1) KCL: current down 150Ω: $i_{150} = +100 - 200 = -100\,mA$

KVL: $v_{ab} = 0.1 \times 150 + 0.2R = 15 + 20 = 35V$ $V_{TH} = V_{ab} = 35V$

2) short-circuit a-b, $i_{sc} = 200 - \frac{150}{R+150} 100 = 140\,mA$, $i_N = i_{sc} = 140mA$

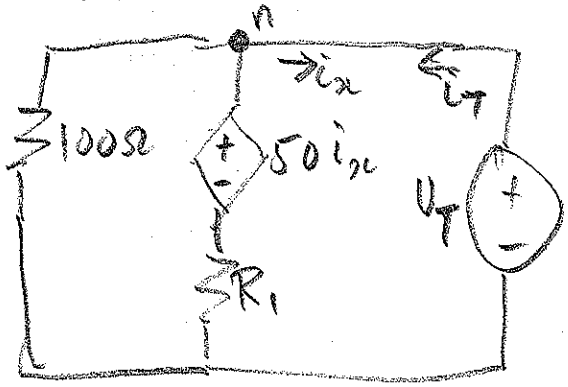
3) Remove redundant resistances of 2Ω, 3Ω, and 40Ω.
Source transformation $V_s/5\Omega \rightarrow 1A/5\Omega$, combine $1A/5\Omega$ and $-1A/20\Omega$ to $0A/4\Omega \Rightarrow 0V/4\Omega$, combine with $-20V \Rightarrow V_{TH} = -20V$

4) From 3) $R_{eq} = 4\Omega$, $R_{TH} = 4\Omega + R_1 = 6\Omega$

5) $-0.01 + \frac{V'_{ab}}{100} + \frac{V'_{ab}}{R_1} = 0 \Rightarrow \frac{V'_{ab}}{50} = 0.01 \Rightarrow V'_{ab} = 0.5 \Rightarrow V'_{TH} = 0.5\,V$

6) require $V''_{ab} = -0.5V$, $\frac{-100}{100+R_1} V_2 = -0.5 \Rightarrow V_2 = 0.5\frac{200}{100} = 1.0V$

7)



KCL at n: $\frac{V_T}{100} + \frac{V_T - 50 i_x}{R_1} - i_T = 0$

$i_x = -i_T \Rightarrow$

$V_T + V_T + 50 i_T - 100 i_T = 0$

$2V_T = 50 i_T \Rightarrow R_{TH} = \frac{V_T}{i_T} = 25\Omega$

8) $V_p = i_s R_3$, $i_2 = \frac{V_n}{R_2} = \frac{i_s R_3}{R_2} = i_s$, $i_1 = 2i_s$, $V_0 = 2i_s R_1 + i_s R_3$

$1 = i_s(10+10) \Rightarrow i_s = 0.05\,mA$

9) $V_1 = -V_s$, $V_2 = -V_s - 2i_s R = -3V_s$, $V_0 = -3V_s - 5i_s R = -8V_s$

$V_s = \frac{-V_0}{8} = 1$, $P_s = V_s^2/R = \frac{1}{500} = 2\,mW$

10) $V_2 = -\frac{R_2}{R_1} V_1 = -0.4V$, $i_4 = \frac{V_2}{R_4} = \frac{-0.4}{10}$, $V_0 = -i_4 R_3 = -\frac{-0.4}{40} \times 50 = 2V$

11) $L_{eq} = ((2L \,//\, L) + L) \,//\, L + 2L = \frac{21}{8} L = \frac{21}{8} H$

$i(t) = \frac{1}{L}\int v(t)\,dt = \frac{8}{21}\int 4\cos 3t\,dt = \frac{32}{63}\sin 3t = 507.9 \sin 3t\,mA$

12) $i_1(t) = C_1 \frac{dv(t)}{dt} = \frac{C_1}{C_1+C_2} \frac{d}{dt}\left[\int i(t)\,dt + i(0)\right] = \frac{C_1}{C_1+C_2} i(t) = te^{-t}$

13) $C_{eq1} = 4+12 = 16\,F$, $C_{eq2} = \frac{1}{2}\times 16F = 8F$, $C_{eq3} = 8+C$,

$C_{eq4} = C+8+12 = 20+C$, $\frac{1}{7.5} = \frac{1}{10} + \frac{1}{20+C} \Rightarrow \frac{2.5}{75} = \frac{1}{20+C} \Rightarrow C = 10\,F$

14) $v_1 = (0.05 - 0.005)\frac{di}{dt}$, $v = (0.05 - 0.005 + 0.01 - 0.005)\frac{di}{dt}$

$v_1/v = \frac{0.045}{0.05} = 0.9$

15) $\tau = \frac{L}{R_{eq}} = \frac{0.2}{\frac{2}{3}R} = \frac{0.3}{50} = 6\ ms$

16) $i_L(0^+) = \frac{100}{100+2R}1.5 = 0.75\,A$, $V(0^+) = -i_L(0^+)R_{eq} =$

$-0.75 \times \frac{2}{3}R = -25\,V$

17) $v_c(0^+) = \frac{R_2}{R_1+R_2+4}\times 24 = 8V$, $v_c(\infty) = 12V$, $\tau = R_{eq}C = (4/4)C =$

$2\,s$, $v_c(t) = 12 - 4e^{-t/2}$, $v_c(0.5) = 12 - 4e^{-1/4} \approx 8.88\,V$

$W_C = \frac{1}{2}CV^2 \approx \frac{1}{2}\,8.88^2 \approx 39.47\,J$.

18) $v_c(0^+) = 0$, $v_c(\infty) = 1\times 2 = 2V$, $\tau = 10^{-6}\times 2\times 10^3 = 2\ ms$

$v_c(t) = 2 - 2e^{-500t}\,V$, $v_{c\,max} = v_c(0.001) = 2 - 2e^{-1/2} \approx$

$0.79\,V$

19) $w_{tot} = \int_0^{1ms} p(t)\,dt = \int_0^{1ms} 10^{-3}\times(2 - 2e^{-500t})\,dt = 2\mu J - 2\times 10^{-3}\int_0^{1ms} e^{-500t}\,dt =$

$2\mu J - \frac{2\times 10^{-3}}{-500}e^{-500t}\Big|_0^{1ms} = 2\mu J + 4\times 10^{-6}\left(e^{-1/2} - 1\right) \approx 0.43\,\mu J$

20) $i(0^+) = \frac{12}{9} = \frac{4}{3}\,A$, $i(\infty) = \frac{2i_a}{3}$, $i_a = \frac{2i_a - 12}{6} = \frac{i_a}{3} - 2 \Rightarrow \frac{2}{3}i_a = 2$

$i_a = -3\,A \Rightarrow i(\infty) = -2A$, find R_{TH}: $i_a = \frac{2i_a}{6} \Rightarrow i_a = 0 \Rightarrow R_{TH} = 3\Omega$

$i(t) = -2 + \left(\frac{4}{3}+2\right)e^{-t/\tau} = -2 + \frac{10}{3}e^{-t3/6}$

$i(0.2) = -2 + \frac{10}{3}e^{-0.1} = 1.016\,A$.