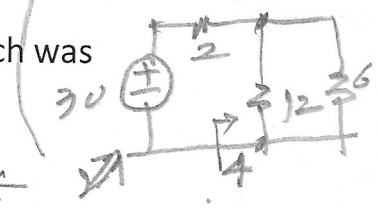
Solution

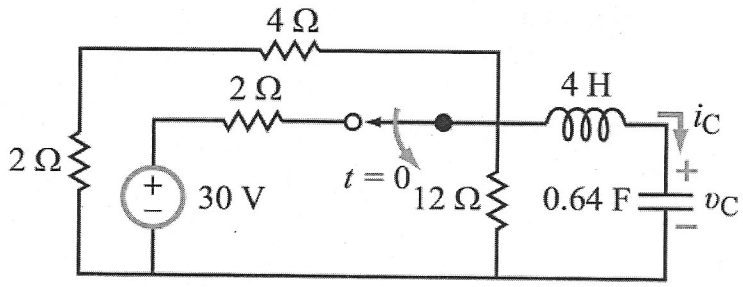
ECE101F19 Quiz 8, Nov. 21, 2019

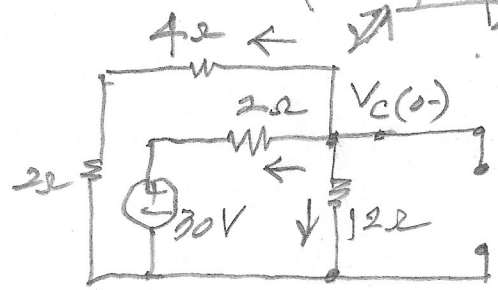
Name_____ Student ID_____

$v_C(0^-) = 30 \times \frac{4}{2+4} = \boxed{20\,V}$



For the RLC circuit below, let us consider v_C(t) for t > 0 after the switch was opened at t=0.





$$\frac{V_C(0)}{6} + \frac{V_C(0)-30}{2} + \frac{V_C(0)}{12} = 0$$

$$\times 12 \Rightarrow 2V_C(0) + 6V_C(0) - 180 + V_C(0) = 0$$

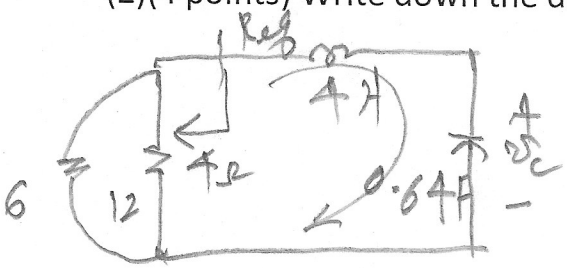
$$9V_C(0) = 180$$

$$\boxed{v_C(0) = 20}$$

(1)(2 points) Find the current v_C(0-) .

$v_C(0^-) = 20\,[V]$

(2)(4 points) Write down the differential equation for v_C(t) for t > 0.



$$4\frac{d}{dt}\left[0.64\frac{dv_C}{dt}\right] + v_C + 4\left(0.64\frac{dv_C}{dt}\right) = 0$$

$$\frac{d^2 v_C}{dt^2} + \left(\frac{4\times 0.64}{4\times 0.64}\right)\frac{dv_C}{dt} + \frac{1}{4\times 0.64}v_C = 0$$

$$\frac{d^2 v_C}{dt^2} + \frac{dv_C}{dt} + \frac{1}{2.56} = 0$$

(3)(2 points) Is the differential equation in (2) overdamped, critically damped, or underdamped?

$\alpha = \frac{1}{2}$ $\quad \omega_0 = \frac{1}{\sqrt{2.56}} = \frac{1}{2\times 0.8} = \frac{1}{1.6}$

$\alpha < \omega_0$, underdamped

(4)(2 points) Find $v_C(\infty)$ by inspection of the circuit for t > 0.

$v_C(\infty) = 0$