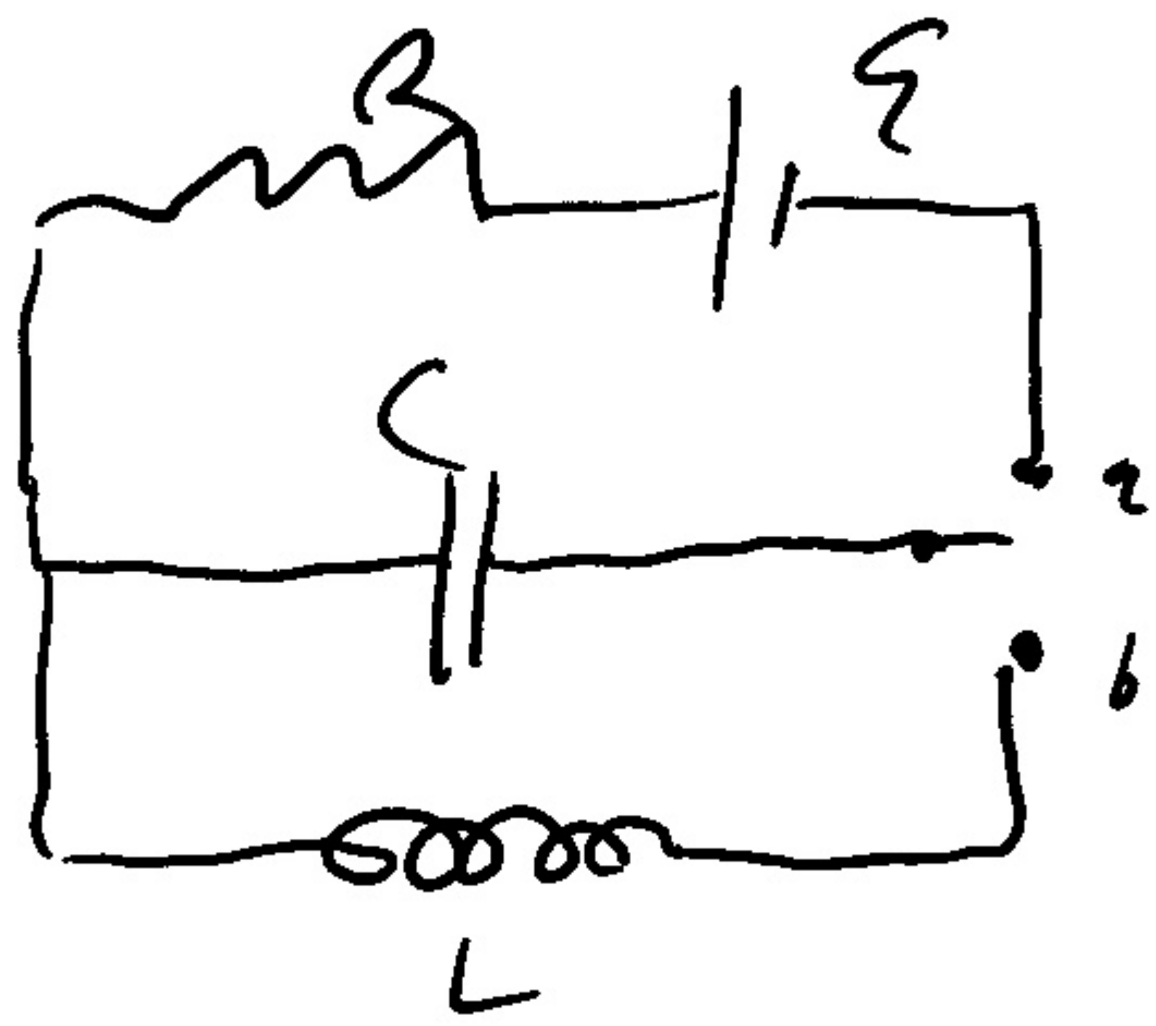
$= \int \mathcal{E}^2/R\,\left(1 - 2e^{-t/\tau_L} + e^{-2t/\tau_L}\right) dt$

