b. Consider 4mF Capacitor at V

↳ Given $v(t) = Ae^{-100t} + Be^{-600t}$ V for $t \geq 0$, $v(0) = 50V$ $i(0) = 20A$

a. Determine A, B, i(t)

i. recall $i(t) = dv/dt = \frac{d}{dt}(Ae^{-100t} + Be^{-600t})$

a. ↳ $-100Ae^{-100t} - 600Be^{-600t}$

↳ recall that $i(t) = C(-100Ae^{-100t} - 600Be^{-600t})$; $C = 4mF$

↳ $(4.10^{-3})(-100Ae^{-100t} - 600Be^{-600t}) = i_c(0)$; $t = 0$

↳ $(4.10^{-3})(-100A - 600B) = i_c(0)$; Given $i_c(0) = 20A$

↳ $4.10^{-3}(-100A - 600B) = 20$

↳ $(-100A - 600B) = 20/4.10^{-3}$

↳ $-100A - 600B = 5000$

↳ $A + 6B = -50$ ✓ 1

ai. Consider $V = 50V$, from derived Equation

recall ↳ $V_c(t) = Ae^{-100t} + Be^{-600t}$

↳ note $V_c(0) = 50 = Ae^{-100(0)} + Be^{-600(0)}$

↳ $50 = A + B$ ✓ 2

aii. from 2, $B = 50 - A$

then $A + 6(50 - A) = -50$

↳ $A + 300 - 6A = -50$

↳ $a = 70$ ✓

from 1, $a = 70$

↳ $70 + 6B = -56$

$6B = 720$

$B = -20$ ✓

b. Determine P and V

given i through 0.5F C

is $i(t) = 6(1 - e^{-t})$ A

Consider Energy $= \frac{1}{2}(V^2(t)$

↳ $v(t) = \frac{1}{C}\int_0^t i(t)\,dt + V(0)$

bi. Thus, $\frac{1}{0.5}\int(6 - 6e^{-t})\,dt + C$

↳ $\frac{1}{.5}(6t + 6e^{-t}) + C = 0$; $V_0 = 0$

$\frac{1}{.5}(0 + 6(1)) + C = 0 \Rightarrow C = -12$

bii. $V_c(2) = 12(1 + e^{-2})$ V

↳ $i(2) = 6(1 - e^{-2})$ A

Consider $P(2) = V(2)\,I(2)$

↳ $6(12)(1 + e^{-2})(1 - e^{-2})$

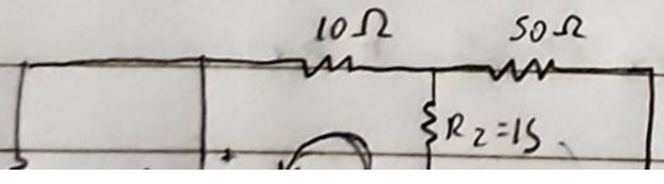
↳ $72(1 - e^{-4})$ ✓

↳ Thus $P = 70.02$ W

Problem No. 2

Given Condition is direct current identify energy stored when C_1 & C_2;

Given $R_1 = 75\Omega$, $R_2 = 15\Omega$, $C_1 = C_2 = 1F$



↳ a = 70 ✓ B = -20 ✓

5(0) + 6(0) + C = 0 ⇒ C = -12

bii. $V_c(2) = 12(1 + e^{-2})$ V

↳ $i(2) = 6(1 - e^{-2})$ A

Consider $P(2) = V(2)\,I(2)$

↳ $6(12)(1 + e^{-2})(1 - e^{-2})$

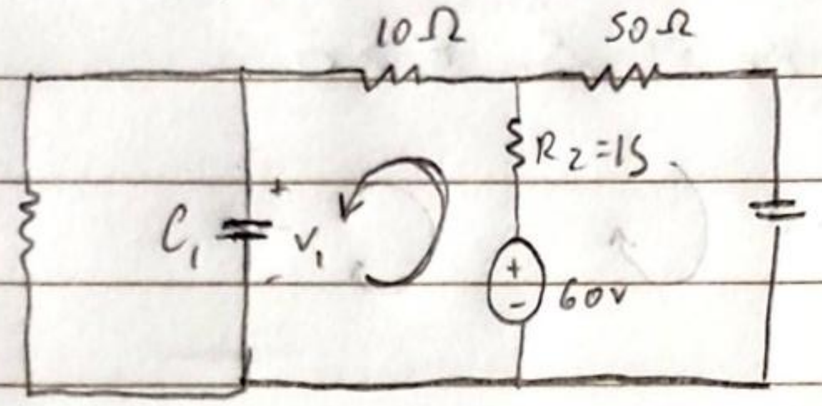
↳ $72(1 - e^{-4})$ ✓

↳ Thus P = 70.92 W

Problem No. 2

Given Condition is direct current identify energy stored when C_1 & C_2;

