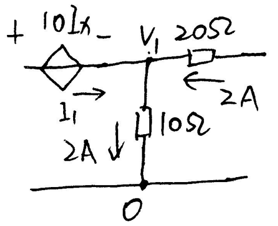
参考答案

1. 只看V: $u_{ab(V)} = \frac{3\|(2+1)}{1+3\|(2+1)}\cdot\frac{1}{2+1}V=\frac{1}{5}V=\sin t$

只I: $u_{ab(I)} = \frac{1}{1+\frac{1}{3}+\frac{1}{2+1}}\cdot I\cdot\frac{1}{2+1}=\frac{1}{5}I=\frac{1}{5}e^{-t}$

∴ $u_{ab}=\sin t+\frac{1}{5}e^{-t}$

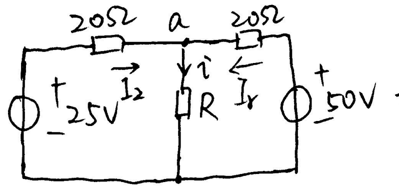
2. $\begin{cases} 50-10I_x=V_1 \\ \frac{V_1-(10I_x+30)}{20}+5=I_x \end{cases} \Rightarrow \begin{cases} I_x=3A \\ V_1=20V \end{cases}$



$I_1=0$

∴ $P=0$

3.



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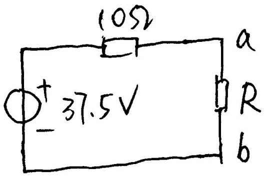

∴ $R=10\Omega$时 P最大. $\frac{1}{4}\times 37.5^2/R = 75^2/160 \approx 35.16(W)$

$i=3.75/2 A$. $u_{ab}=\frac{75}{4}V$. ∴右边50V上电流$I_r=\frac{50-u_{ab}}{20}=\frac{25}{16}A$. $P_r=\frac{1250}{16}W$

$=\frac{15}{8}A$.

$I_2=i-I_r=\frac{5}{16}A$ ∴左边50V上电流$I_l=\frac{50-(u_{ab}+10I_2)}{20}=\frac{45}{32}A$. $P_l=\cancel{\frac{2250}{32}}\ \frac{1125}{16}W$

$P_{总}=\frac{2375}{16}W=148.4375W$

4. R_3上的电流 $I_3=\frac{R_2\|R_3}{R_1+R_2\|R_3}\cdot\frac{1}{R_3}u_s=\frac{R_2}{R_1(R_2+R_3)+R_2R_3}u_s$

$u_o=-I_3R_4$ ∴ $\frac{u_o}{u_s}=-\frac{R_2R_4}{R_1R_2+R_2R_3+R_1R_3}$

5、左边 $u_1(t)$. 右边 $u_2(t)$，则 $u(t)=u_1(t)-u_2(t)$

$$\begin{cases}\left[\frac{1}{2}u_1(t)+0.5\frac{du_1(t)}{dt}\right]\cdot 1+u_1(t)=3\\ u_2(t)=1\cdot\frac{di_L(t)}{dt}\\ 3[9-i_L(t)]=6i_L(t)+u_2(t)\end{cases} \Rightarrow \begin{cases}\frac{du_1(t)}{dt}+3u_1(t)=6\\ \frac{di_L(t)}{dt}+9i_L(t)=27\end{cases}$$

$u_1(0_-)=0$. $i_L(0_-)=\frac{3}{1}+\frac{3}{6+3}\times 9=6A$ $\therefore u_1(0_+)=0$, $i_L(0_+)=6A$

$$\begin{cases}u_1(t)=C_1e^{-3t}+2\\ i_L(t)=C_2e^{-9t}+3\end{cases} \Rightarrow \begin{cases}C_1=-2\\ C_2=3\end{cases}$$

$u_2(t)=\frac{di_L(t)}{dt}=-27e^{-9t}$, $u_1(t)=-2e^{-3t}+2$

$\therefore u(t)=27e^{-9t}-2e^{-3t}+2$, $t>0$

6、$i_1=\frac{u_i}{R_1}=i_2$，~~$u_c=-i_2$~~

$$\begin{cases}-\frac{u_o}{R_2}+C\frac{du_c}{dt}=i_2\\ u_c=-u_o\end{cases} \Rightarrow -R_1C\frac{du_o}{dt}-\frac{R_1}{R_2}u_o=u_i$$

