Princess Sumaya University for Technology
جامعة الأميرة سمية للتكنولوجيا

King Abdullah II School of Engineering

EE21221
Electric Circuits (1)
Section #1

Quiz #5
Thursday 6/1/2022

Name: ……

Q.1) The switch in the circuit shown in Figure Q.1 has been closed for a long time, and it is opened at t=0. Find v(t) for t≥0. [4-Points]

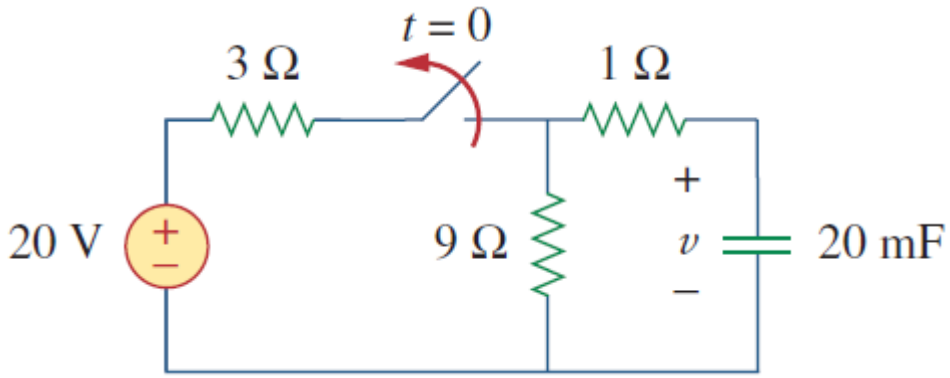


Figure Q.1

Solution:

$t < 0,$

$$v_C(t) = \frac{9}{9+3}(20) = 15 \text{ V}, \qquad t < 0$$

$$v_C(0) = V_0 = 15 \text{ V}$$

For $t > 0,$

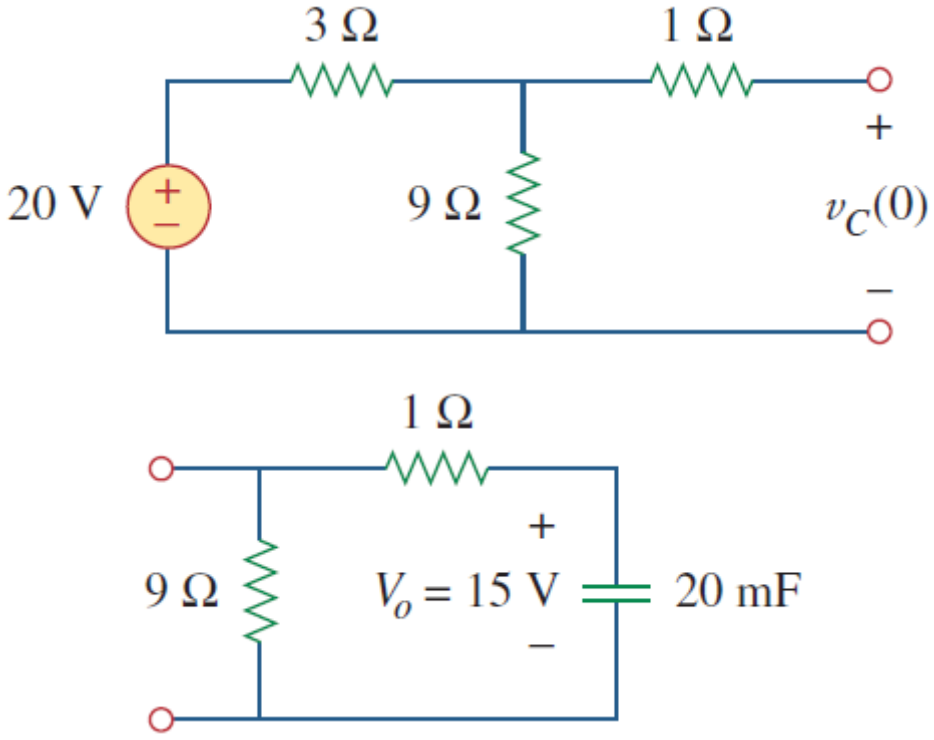
$$R_{eq} = 1 + 9 = 10\ \Omega$$

$$\tau = R_{eq}C = 10 \times 20 \times 10^{-3} = 0.2 \text{ s}$$

$$v(t) = v_C(0)e^{-t/\tau} = 15e^{-t/0.2}\ \text{V}$$

$$v(t) = 15e^{-5t}\ \text{V}$$

$$w_C(0) = \frac{1}{2}Cv_C^2(0) = \frac{1}{2} \times 20 \times 10^{-3} \times 15^2 = 2.25\ \text{J}$$



Q.2) Find i(t) in the circuit of Figure Q.2 for t>0. Assume that the switch has been closed for a long time. [6-Points]

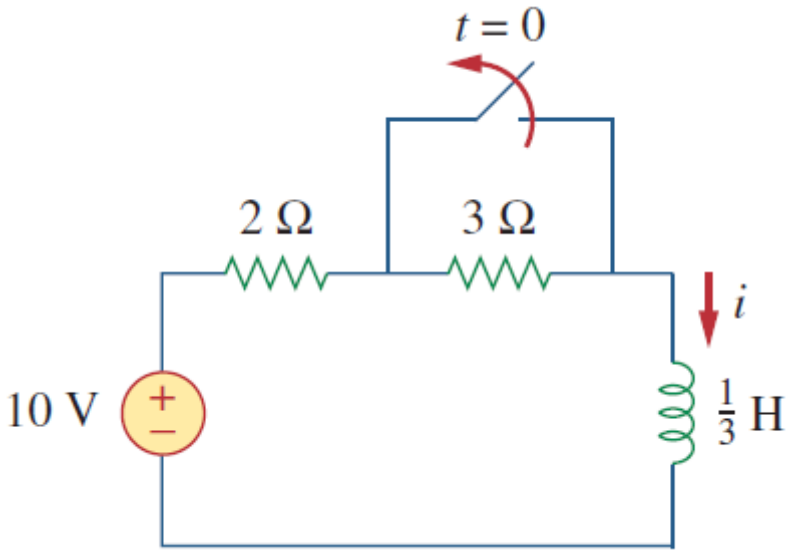


Figure Q.2

Solution:

When $t < 0$,

$$i(0^-) = \frac{10}{2} = 5 \text{ A}$$

$$i(0) = i(0^+) = i(0^-) = 5 \text{ A}$$

When $t > 0$,

$$i(\infty) = \frac{10}{2 + 3} = 2 \text{ A}$$

$$R_{\text{Th}} = 2 + 3 = 5 \ \Omega$$

$$\tau = \frac{L}{R_{\text{Th}}} = \frac{\frac{1}{3}}{5} = \frac{1}{15} \text{ s}$$

$$i(t) = i(\infty) + [i(0) - i(\infty)]e^{-t/\tau}$$

$$= 2 + (5 - 2)e^{-15t} = 2 + 3e^{-15t} \text{ A}, \qquad t > 0$$