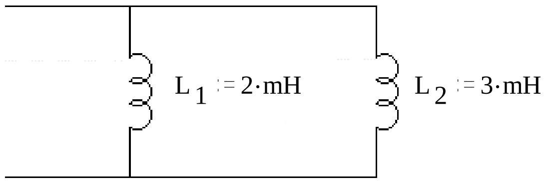
**Name:** ________________________________ ECE 2210 / 00 hw Ind Due: Sat, 9/30/23 b

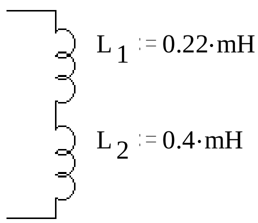
Inductors

1. Find $L_{eq}$ in each case

a)

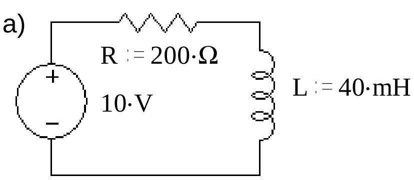



b)

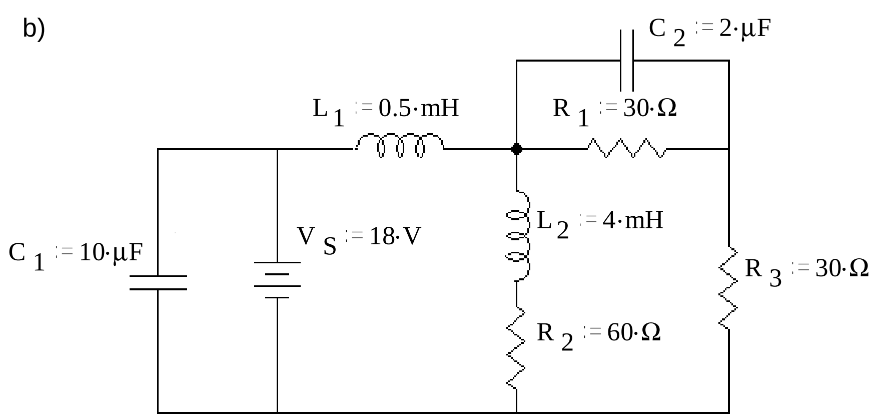



2. Find the stored energy in each capacitor and/or inductor under steady-state conditions. Note: Treat caps as opens and inductors as shorts to find DC voltages and currents.

a)



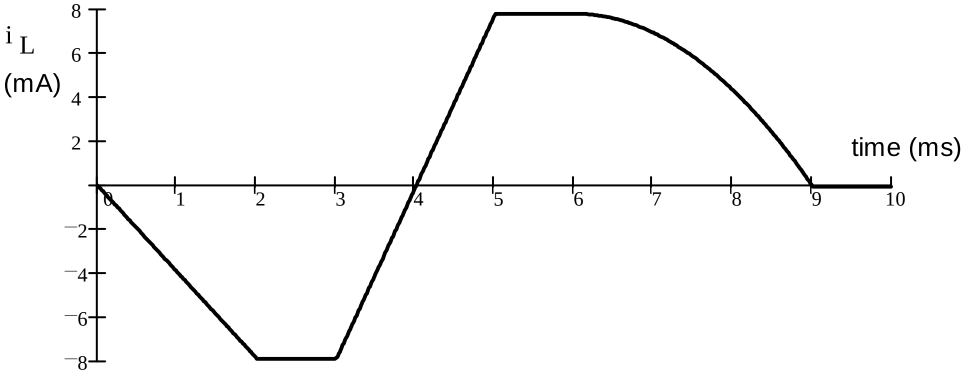

b)

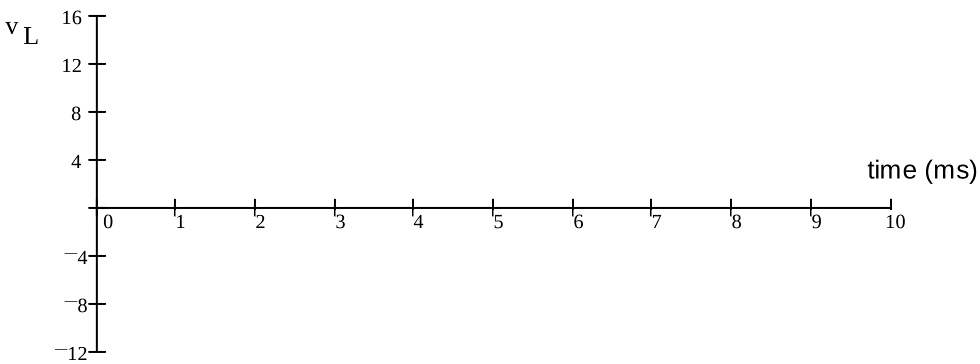


3. The current waveform shown below flows through a $2\ \text{mH}$ inductor. Make an accurate drawing of the voltage across it. Label your graph.

