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) \( L_1 := 2 \text{ mH} \)
   b) \( L_1 := 0.22 \text{ mH} \)
   \( L_2 := 3 \text{ mH} \)
   \( L_2 := 0.4 \text{ mH} \)

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) \( \begin{align*}
   R &:= 200 \Omega \\
   V &:= 10 \text{ V} \\
   L &:= 40 \text{ mH} \\
   C_1 &:= 10 \mu \text{F}
   \end{align*} \)

3. The current waveform shown below flows through a 2 mH inductor. Make an accurate drawing of the voltage across it. Label your graph.
   The curve is 2\textsuperscript{nd} order and starts at 6ms

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 \( v_L = 4 \cdot \text{mV} \cdot \cos(300 \cdot t) \) find \( i_L \).

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

\[
\omega_0 = \frac{1}{\sqrt{L \cdot C}}, \quad f_o = \frac{1}{2 \cdot \pi \sqrt{L \cdot C}}
\]

8. Find the resonant frequency, \( f_o \) in each case.

<table>
<thead>
<tr>
<th>Circuit</th>
<th>( f_o )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) ( L_1 := 0.5 \cdot \text{mH} )</td>
<td>17.79 kHz</td>
</tr>
<tr>
<td>b) ( L_1 := 10 \cdot \text{mH} )</td>
<td>5305 Hz</td>
</tr>
<tr>
<td>C_1 := 0.12 \mu F</td>
<td></td>
</tr>
<tr>
<td>C_2 := 0.22 \mu F</td>
<td></td>
</tr>
</tbody>
</table>

Answers

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