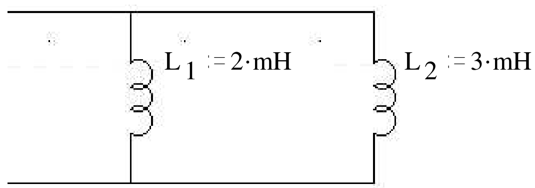
Name: ________________________ ECE 2210 / 00 hw # 9 a

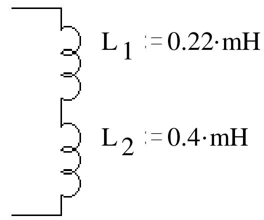
You will need another paper for your calculations, but you may want to hand this sheet in with your drawings.

1. Find L_{eq} in each case

a)

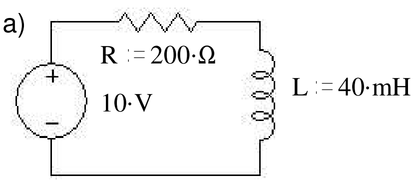


b)

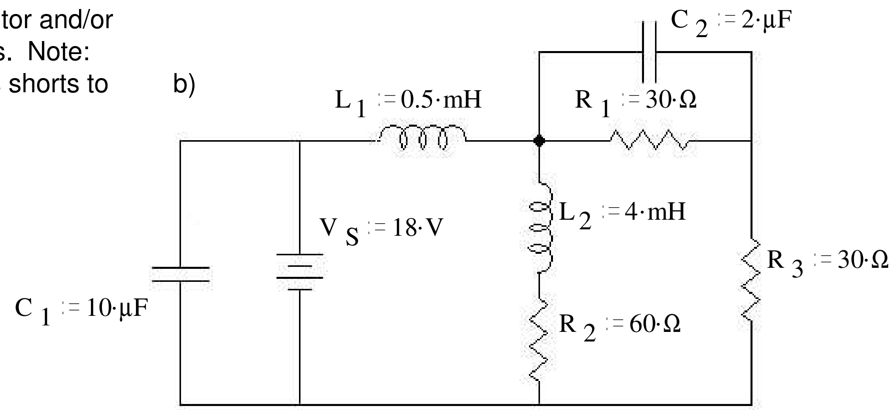


2. Find the stored energy in each capacitor and/or inductor under steady-state conditions. Note: Treat caps as opens and inductors as shorts to find DC voltages and currents.

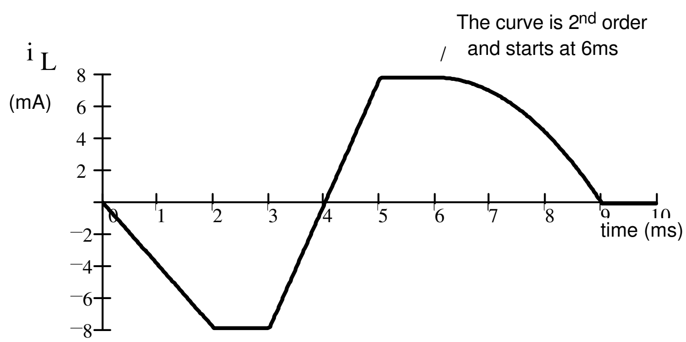
a)



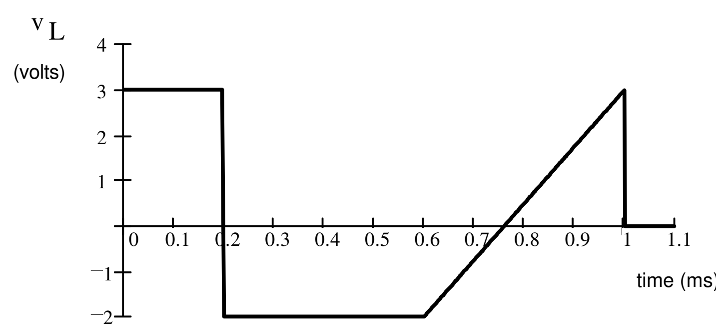
b)

