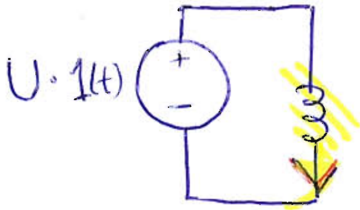
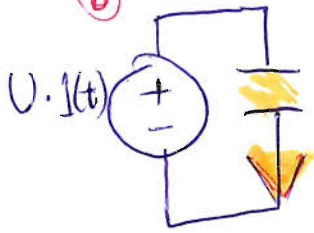
Identify any current or voltage (anywhere in a circuit) that is either changing forever (no equilibrium) or has an impulse (very big pulse, "delta")

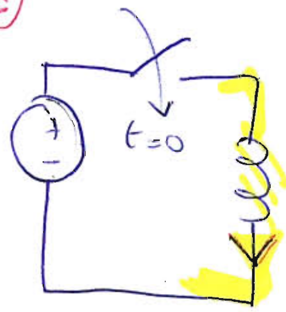
(a)

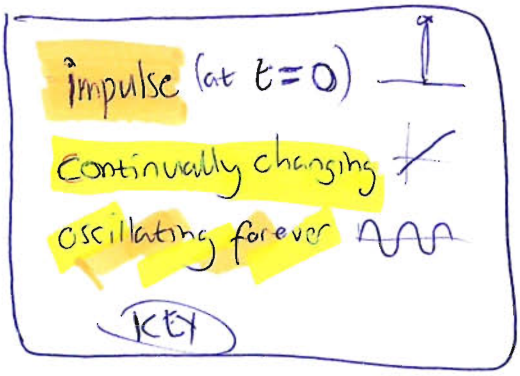



(b)

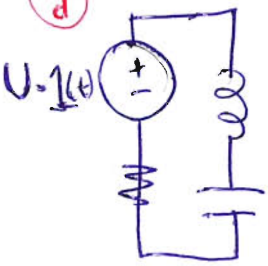



(c)

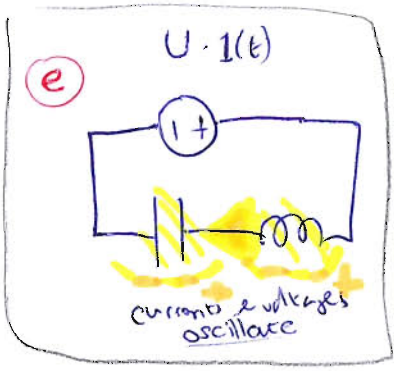


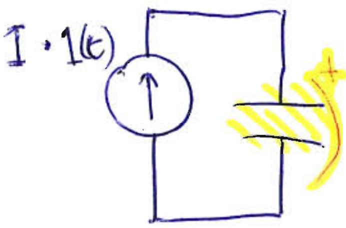

(d)



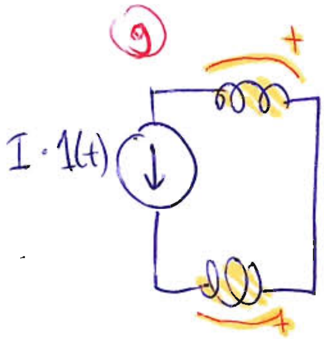

(e)



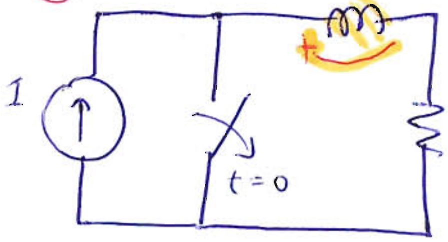

(f)