$= \mathcal{E}^2/R\left(t + 2\tau_L e^{-t/\tau_L} - \frac{\tau_L}{2} e^{-2t/\tau_L}\right)\Big|_0^6$

$= 6\,\mathcal{E}^2/R + 2\mathcal{E}^2 L/R^2\left(e^{-6/\tau_L} - 1\right) + \frac{\mathcal{E}^2 L}{2R^2}\left(1 - e^{-12/\tau_L}\right)$

$U_{bat} = U_{ind} + U_{res}$

M3:



- After long time, $I = 0$, $Q = C\mathcal{E}$
- switch from a to b

$$\omega = 1/\sqrt{LC} \Rightarrow f = 1/2\pi\sqrt{LC}$$

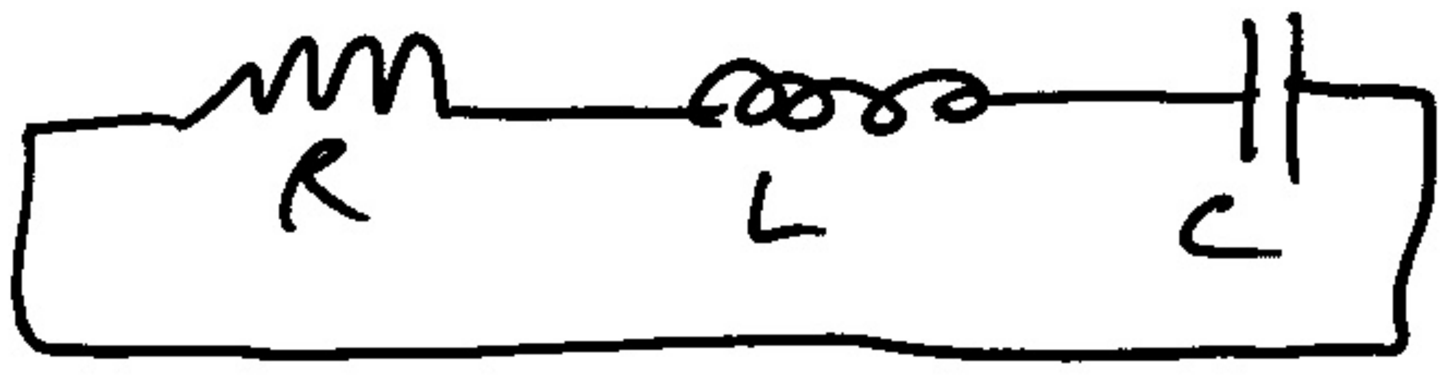
$$U_{B\,max} = \tfrac{1}{2} L I^2 = U_{E\,max} = Q^2/2C$$

$$\Rightarrow \quad I_{max} = Q_{max}/\sqrt{LC}$$

$$= C\mathcal{E}/\sqrt{LC}$$

$$= \mathcal{E}\sqrt{C/L}$$

M4:



