**P7.3-2**

$$i(t) = C\frac{d}{dt}v(t) = \frac{1}{8}\frac{d}{dt}12\cos(2t+30^\circ) = \frac{1}{8}(12)(-2)\sin(2t+30^\circ) = 3\cos(2t+120^\circ)\ \text{A}$$

**P7.3-4**

$$v(t) = \frac{1}{C}\int_0^t i(\tau)\,d\tau + v(0) = \frac{1}{2\times10^{-12}}\int_0^t i(\tau)\,d\tau - 10^{-3}$$

$0 < t < 2\times10^{-9}$ $\quad i_s(t) = 0 \;\Rightarrow\; v(t) = \frac{1}{2\times10^{-12}}\int_0^t 0\,d\tau - 10^{-3} = -10^{-3}$

$2\times10^{-9} < t < 3\times10^{-9}$ $\quad i_s(t) = 4\times10^{-6}$ A

$$\Rightarrow\; v(t) = \frac{1}{2\times10^{-12}}\int_{2\text{ns}}^t \left(4\times10^{-6}\right)d\tau - 10^{-3} = -5\times10^{-3} + \left(2\times10^{6}\right)t$$

In particular, $v\left(3\times10^{-9}\right) = -5\times10^{-3} + \left(2\times10^{6}\right)\left(3\times10^{-9}\right) = 10^{-3}$

$3\times10^{-9} < t < 5\times10^{-9}$ $\quad i_s(t) = -2\times10^{-6}$ A

$$\Rightarrow\; v(t) = \frac{1}{2\times10^{-12}}\int_{3\text{ns}}^t \left(-2\times10^{-6}\right)d\tau + 10^{-3} = 4\times10^{-3} - \left(10^{6}\right)t$$

In particular, $v\left(5\times10^{-9}\right) = 4\times10^{-3} - \left(10^{6}\right)\left(5\times10^{-9}\right) = -10^{-3}$ V

$5\times10^{-9} < t$ $\quad i_s(t) = 0 \;\Rightarrow\; v(t) = \frac{1}{2\times10^{-12}}\int_{5\text{ns}}^t 0\,d\tau - 10^{-3} = -10^{-3}$ V

**P7.4-2**

$$i_c = C\frac{dv}{dt} = \left(10\times10^{-6}\right)(-5)(-4000)e^{-4000t} = \underline{0.2e^{-4000t}\ \text{A}} \;\Rightarrow\; \begin{cases} \underline{i_c(0) = 0.2\ A} \\ \underline{i_c(10ms) = 8.5\times10^{-19}\ A} \end{cases}$$

$$\mathcal{W}(t) = \frac{1}{2}Cv^2(t) \quad \text{and} \quad v(0) = 5 - 5e^{0} = 0 \;\Rightarrow\; \underline{\mathcal{W}(0) = 0}$$

$$v\left(10\times10^{-3}\right) = 5 - 5e^{-40} = 5 - 21.2\times10^{-18} \cong 5 \;\Rightarrow\; \underline{\mathcal{W}(10) = 1.25\times10^{-4}\ \text{J}}$$

**P7.5-1**

$2\mu\text{F} \,\|\, 4\mu\text{F} = 6\mu\text{F}$

$6\mu$F in series with $3\mu\text{F} = \frac{6\mu\text{F}\cdot3\mu\text{F}}{6\mu\text{F}+3\mu\text{F}} = 2\mu\text{F}$

$$i(t) = 2\ \mu\text{F}\,\frac{d}{dt}(6\cos100t) = (2\times10^{-6})\ (6)\ (100)\ (-\sin100t)\ \text{A} = \underline{-1.2\ \sin100t\ \text{mA}}$$

**P7.5-3**

$$C \text{ in series with } C = \frac{C \cdot C}{C+C} = \frac{C}{2}$$

$$C \parallel C \parallel \frac{C}{2} = \frac{5}{2}C$$

$$C \text{ in series with } \frac{5}{2}C = \frac{C \cdot \frac{5}{2}C}{C + \frac{5}{2}C} = \frac{5}{7}C$$

$$(25\times10^{-3})\cos 250t = \left(\frac{5}{7}C\right)\frac{d}{dt}(14\sin 250t) = \left(\frac{5}{7}C\right)(14)(250)\cos 250t$$

$$\text{so } 25\times10^{-3} = 2500\,C \Rightarrow C = 10\times10^{-6} = 10\ \mu\text{F}$$