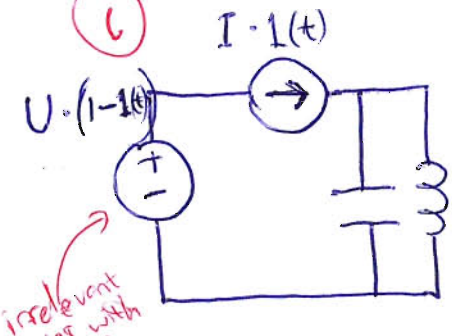

(g)



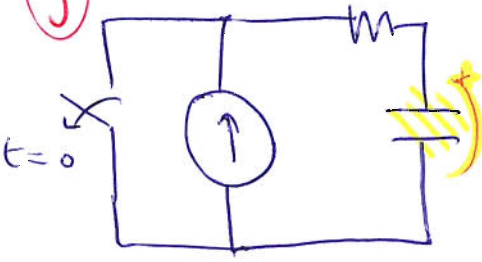

(h)



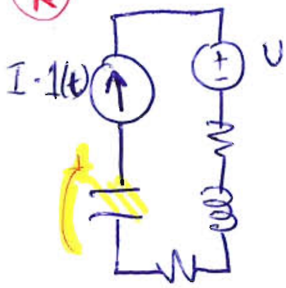

(i)



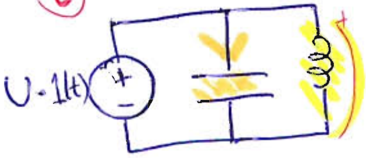

(j)



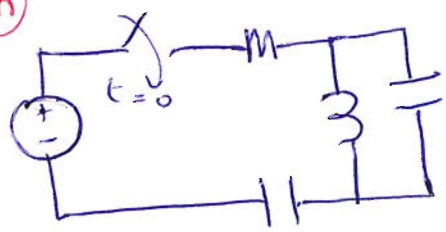

(k)



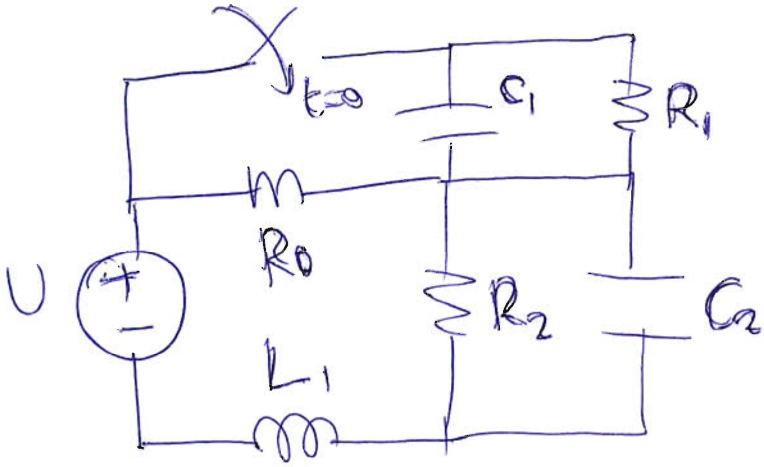

(l)




(m)




It's just an exercise in thinking about integration, differentiation, and basic circuits (switch, step, LC)

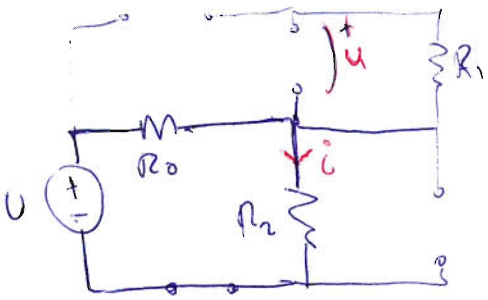



find the power in $R_2$ / charge on $C_1$ at times $t=0^-$ / $t=\infty$

REDRAW!

