

Quiz 8 Solution

Electrical Circuits 1

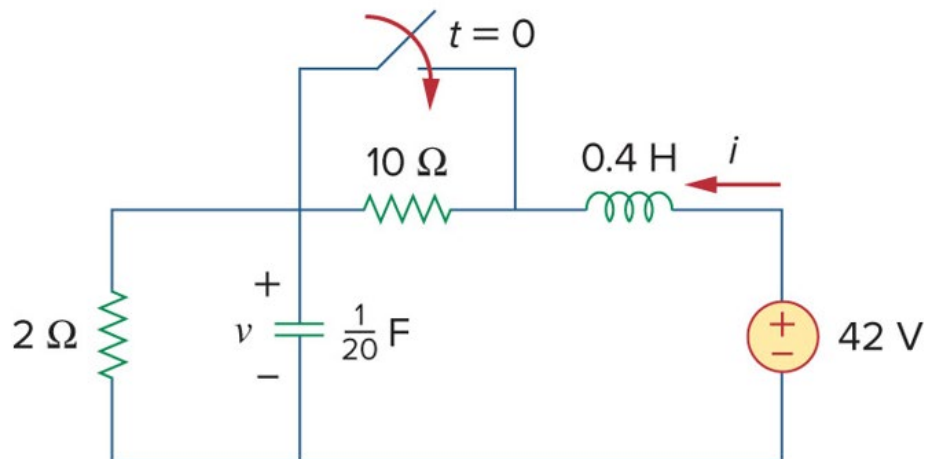
TE1002

Tecnológico de Monterrey

Dr. Juan-Manuel CAMPOS-SANDOVAL

Name _____

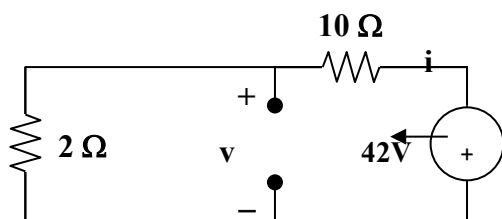
Find $i(0^+)$, $v(0^+)$, $di(0^+)/dt$ and $dv(0^+)/dt$.



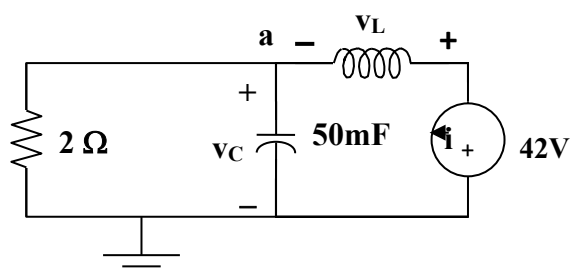
Answer: (a) 3.5 A, 7 V, (b) 87.5 A/s, 0 V/s, (c) 21 A, 42 V.

Solution

(a) At $t = 0^-$, we have the equivalent circuit shown in Figure (a).



(a)



(b)

$$i(0^-) = 42/(2 + 10) = \mathbf{3.5\ A}, \quad v(0^-) = 2i(0^-) = 7\ \text{V}$$

$$\text{hence, } v(0^+) = v(0^-) = \mathbf{7\ V}.$$

(b) At $t = 0^+$, the switch is closed.

$$L(di/dt) = v_L, \text{ leads to } (di/dt) = v_L/L$$

$$\text{But, } v_C(0^+) + v_L(0^+) = 42 = 7 + v_L(0^+), \text{ or } v_L(0^+) = 35\ \text{V}$$

$$(di(0^+)/dt) = 35/0.4 = \mathbf{87.5\ A/s}$$

$$C(dv/dt) = i_C \text{ leading to } (dv/dt) = i_C/C$$

$$\text{But at node a, KCL gives } i(0^+) = i_C(0^+) + v(0^+)/2 = 3.5 = i_C(0^+) + 7/2$$

$$\text{or } i_C(0^+) = 0, \text{ hence } (dv(0^+)/dt) = \mathbf{0\ V/s}$$

(c) As t approaches infinity, the capacitor is replaced by an open circuit and the inductor is replaced by a short circuit.

$$v(\infty) = \mathbf{42\ V}, \text{ and } i(\infty) = \mathbf{21\ A}.$$