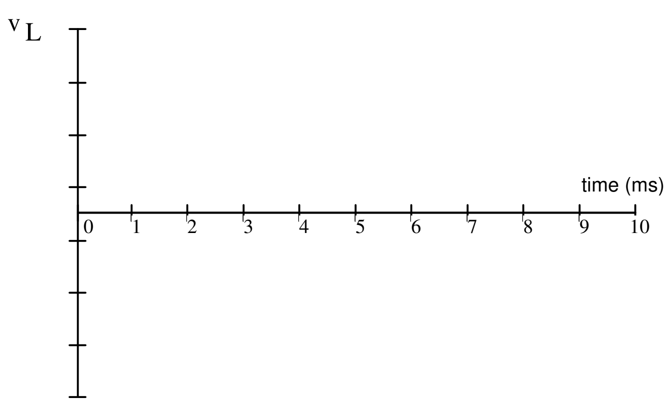


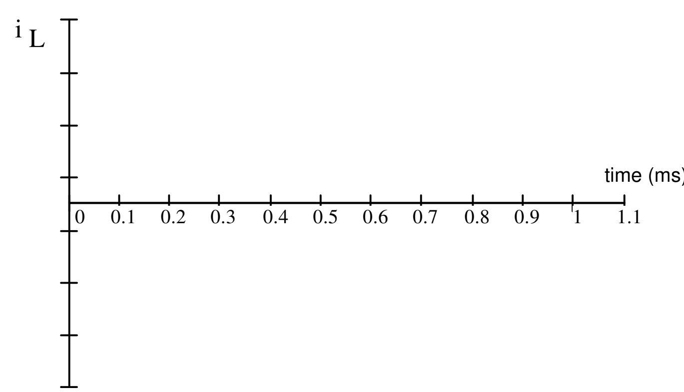
3. The current waveform shown below flows through a 2 mH inductor. Make an accurate drawing of the voltage across it. Label your graph.



4. The voltage across a 0.5 mH inductor is shown below. Make an accurate drawing of the inductor current. Label your graph. Assume the initial current is 0 mA.







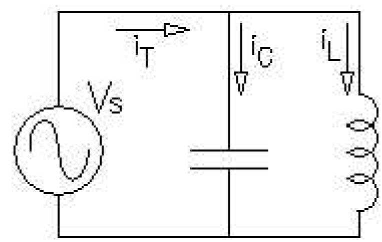
5. The voltage across a 1.2 mH inductor is $v_L = 4 \cdot mV \cdot \cos(300 \cdot t)$ find i_L.

6. The current through a 0.08 mH inductor is $i_L = 20 \cdot mA \cdot \cos\left(628 \cdot t - \frac{\pi}{4}\right)$ find v_L.

7. Refer to the circuit shown. Assume that V_s is a sinusoidal input voltage whose frequency can be adjusted. At some frequency of V_s this circuit can resonate. At that frequency $i_C(t) = -i_L(t)$. ($i_C(t)$ is 180 degrees out-of-phase with $i_L(t)$).

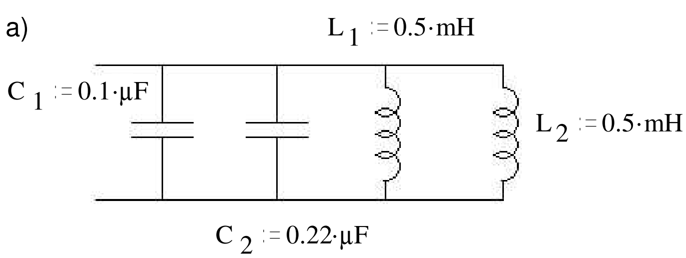
   Show that resonance occurs at this frequency:

$$\omega_o = \frac{1}{\sqrt{L \cdot C}} \quad , \quad f_o = \frac{1}{2 \cdot \pi \cdot \sqrt{L \cdot C}}$$

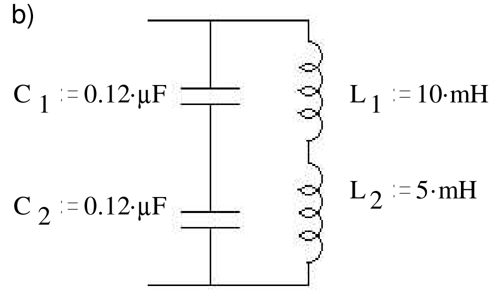


8. Find the resonant frequency, f_o in each case.

a)



b)



Answers

1. $1.2 \cdot mH$ $\quad 0.62 \cdot mH$ $\qquad$ 2. a) $0.05 \cdot mJ$ $\quad$ b) $1.62 \cdot mJ$ $\quad 0.081 \cdot mJ$ $\quad 0.09 \cdot mJ$ $\quad 0.18 \cdot mJ$
3. Straight lines between the following points: (0ms,-8mV), (2ms,-8mV), (2ms,0mV), (3ms,0mV), (3ms,16mV), (5ms,16mV), (5ms,0mV), (6ms,0mV), (9ms,-10.67mV), (9ms,0mV), (10ms,0mV)
4. Straight lines between the following points: (0ms,0A), (0.2ms,1.2A), (0.6ms,-0.4A), curves until it's flat at (0.76ms, -0.72A), continues to curve up to (1ms, 0A), (1.1ms,0A)
5. $i_L = 11.1 \cdot mA \cdot \sin(300 \cdot t)$ $\qquad$ 6. $v_L = -1 \cdot mV \cdot \sin\left(628 \cdot t - \frac{1}{4} \cdot \pi\right)$
7. Assume a sinusoidal voltage, find i_C and i_L by integration and differentiation, and show that they are equal and opposite at the resonant frequency.
8. a) $17.79 \cdot kHz$ $\qquad$ b) $5305 \cdot Hz$