Q/Q_0 after 5, 10, 100 cycles

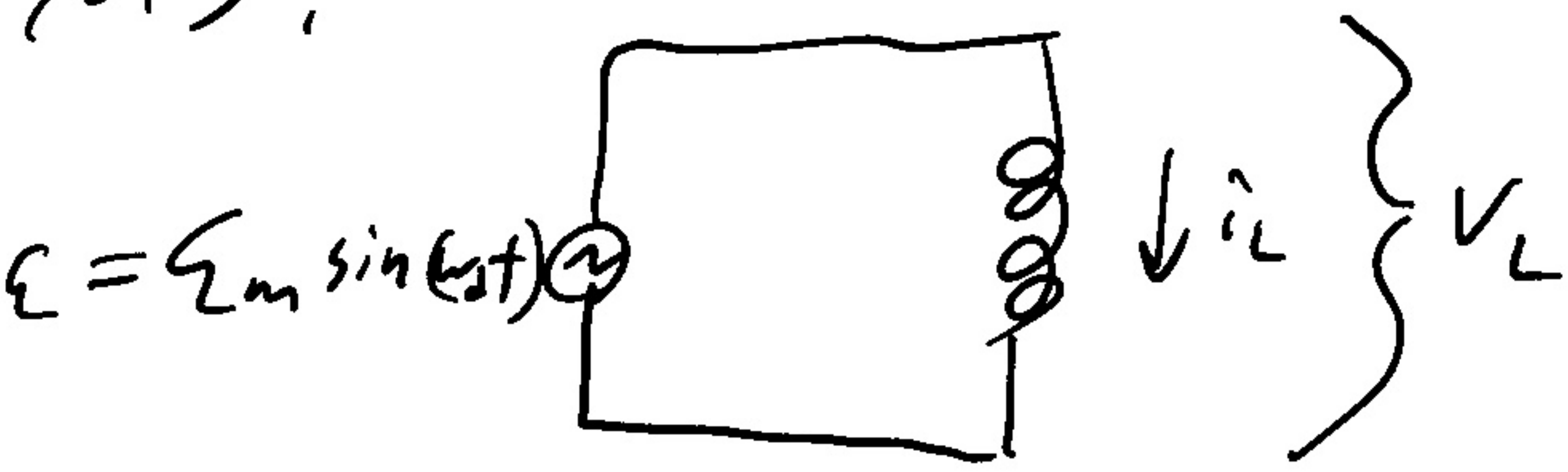
$$Q/Q_0 = e^{-tR/2L}$$

$$T = 2\pi/\omega = 2\pi\sqrt{LC}$$

so $Q/Q_0 = e^{-2\pi N\sqrt{LC}\,R/2L} = e^{-\pi N\sqrt{C/L}\,R}$

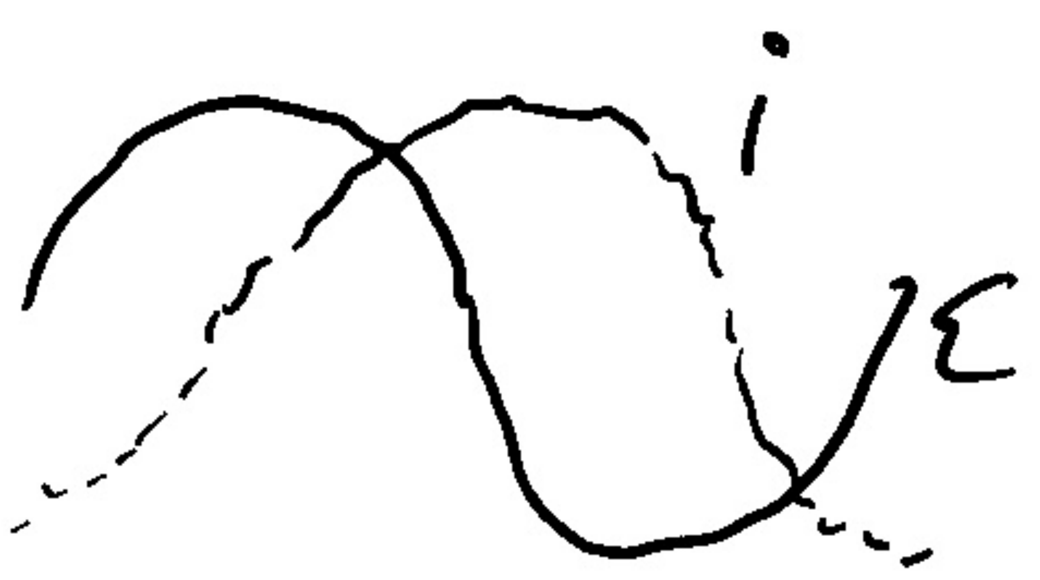
C/L small so falls slowly

MS:



a. $i_{max} = I = \mathcal{E}_m / X_L = \mathcal{E}_m / \omega_d L$

b. $\mathcal{E}$ when $i = i_{max}$ $= 0$



$\mathcal{E}$ leads i
for inductor

c. $i = -\mathcal{E}_m / X_L \cos(\omega_d t)$
$= \mathcal{E}_m / X_L \sin(\omega_d t - \pi/2)$

solve $\mathcal{E} = \mathcal{E}_m \sin(\omega_d t)$
for t and plug in