(1) $h(t)=C_1e^{-t/R_2C_1}$，设 $u_o'(t)=a\delta(t)+b\Delta u(t) \Rightarrow a=-\frac{1}{R_1C} \Rightarrow u_o(0_+)=-\frac{1}{R_1C}$

$\therefore h(t)=-\frac{1}{R_1C}e^{-t/R_2C_1}$, $t>0$

(2) $u_o(t)=C_2e^{-t/R_2C_1}-\frac{R_2}{R_1}$，$u_c(0_-)=0$. $u_c(0_+)=0$. $\therefore u_o(0_+)=0 \Rightarrow C_2=\frac{R_2}{R_1}$

$\therefore u_o(t)=\frac{R_2}{R_1}(e^{-t/R_2C_1}-1)$, $t>0$

7. $i_s=L\frac{di}{dt}/0.5+i \Rightarrow \frac{di}{dt}+i=i_s$. $h(t)=e^{-t}$, $t>0$

$i(t)=h(t)*i_s(t)=\int_0^t h(t)*i_s'(t)=(1-e^{-t})u(t)-(1-e^{-(t-1)})u(t-1)$

8. $f(n)=y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)$ $\lambda=\frac{1}{2},\frac{1}{4}$. $\therefore h(n)=C_1(\frac{1}{2})^n+C_2(\frac{1}{4})^n$

$y(0)=f(0)=1$, $y(1)=\frac{3}{4}y(0)=\frac{3}{4}$, $\Rightarrow C_1=2$, $C_2=-1$ $\therefore h(n)=(\frac{1}{2})^{n-1}-(\frac{1}{4})^n$, $n\geq 0$

(2) 特解 $Dn(\frac{1}{2})^n \Rightarrow D=2$. $\therefore y(n)=C_3(\frac{1}{2})^n+C_4(\frac{1}{4})^n+2n(\frac{1}{2})^n$

$y(0)=f(0)=1$, $y(1)=f(1)+\frac{3}{4}y(0)=\frac{5}{4} \Rightarrow C_3=0,\ C_4=1 \Rightarrow y(n)=(\frac{1}{4})^n+n(\frac{1}{2})^{n-1},\ n\geq 0$

9. $y_1(t)=y_{zi}(t)+y_{zs}(t)=e^{-t}+\cos\pi t$

$y_2(t)=y_{zi}(t)+2y_{zs}(t)=2\cos\pi t$

$\therefore\ y_{zs}=-e^{-t}+\cos\pi t$.

$y_3(t)=y_{zi}(t)+3y_{zs}(t)=y_2(t)+y_{zs}(t)=-e^{-t}+3\cos\pi t,\ t\geq 0$.

10. (1) $y(n)=x_1(n)*x_2(n)=x_1(n+1)*x_2(n-1)=2^{n+1}u(n)*3^{n-1}u(n)$

$=\sum_{m=0}^{n}2^{m+1}\cdot 3^{n-m-1}=\frac{2}{3}\cdot 3^n\sum_{m=0}^{n}(\frac{2}{3})^m=2\cdot 3^n\cdot[1-(\frac{2}{3})^{n+1}]=2\cdot 3^n-\frac{4}{3}\cdot 2^n,\ n\geq 0$

$=\frac{2}{3}(3^{n+1}-2^{n+1})u(n)$

(2) $y(t)=x_1'(t)*\int_{-\frac{T}{2}}^{t}x_1(t)=[\delta(t+\frac{T}{2})-\delta(t-\frac{T}{2})]*x_2(t)$

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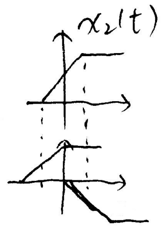

或 $y(t)=\begin{cases}\int_{-\frac{T}{2}}^{t+\frac{T}{2}}dt, & -T\leq t\leq 0\\ \int_{t-\frac{T}{2}}^{\frac{T}{2}}dt, & 0\leq t\leq T\end{cases}=\begin{cases}t+T, & -T\leq t\leq 0\\ T-t, & 0\leq t\leq T\\ 0, & 其它\end{cases}$