---

$t=0^-$

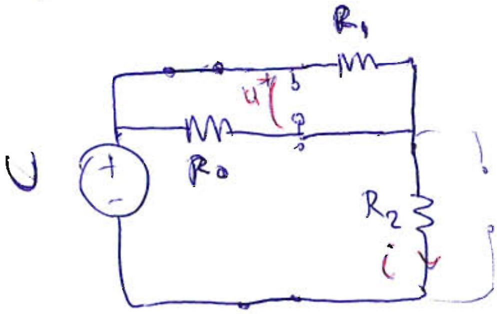



$$i = \frac{U}{R_0+R_2} \Rightarrow \boxed{P_{R_2} = i^2 R_2 = \frac{U^2 R_2}{(R_0+R_2)^2}}$$

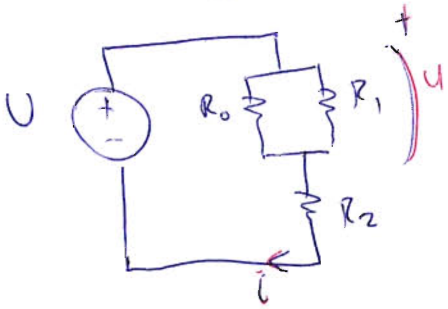
$$u = 0 \Rightarrow \boxed{Q_{C1} = u C_1 = 0}$$

---

$t \to \infty$




⇓

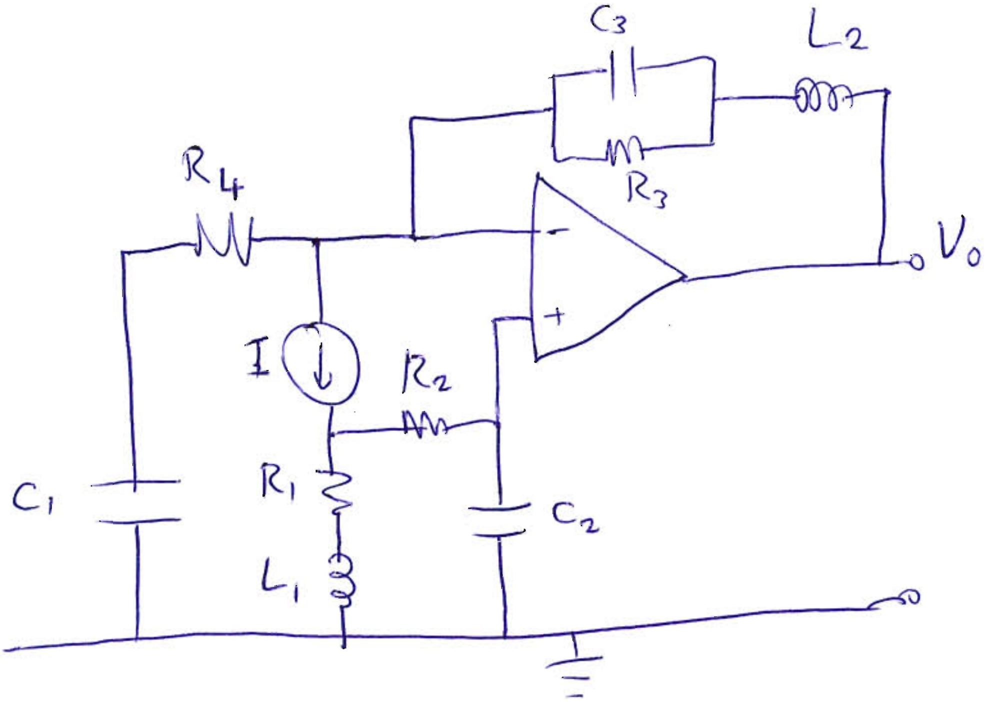



$$i = \frac{U}{R_2 + \frac{R_0 R_1}{R_0+R_1}} = \frac{U(R_0+R_1)}{R_0R_1 + R_0R_2 + R_1R_2}$$

$$\boxed{P_{R2} = i^2 R_2 = \frac{U^2 R_2 (R_0+R_1)^2}{(R_0R_1 + R_0R_2 + R_1R_2)^2}}$$

