test 3 V2 | Ross Fischer | 110

30

1

$v(t) = L\frac{di(t)}{dt} = (300\times10^{-3})(-1000e^{-200t})$

$L = 300\times10^{-3}\ H = .3$

$i(t) = 5e^{-200t}$ A

$\frac{di}{dt} = -1000e^{-200t}$

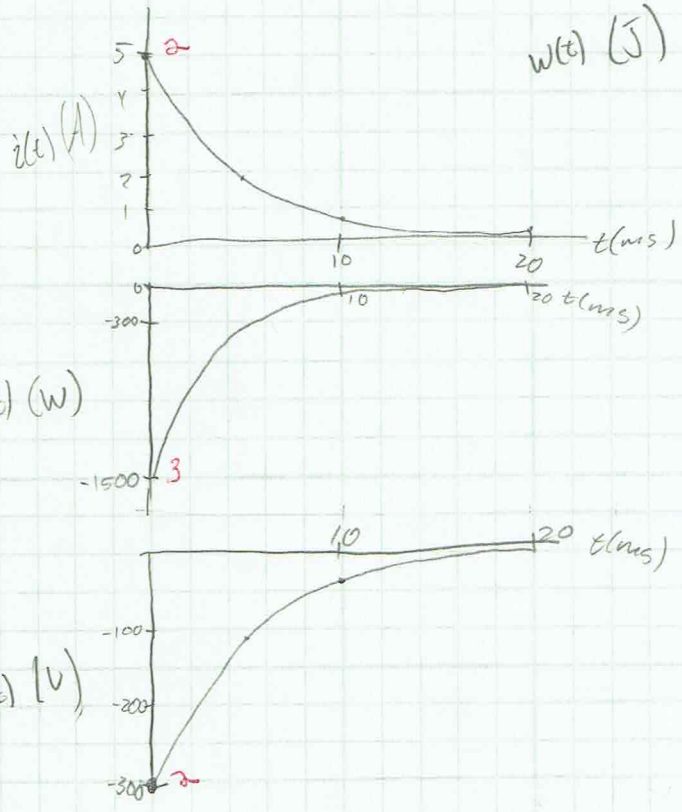
$v(t) = -300e^{-200t}$ V 6

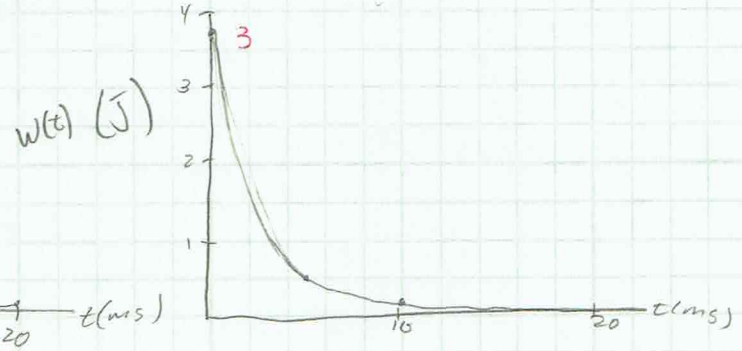
$p(t) = v(t)i(t) = (-300e^{-200t})(5e^{-200t}) = -1500e^{-400t}$

$p(t) = -1500e^{-400t}$ W 7

$w(t) = \frac{1}{2}Li^2 = (\frac{1}{2})(.3)(5e^{-200t})^2 = 3.75e^{-400t}$

$w(t) = 3.75e^{-400t}$ J 7

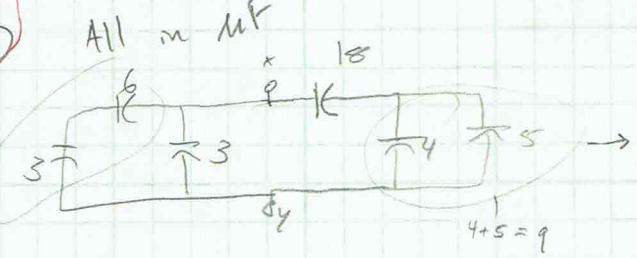


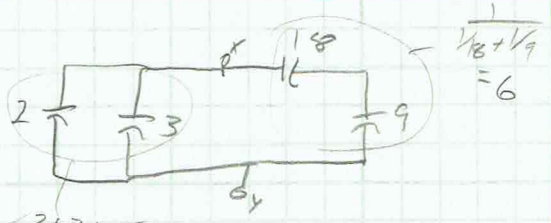


10

(2)

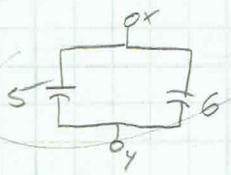
All in μF





$\frac{1}{1/18+1/9} = 6$

$\frac{1}{1/3+1/6} = 2$

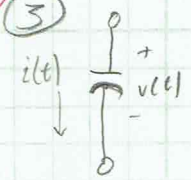


$5+6=11$ → $C_{xy} = 11\,\mu F$

20

(3)