**P7.6-4**

$$v(t) = (250\times10^{-3})\frac{d}{dt}(120\times10^{-3})\sin(500t-30^\circ) = (0.25)(0.12)(500)\cos(500t-30^\circ)$$

$$= 15\cos(500t-30^\circ)$$

**P7.6-5**

$$i_L(t) = \frac{1}{5\times10^{-3}}\int_0^t v_s(\tau)\,d\tau - 2\times10^{-6}$$

for $0 < t < 1\ \mu\text{s}$ $\quad v_s(t) = 4$ mV

$$i_L(t) = \frac{1}{5\times10^{-3}}\int_0^t 4\times10^{-3}\,d\tau - 2\times10^{-6} = \left(\frac{4\times10^{-3}}{5\times10^{-3}}\right)t - 2\times10^{-6} = 0.8 - 2\times10^{-6}\ \text{A}$$

$$i_L(1\mu\text{s}) = \left(\frac{4\times10^{-3}}{5\times10^{-3}}\left(1\times10^{-6}\right)\right) - 2\times10^{-6} = -\frac{6}{5}\times10^{-6}\ \text{A} = -1.2\ \text{A}$$

for $1\mu s < t < 3\ \mu\text{s}$ $\quad v_s(t) = -1$ mV

$$i_L(t) = \frac{1}{5\times10^{-3}}\int_{1\mu s}^t\left(-1\times10^{-3}\right)d\tau - \frac{6}{5}\times10^{-6} = -\frac{1\times10^{-3}}{5\times10^{-3}}(t-1\times10^{-6}) - \frac{6}{5}\times10^{-6} = \left(-0.2t - 10^{-6}\right)\ \text{A}$$

$$i_L(3\mu s) = \left(-\frac{1\times10^{-3}}{5\times10^{-3}} + 3\times10^{-6}\right) - 1\times10^{-6} = -1.6\ \mu\text{A}$$

for $3\mu s < t$ $\quad v_s(t) = 0$ so $i_L(t)$ remains $-1.6\ \mu\text{A}$

**P7.7-2**

$$p(t)=v(t)\,i(t)=\left[5\frac{d}{dt}(4\sin 2t)\right](4\sin 2t)$$
$$=\ 5\ (8\cos 2t)\ (4\sin 2t)$$
$$=80\ [2\cos 2t\ \ \sin 2t]$$
$$=80\ [\sin(2t+2t)\ +\ \sin(2t-2t)]=80\ \ \sin 4t\ \text{W}$$

$$\mathcal{W}(t)=\int_0^t p(\tau)\,d\tau\ =80\int_0^t \sin 4\tau\ d\tau=-\ \frac{80}{4}\ [\cos 4\tau\,|_0^t]=20\ (1-\cos 4t)$$

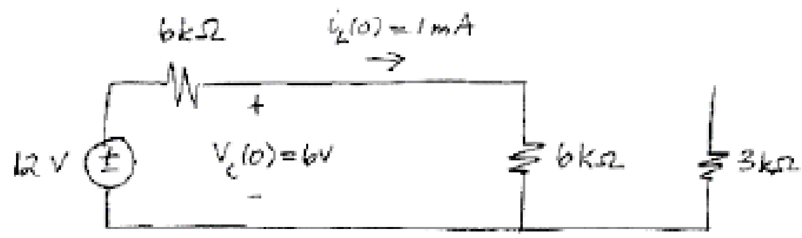
**P7.8-2**

$$4\text{ mH}+4\text{ mH}=8\text{ mH}\quad,\quad 8\text{mH}\,\|\,8\text{mH}=\frac{\left(8\times10^{-3}\right)\times\left(8\times10^{-3}\right)}{8\times10^{-3}+8\times10^{-3}}\ =\ 4\text{ mH}$$

and $\quad 4\text{ mH}+4\text{ mH}=8\text{ mH}$

$$v(t)\ =\ (8\times10^{-3})\ \frac{d}{dt}\ (5+3e^{-250t})=\ (8\times10^{-3})(0+3(-250)\,e^{-250t})\ =-6\,e^{-250t}\ \text{ V}$$

**P7.9-2**




Then

$$i_L\left(0^+\right)=i_L\left(0^-\right)=1\text{ mA}\quad\text{and}\quad v_C\left(0^+\right)=v_C\left(0^-\right)=6\text{ V}$$

Next