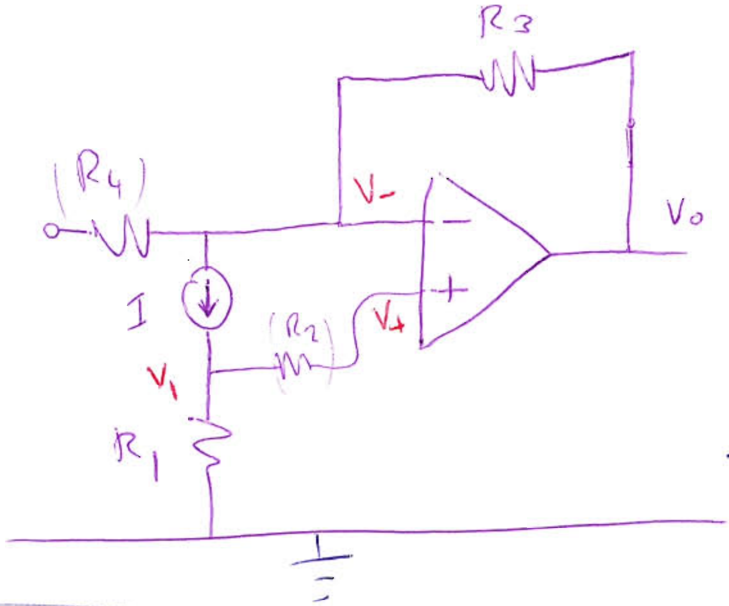
$$u = \frac{R_0R_1}{R_0+R_1} \cdot i = \frac{U}{1 + \frac{R_2(R_0+R_1)}{R_0R_1}}$$

$$\boxed{Q_{C1} = u C_1 = \frac{U C_1 R_0 R_1}{R_0R_1 + R_0R_2 + R_1R_2}}$$




find the equilibrium value of $V_0$

RE-DRAW




$V_1 = IR_1$ (ohm's law)

$V_+ = V_1$ (no current in $R_2$, so no voltage)

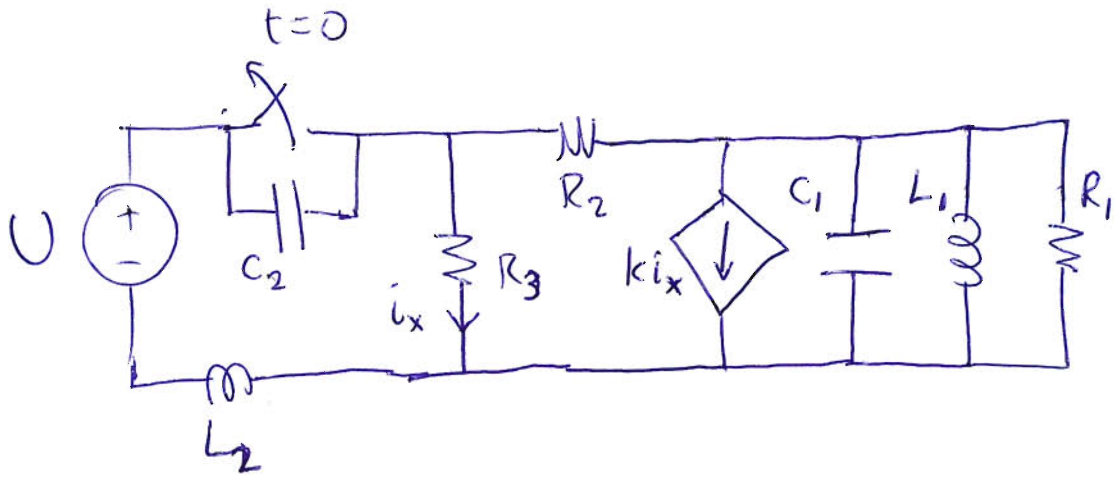
$V_- = V_+$ (opamp neg. fb.)

