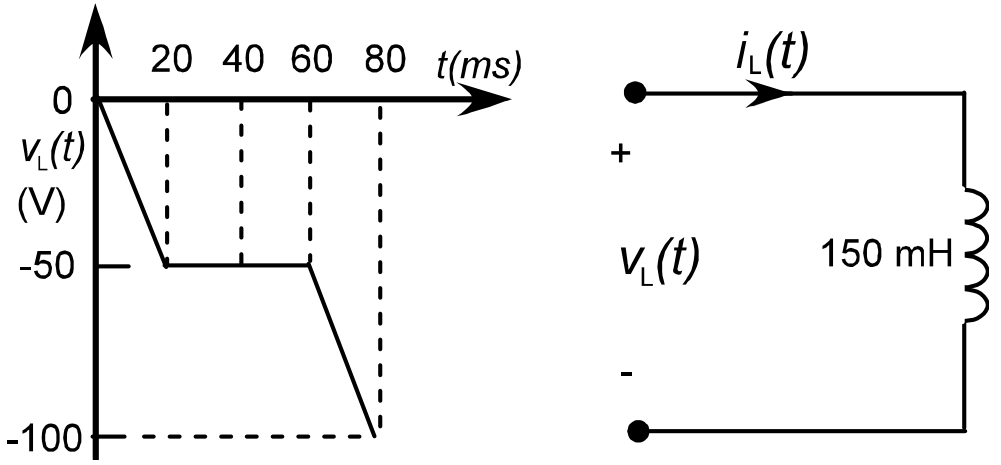
Homework Set #25
DUE Monday, May 15, 2017

1. Consider the voltage waveform shown in the graph below left:



Suppose the voltage is applied across the 150 mH inductor, find the instantaneous current through the inductor and total energy stored at t = 40 ms ($i_L(40$ ms$)$ & $w_L(40$ ms$)$) if the initial current is zero.

$$v_L(t) = L_{eq}\frac{di_L}{dt} \quad and \quad i_L(t) = \frac{1}{L_{eq}}\int v_L dt$$

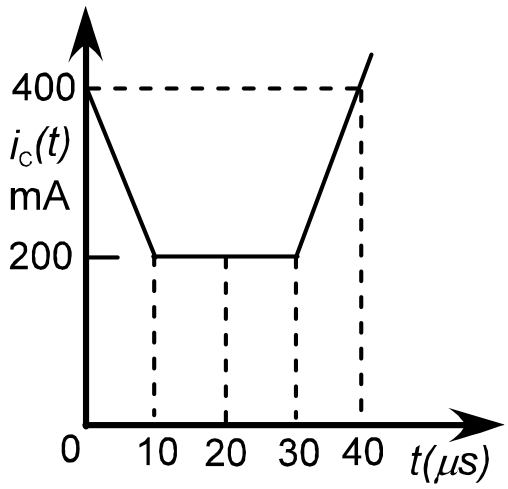
$$\int v(t)dt = 0.5\ x\ 20\ x\ 10^{-3}\ x\ (-50) + 20\ x\ 10^{-3}\ x\ (-50) = -1.5\ Vs\ \ @\ t = 40ms$$

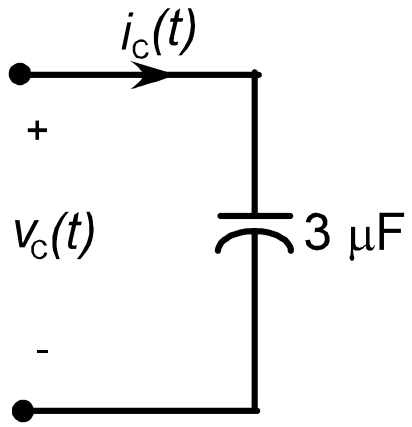
$$\boxed{i_L(40\text{ ms}) = -10\text{ A}}$$

$$w_L(t) = 0.5\ x\ L_{eq}\ x\ i^2 = 0.5\ x\ 0.15\ x\ (-10)^2$$

$$\boxed{w_L(40\text{ ms}) = 7.5\text{ J}}$$

2. Consider the current waveform shown in the graph below left:





Suppose the current is applied to the 3 μF capacitor, find the instantaneous voltage across the capacitor and total energy stored at t = 25 μs (v_C(25μs) & w_C(25μs)) if the initial voltage is zero.

$$i_C(t) = C_{eq}\frac{dv_C}{dt} \quad and \quad v_C(t) = \frac{1}{C_{eq}}\int i_C dt$$

$$\int i(t)dt = 0.5 \times 10 \times 10^{-6} \times 200 \times 10^{-3} + 200 \times 10^{-3} \times 25 \times 10^{-6} = 6\ \mu As \ @\ t = 25\mu s$$

$$\boxed{v_C(25\mu s) = 2\ V}$$

$$w(t) = 0.5 \times C_{eq} \times v^2 = 0.5 \times 3 \times 10^{-6} \times 2^2$$

$$\boxed{w_C\ (50\mu s) = 6\ \mu J}$$