Problem 1

$$v = \sqrt{\frac{2W}{C}} = \sqrt{\frac{20sin^2360t}{20\times10^{-6}}} = \frac{sin360t}{10^{-3}} = 1000sin360t \text{ V}$$

$$i = C \cdot \frac{dv}{dt} = 20 \times 10^{-6} \times (360 \times 1000cos360t) = 7.2cos360t \text{ A}$$

Problem 2

(a) $i = C \cdot \frac{dv}{dt} = 4 \times 10^{-3} \times (-100Ae^{-100t} - 500Be^{-500t})$

$i(0) = 4 \times 10^{-3} \times (-100A - 500B) = 2 \quad \Rightarrow \quad A + 5B = -5$

when t=0, $\quad 15 = A \cdot 1 + B \cdot 1 \quad \Rightarrow \quad A + B = 15$

$$\begin{cases} A + 5B = -5 \\ A + B = 15 \end{cases} \Rightarrow \begin{cases} A = 20 \\ B = -5 \end{cases}$$

(b) $w = \frac{1}{2}CV^2 = 0.5 \times 4 \times 10^{-3} \times 225 \text{ J} = 0.45 \text{ J}$

(c) $i = C \cdot \frac{dv}{dt} = 4 \times 10^{-3} \times (-100 \times 20e^{-100t} + 500 \times 5e^{-500t})$

$= -8e^{-100t} + 10e^{-500t} \text{ A}$

Problem 3

$v(t) = v(t_0) + \frac{1}{C}\int_{t_0}^{t} i\, dt.$

$$v(2) = v(0) + \frac{1}{0.5}\int_0^2 6(1 - e^{-2t})\, dt = 0 + 2\int_0^2 6 - 6e^{-2t}\, dt$$

$$= 2(6t + 3e^{-2t})\Big|_0^2 = 18 + 6e^{-4} = 18.1099\ V$$

$P = VI = 18.1099 \times 6 \times (1 - e^{-4})W = 106.6692W$

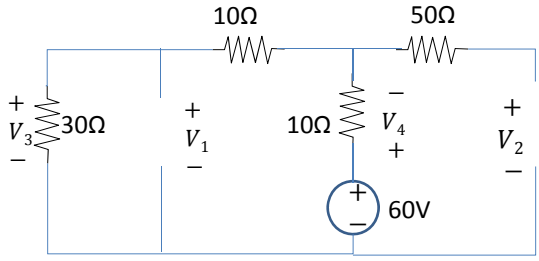
Problem 4

$$v_3 = 60 \times \frac{30}{30 + 10 + 10} V = 36V$$

$$v_4 = 60 \times \frac{10}{30 + 10 + 10} V = 12V$$

$v_1 = v_3 = 36V$

$v_2 = 60 - v_4 = 48V$



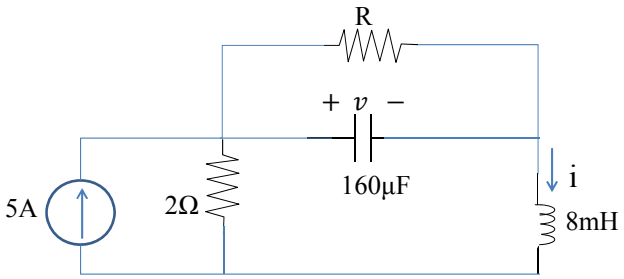
Problem 5

$$V = L \cdot \frac{di}{dt} = 12 \times 10^{-3} \times 800cos200t = 9.6cos200t\ V$$
$$W = \frac{1}{2}Li^2 = 0.5 \times 12 \times 10^{-3} \times (4\sin\left(200 \times \frac{\pi}{200}\right))^2 = 0.006 \times 0 = 0J$$

Problem 6

$$i(t) = i(t_0) + \frac{1}{L}\int_{t_0}^{t} v\ dt$$
$$= 1 + \frac{1}{0.2}\int_0^t 6t^2 + 2t + 3\ dt = 1 + 5(2t^3 + t^2 + 3t)\Big|_0^t$$
$$= 10t^3 + 5t^2 + 15t + 1\ \text{A}$$

Problem 7

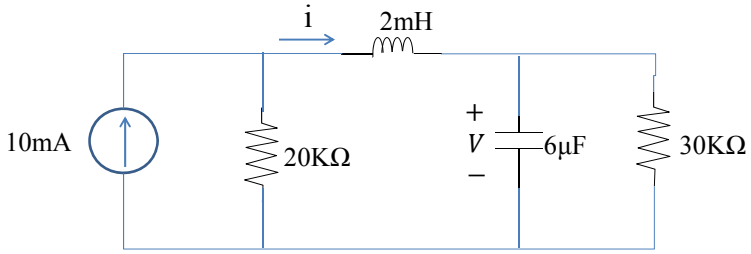


$W_L = 0.5Li^2$ $\quad W_C = 0.5Cv^2$

$W_L = W_C \quad \Rightarrow \quad 0.5Li^2 = 0.5Cv^2 \quad \Rightarrow \quad \frac{v}{i} = \sqrt{\frac{L}{C}}$

$$R = \frac{v}{i} = \sqrt{\frac{L}{C}} = \sqrt{\frac{8\times10^{-3}}{160\times10^{-6}}} = \sqrt{50}\Omega = 7.071\Omega$$

Problem 8



$i = 10 \times \frac{20}{20+30} mA = 4mA = 4 \times 10^{-3} A.$

$v = iR = 4 \times 10^{-3} \times 30 \times 1000 = 120V$