Given $R_1 = 75\,\Omega$, $R_2 = 15\,\Omega$, $C_1 = C_2 = 1$ F



a. kvl at loop 1

$-60V + 15i_1 + 10i_1 + 75i_1 = 0$

↳ $-60V + 100i_1 = 0$

↳ $-100i_1 = 60V$

↳ $i_1 = \frac{60}{100} = \frac{6}{10}$ A

b. $V_1 = 75(\frac{6}{10}) = 45V$

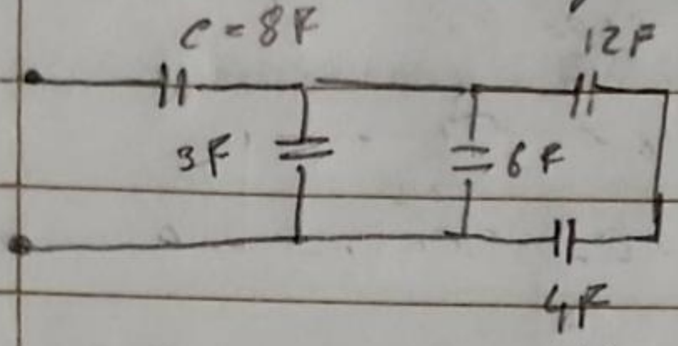
$V_2 = -20(0.6) + 60 = 48V$

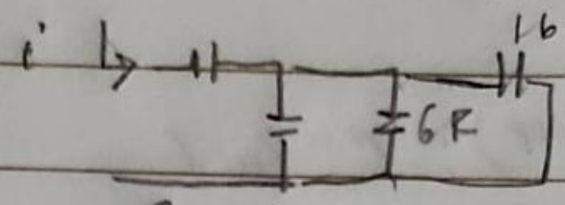
c. Consider Energy $C_1 = \frac{1}{2}V_1^2 C_1 = 0.5(45)^2 = 1012.5$ ✓

$C_2 = \frac{1}{2}V_2^2 C_2 = 0.5(48V)^2 = 1152$ ✓

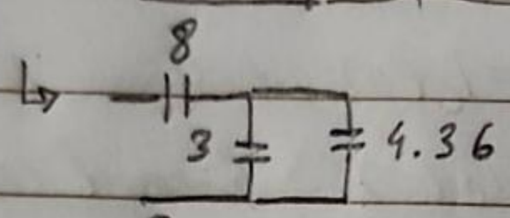
Page

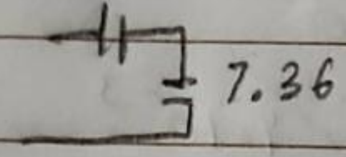
8a. Determine the equivalent Capacitance for Circuit, given C = 8F