$L := 2\cdot \text{mH}$

The curve is 2nd order and starts at 6ms

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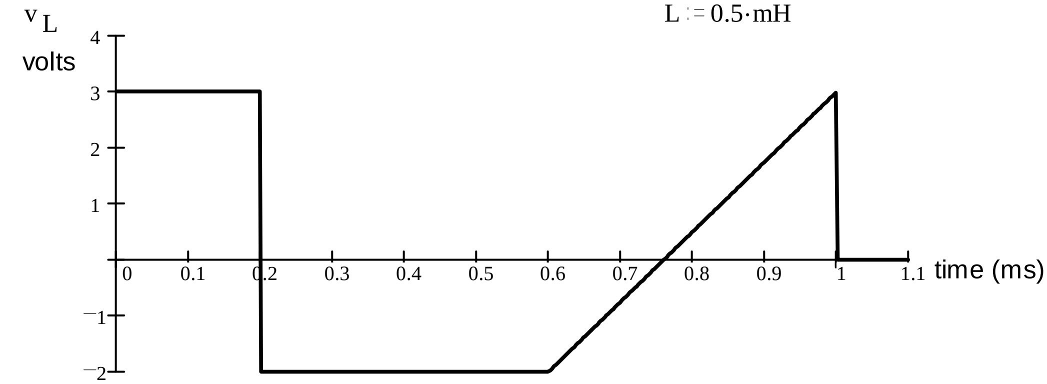
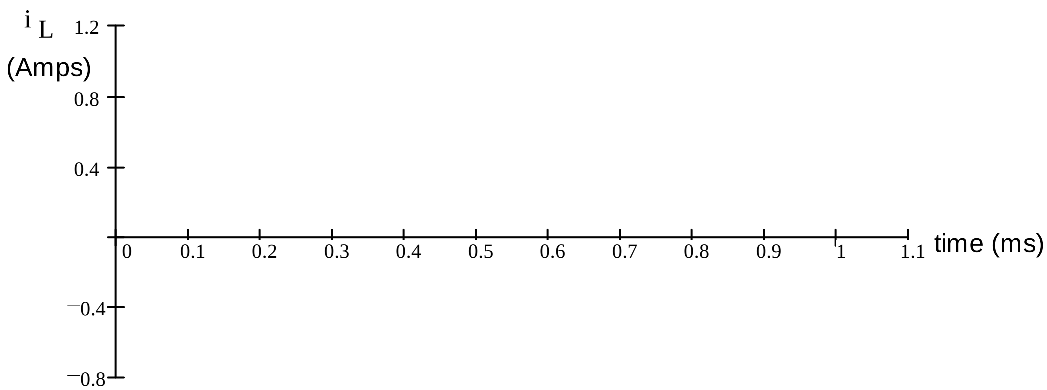
**Answers**

1. $1.2\cdot \text{mH}$ $\quad 0.62\cdot \text{mH}$
2. a) $0.05\cdot \text{mJ}$ b) $1.62\cdot \text{mJ}$ $\quad 0.081\cdot \text{mJ}$ $\quad 0.09\cdot \text{mJ}$ $\quad 0.18\cdot \text{mJ}$
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. $i_L = 11.1\cdot \text{mA}\cdot\cos(300\cdot t - 90\cdot \text{deg})$
6. $v_L = 1\cdot \text{mV}\cdot\cos\left(628\cdot t + \frac{1}{4}\cdot\pi\right)$
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) $17.79\cdot \text{kHz}$ b) $5305\cdot \text{Hz}$

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.

$L := 0.5 \cdot mH$



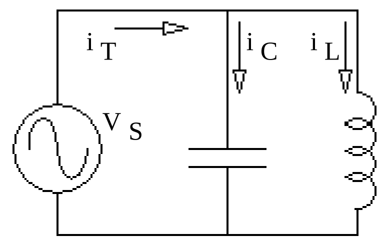




5. The voltage across a 1.2 mH inductor is $v_L = 4 \cdot mV \cdot \cos(300 \cdot t)$ find $i_L$.

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 $v_L$.

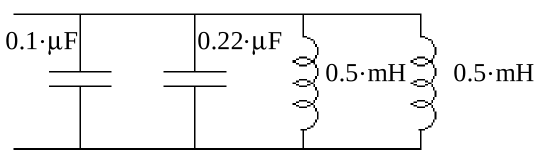
7. Refer to the circuit shown. Assume that $V_s$ is a sinusoidal input voltage whose frequency can be adjusted. At some frequency of $V_s$ this circuit can resonate. At that frequency $i_C(t) = -i_L(t)$. ($i_C(t)$ is 180 degrees out-of-phase with $i_L(t)$).

   Show that resonance occurs at this frequency:  $\omega_o = \frac{1}{\sqrt{L \cdot C}}$ ,  $f_o = \frac{1}{2 \cdot \pi \cdot \sqrt{L \cdot C}}$

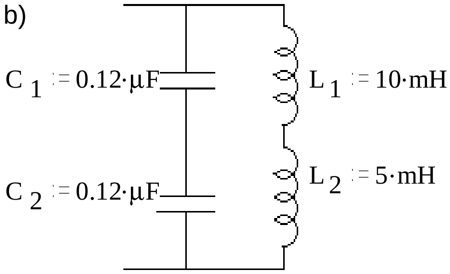



8. Find the resonant frequency, $f_o$ in each case.

   a)




   b)

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