$L = 50mH$ $\quad i = 120mA \quad t \leq 0$

$i = A_1 e^{-500t} + A_2 e^{-2000t} \quad t \geq 0$

$V_L(0) = 3V$

a) find V_L for $t > 0$

$i_L(0) = 0.12 = A_1 + A_2$ (1)

$V_L = L\frac{di}{dt} = (0.05)\left[-500A_1 e^{-500t} - 2000A_2 e^{-2000t}\right] = 3 \text{ @ } t = 0$

$(.05)(-500A_1 - 2000A_2) = 3$ (2)

Solving (1) + (2): $A_1 = 0.2$, $A_2 = -0.08$

$$\boxed{V_L = -5e^{-500t} + 8e^{-2000t} \text{ volts}}$$

b) find t when power = 0

$P_L = V_L I_L$ = zero when $V_L = 0$ or $i_L = 0$

$V_L = 0$ when $5e^{-500t} = 8e^{-2000t} \Rightarrow t = 313.3mS$

$I_L = 0$ when $.2e^{-500t} = .08e^{-2000t}$ or $t = -611 \mu S$

Choose $\boxed{t = 313.3mS}$

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The current in an inductor ($L = 50\,mH$) is

$$i = 120\,mA \quad t \le 0$$
$$i = A_1 e^{-500t} + A_2 e^{-2000t}\,A \quad t \ge 0$$

$$V_L(0) = -18\,V$$

a) Find i_L and V_L for $t \ge 0$

① $i_L(0) = 120\,mA = A_1 + A_2$

$V_L = L\frac{di}{dt} = (.05)(-500A_1 e^{-500t}) + A_2(-2000)e^{-2000t}$ (.05)

② $V_L(0) = -18 = -25A_1 - 100A_2$

$A_1 = -.08$

$A_2 = 0.20$

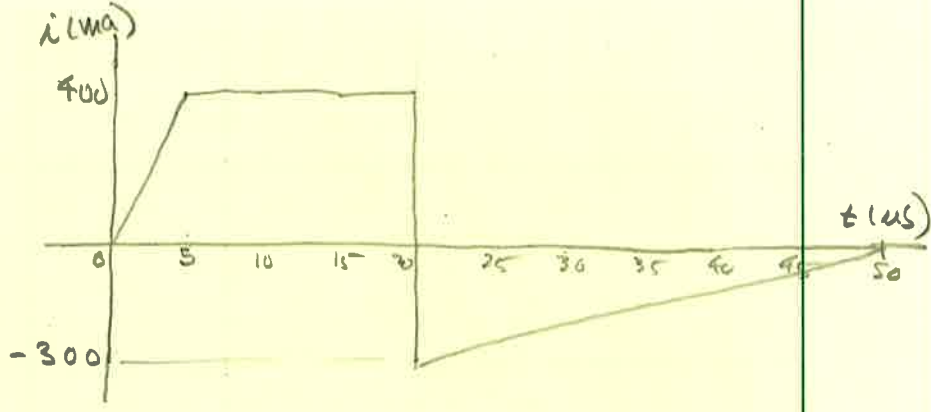
$$\boxed{i_L = -.08e^{-500t} + 0.20e^{-2000t}\ A}$$

$$\boxed{V_L = 2e^{-500t} - 20e^{-2000t}\ V}$$

b) Specify the time intervals when the inductor is storing energy and when it is delivering energy.

inductor stores energy when power > 0

" delivers " " " < 0



the current is applied to a 0.25 μF capacitor with $V_0 = 0$

a) Find Charge @ $t = 15\,\mu s$

$0 \le t \le 5\,ms$; $i = \frac{400\,mA}{5\,\mu s} t = 80 \times 10^3 t$

$5 \le t \le 20\,ms$

$i = 400\,mA$

$20 \le t \le 50\,\mu s$

$i = \frac{300\,mA}{30\,\mu s} t - 0.5$

$$q = \int i\,dt$$

$$q(15\,\mu s) = \int_0^{5\,\mu s} 80 \times 10^3 t\,dt + \int_{5\,\mu s}^{15\,\mu s} .4\,dt$$

$$= 1\,\mu C + 4\,\mu C$$

$$\boxed{q(15\,\mu s) = 5\,\mu C}$$

b) Find V_{cap} @ $t = 30\,\mu s$

$$V = \frac{1}{C} \int i_c\,dt$$

$$V = 4 \times 10^6 \left[\int_0^{5\,\mu s} 80 \times 10^3 t\,dt + \int_{5\,\mu s}^{15\,\mu s} .4\,dt + \int_{20\,\mu s}^{30\,\mu s} (10^4 t - .5)\,dt \right]$$

$$\boxed{V(30\,\mu s) = 18\,V}$$

c) Find energy stored in Cap.

$V(50\,\mu s) = 10\,V$

$$\boxed{W = \frac{1}{2} C V^2 = 12.5\,\mu J}$$

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