i ↳ 

$\frac{16 \cdot 6}{16+6} = {}^{48}/_{11} = 4.36$

ii ↳ 

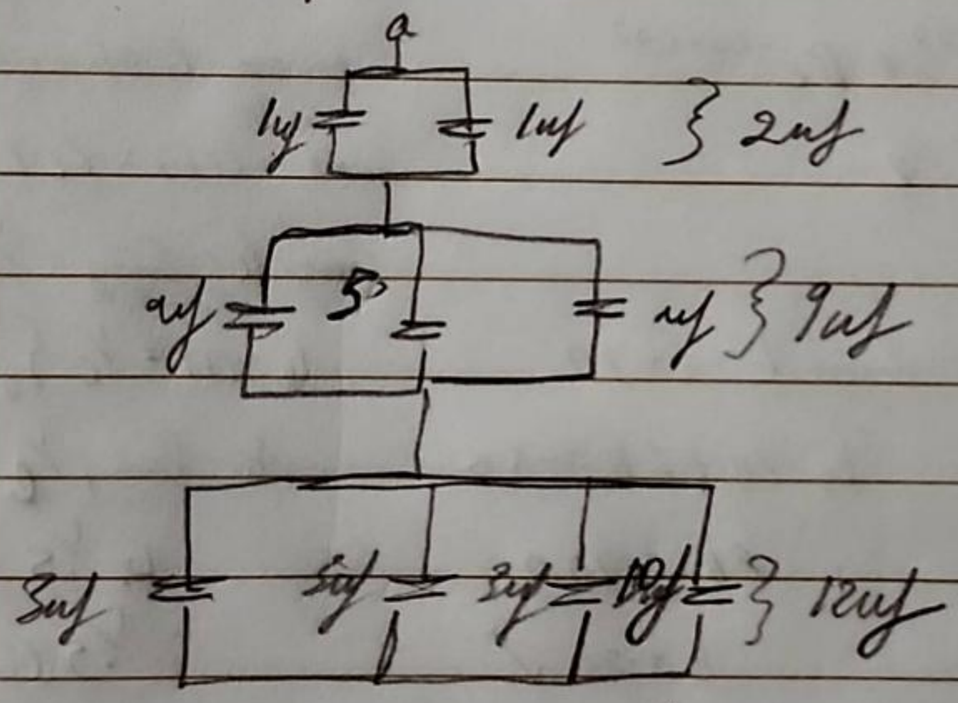
iii ↳ 

$\frac{7.36(8)}{7.36+8} = 3.83.$

Thus, $C_{eq} = 3.83$ ✓

b. Given $p = 5uf$ and $Q = 10uf$

Find Capacitance at terminal a-b of given circuit



i ↳ $\frac{1}{C_{ab}} = \frac{1}{2uf} + \frac{1}{9uf} + \frac{1}{12uf}$

ii ↳ $uf = 1 \cdot 10^{-6}$

↳ $\frac{(1 \cdot 10^{-6})}{0.66374} = 1.506\ uf$ ✓

9. Current through a 99-mH inductor is $i(t) = te^{-2t}$ for $t > 0$

Find inductor voltage.

i ↳ $i_L = te^{-2t}, t > 0, \quad 99 \cdot 10^{-3}$

↳ $(99 \cdot 10^{-3}) \frac{d}{dt}(te^{-2t})$

↳ $(99 \cdot 10^{-3})(t'e^{-2t} + t(e^{-2t})')$

↳ $v(t) = (99 \cdot 10^{-3})(e^{-2t} - 2e^{-2t})$ ✓

4b. Voltage across 200mH has inductor $v(t) = 3t^2 + 2t + 4v$ for $t \geq 0$

a. find current i(t) through inductor - Assuming $i(0) = 1A$

↳ $200mH = 200 \cdot 10^{-3}$, $v_L(t) = 3t^2 + 2t + 4v$ for $t \geq 0$, $i(0) = 1A$

↳ Consider current through inductor: $i(t) = \frac{1}{L}\int_0^t v_L\,dt + i(0)$

↳ $\frac{1}{200 \cdot 10^{-3}} \int_0^t (3t^2 + 2t + 4)\,dt + 1$

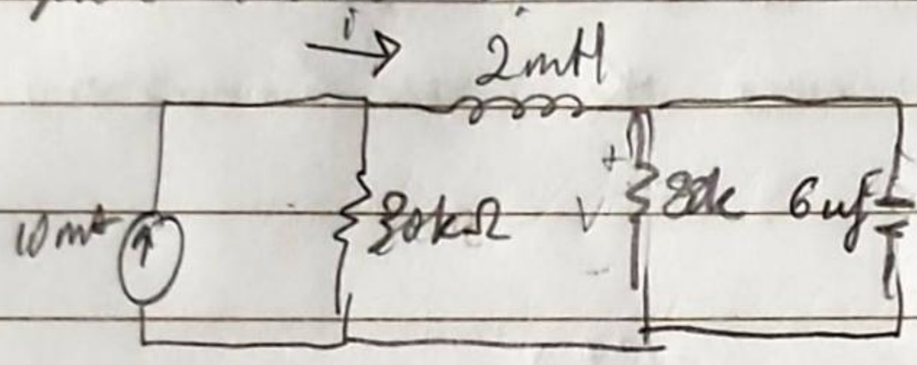
↳ $\frac{1}{200 \cdot 10^{-3}} \left[\frac{3t^3}{3} + \frac{2t^2}{2} + 4t \right]_0^t + 1$