$$\frac{V_- - V_0}{R_3} + I = 0 \quad \text{(KCL)}$$

$$V_0 = V_- + IR_3$$

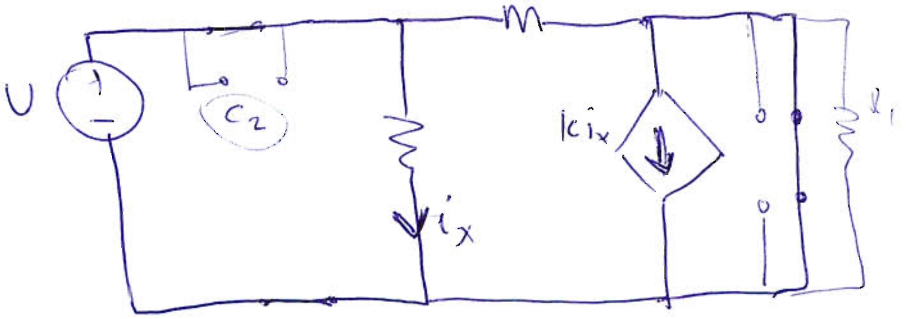
$$\boxed{V_0 = I(R_1 + R_3)}$$

Danger! The zero voltage across the current source is because of the opamp! In general, a current source can have nonzero voltage.

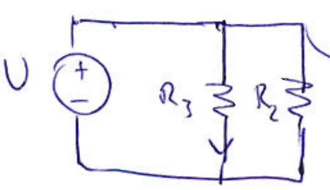



find at $\left\{ \begin{array}{l} t = 0^- \\ \text{and} \\ t \to \infty \end{array} \right.$ the $\left\{ \begin{array}{l} \text{value of } i_x \\ \text{energy in } C_2 \end{array} \right.$

$t = 0^-$ redraw (with switch closed, and C, L replaced by open/short)




$\Downarrow$



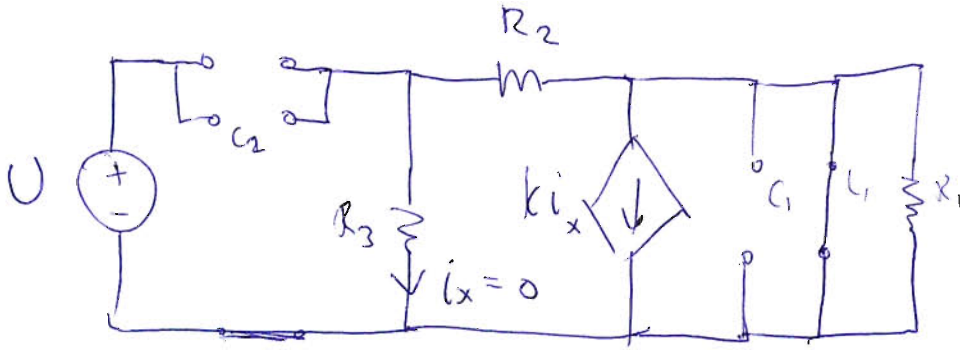

$i_x = \dfrac{U}{R_3}$ from parallel connection to voltage source U.

and energy in $C_2$ is zero

from short circuit by switch: $\frac{1}{2}U^2C = \frac{1}{2}0^2C = 0$

(cont.d.)

$t \to \infty$




This has two separate parts. The part on the right (everything ~~except~~ U, $C_2$) has no independent source, (as it only connects to U by one node).
So we assume nothing happens at the right: all voltages and currents are zero, as there is no independent source to stimulate the controlling variable of the dependent source (this is a general principle about independent and dependent sources).
(Alternatively we can take KVL around the loop of $L_1$ $R_2$ $R_3$ to prove $u_{R_3} = 0$).

So a voltage U exists across the capacitor $C_2$.
Its stored energy is $\frac{1}{2} C_2 U^2$.

And $i_x = 0$