$C = 20\times10^{-6}$ F



$v(t) = 10 - 10e^{-2000t}$ → $\frac{dv(t)}{dt} = 20{,}000\,e^{-2000t}$

$i = C\frac{dv(t)}{dt} = 20\times10^{-6}\cdot 20{,}000e^{-2000t}$

$i(t) = .4\,e^{-2000t}$

$p(t) = v(t)\,i(t) = (10-10e^{-2000t})(.4e^{-2000t})$ 7

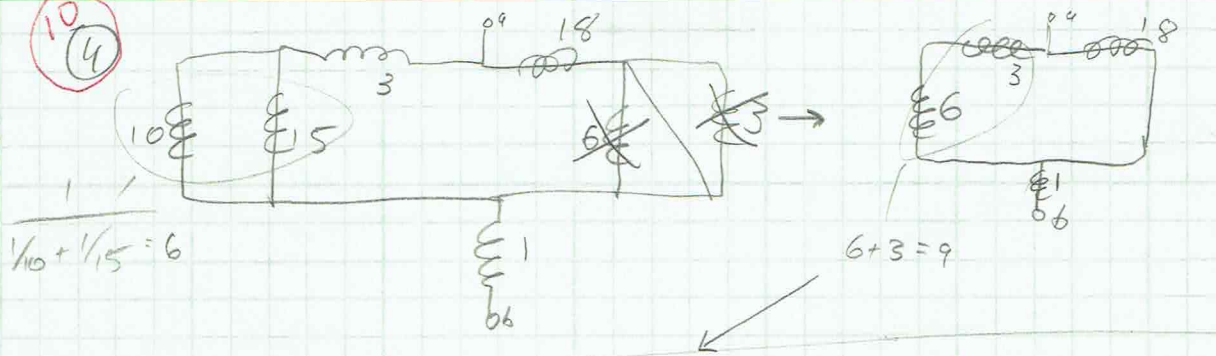
a) $p(0) = 0$ W 3

b) $p(.5\times10^{-3}) = .93$ W being absorbed 7 3

All in H

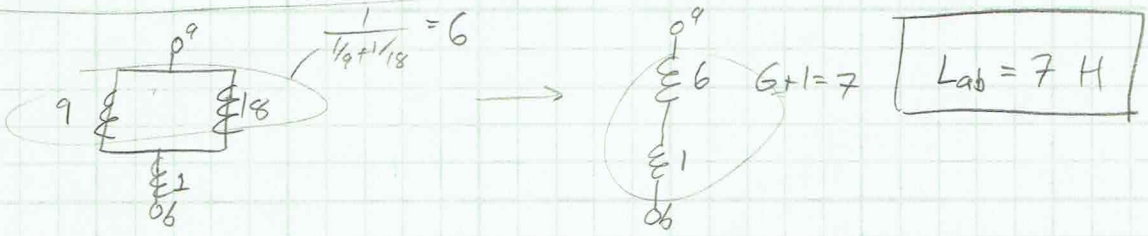
10

(4)



$1/10 + 1/15 = 6$

$6 + 3 = 9$



$\frac{1}{1/9 + 1/18} = 6$

$6 + 1 = 7$

$L_{ab} = 7\ H$

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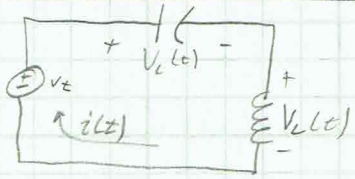
(5) 30

$C = 250\ \mu F \qquad L = 4\ mH$

$v_c(t) = 10\cos(1000t) \rightarrow \frac{dv}{dt} = -10{,}000\sin(1000t)$



$i_c(t) = C\frac{dv}{dt} = (250\times10^{-6})(-10{,}000\sin(1000t)) = -2.5\sin(1000t)$

$i_c(t) = \boxed{i(t) = -2.5\sin(1000t)\ A}$ 5

$\frac{di}{dt} = -2500\cos(1000t)$

$V_L(t) = L\frac{di}{dt} = (4\times10^{-3})(-2500\cos(1000t))$

$\boxed{V_L(t) = -10\cos(1000t)\ V}$ 5

$v(t) = V_c(t) + V_L(t) = 10\cos(1000t) - 10\cos(1000t) = 0$

$\boxed{V(t) = 0\ V}$ 5

Cap energy

$w_c(t) = \frac{1}{2}(250\times10^{-6})(10\cos(1000t))^2$

$\boxed{w_c(t) = .0125\cos^2(1000t)\ J}$ 5

Inductor energy

$w_L(t) = \frac{1}{2}Li(t)^2$

$= \frac{1}{2}(4\times10^{-3})(-2.5\sin(1000t))^2$

$\boxed{w_L(t) = .0125\sin^2(1000t)\ J}$ 5

total energy $= w_c + w_L$

$w_t(t) = .0125\cos^2(1000t) + .0125\sin^2(1000t)$

$w_t(t) = .0125(\cos^2(1000t) + \sin^2(1000t)) \rightarrow 1$

$\boxed{W_t = .0125\ J}$ 5

(6) 10

$L = \frac{\mu N^2 A}{\ell}$ H

$N = 22$

$\mu = \mu_r \mu_0$

$\mu_r = 8000$

$\mu_0 = 4\pi \times 10^{-7}$

$\mu = .01$

$\ell = 6 \times 10^{-3}$ m

$r = 3 \times 10^{-3}$ m

$A = \pi r^2 = 2.83 \times 10^{-5}$ m^2

$\ell = .04$ m

$L = \frac{(.01)(22^2)(2.83 \times 10^{-5})}{.04}$

$L = .00342$ H

$L = 3.42$ mH