↳ Thus, $5((t^3 + t^2 + 4t) - (0 - 0 - 0)) + 1$

↳ $5(t^3 + t^2 + 4t) + 1$ ✓

5. Consider the Below circuit operating under DC condition and $i = 10mA$

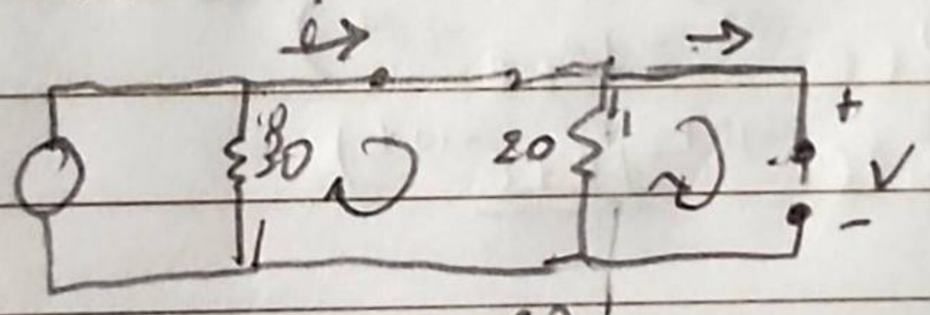
Compute i and v.



a ↳ DC Condition,

Leave open the Capacitor and

short the Inductor



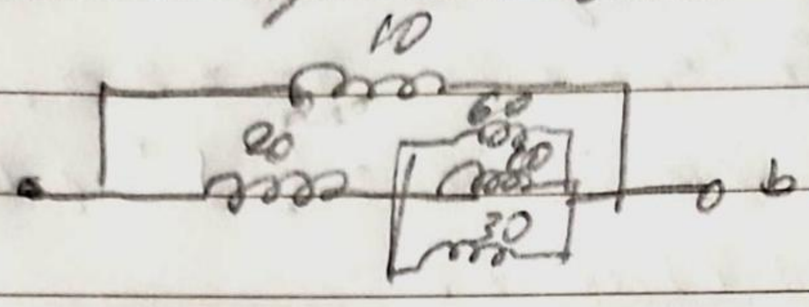
↳ $(10 \cdot 10^{-3}) \frac{30}{30+20} = 0.006 \approx 6mA$ ✓

b. $v = (6 \cdot 10^{-3})(20 \cdot 10^{-3})$;

↳ 120V ✓

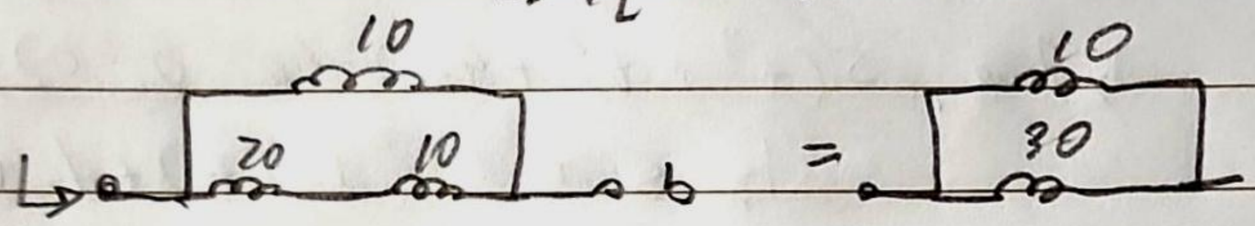
Problem 6

a. Determine Equivalent Inductance Leq ; L = 20mH



↳ $= 1/60 + 1/30 + 1/30 = 6/60 = 1/10$

↳ $1/L' = 10\,mH$



$= \frac{30 \cdot 10}{30+10} = \frac{300}{40} = 7.5V$ ✓

b. Given model series of R = 12Ω and Inductor = 200mH
$i(t) = 2te^{-10t}A \quad t \geq 0s$. Find v(t) across the combination for $t \geq 0s$.

↳ Consider $v(t) = Ri(t) + L\, di(t)/dt$

↳ $12(2te^{-10t}) + (200 \cdot 10^{-3})\, d/dt\,(2te^{-10t})$

↳ $2\int te^{-10t}$

↳ $2(t'e^{-10t} + t(e^{-10t})')$

↳ $2(e^{-10t} + -10te^{-10t})$

↳ $24te^{-10t} + (200 \cdot 10^{-3}) \cdot 2(e^{-10t} - 10te^{-10t})$

↳ $\underline{\underline{24te^{-10t}}} + (.2^2)(e^{-10t} - \underline{\underline{10te^{-10t}}})$

↳ $24te^{-10t} + .4e^{-10t} - 4te^{-10t}$

↳ $\underline{.4e^{-10t} + 20te^{-10t}}$ ✓