6.4 The triangular current pulse shown in Fig. P6.4 is applied to a 20 mH inductor.
   a) Write the expressions that describe \( i(t) \) in the four intervals \( t < 0, \ t \leq 5 \text{ ms}, \ 5 \text{ ms} \leq t \leq 10 \text{ ms}, \) and \( t > 10 \text{ ms}. \)
   b) Derive the expressions for the inductor voltage, power, and energy. Use the passive sign convention.

![Figure P6.4](image)

6.6 The current in a 20 mH inductor is known to be
   \[ i = 40 \text{ mA}, \quad t \leq 0; \]
   \[ i = A_1 e^{-10.000 t} + A_2 e^{-40.000 t}, \quad t > 0. \]

The voltage across the inductor (passive sign convention) is 28 V at \( t = 0. \)
   a) Find the expression for the voltage across the inductor for \( t > 0. \)
   b) Find the time, greater than zero, when the power at the terminals of the inductor is zero.

6.9 a) Find the inductor current in the circuit in Fig. P6.9 if \( v = -50 \sin 250 t \ V, \ L = 20 \text{ mH,} \) and \( i(0) = 10 \ A. \)
   b) Sketch \( v, \ i, \ p, \) and \( w \) versus \( t. \) In making these sketches, use the format used in Fig. 6.8. Plot over one complete cycle of the voltage waveform.
   c) Describe the subintervals in the time interval between 0 and 8\( \pi \) ms when power is being absorbed by the inductor. Repeat for the subintervals when power is being delivered by the inductor.

![Figure P6.0](image)

6.14 The current shown in Fig. P6.14 is applied to a 0.25 \( \mu \text{F} \) capacitor. The initial voltage on the capacitor is zero.
   a) Find the charge on the capacitor at \( t = 15 \mu \text{s}. \)
   b) Find the voltage on the capacitor at \( t = 30 \mu \text{s}. \)
   c) How much energy is stored in the capacitor by this current?

![Figure P6.14](image)

6.15 The initial voltage on the 0.5 \( \mu \text{F} \) capacitor shown in Fig. P6.15(a) is -20 V. The capacitor current has the waveform shown in Fig. P6.15(b).
   a) How much energy, in microjoules, is stored in the capacitor at \( t = 500 \mu \text{s}? \)
   b) Repeat (a) for \( t = \infty. \)

![Figure P6.15](image)
6.19 The voltage at the terminals of the capacitor in Fig. 6.10 is known to be
\[ v = \begin{cases} -20 \text{ V}, & t < 0, \\ 100 - 40e^{-2000t} (3 \cos 1000t + \sin 1000t) \text{ V} & t \geq 0. \end{cases} \]
Assume \( C = 4 \, \mu\text{F}. \)
(a) Find the current in the capacitor for \( t < 0. \)
(b) Find the current in the capacitor for \( t > 0. \)
(c) Is there an instantaneous change in the voltage across the capacitor at \( t = 0^+ \)?
(d) Is there an instantaneous change in the current in the capacitor at \( t = 0^- \)?
(e) How much energy (in millijoules) is stored in the capacitor at \( t = \infty \)?

Section 6.3

6.20 Assume that the initial energy stored in the inductors of Fig. 6.20 is zero. Find the equivalent inductance with respect to the terminals a, b.

Figure P6.20

6.23 The three inductors in the circuit in Fig. P6.23 are connected across the terminals of a black box at \( t = 0 \). The resulting voltage for \( t > 0 \) is known to be
\[ v_o = 2000e^{-100t} \text{ V}. \]
If \( i_1(0) = -6 \text{ A} \) and \( i_2(0) = 1 \text{ A} \), find
(a) \( i_0(0) \);
(b) \( i_0(t), t \geq 0; \)
(c) \( i_1(t), t \geq 0; \)
(d) \( i_2(t), t \geq 0; \)
e) the initial energy stored in the three inductors;
f) the total energy delivered to the black box; and
g) the energy trapped in the ideal inductors.

Figure P6.23

6.26 Find the equivalent capacitance with respect to the terminals a, b for the circuit shown in Fig. P6.26.

Figure P6.26

6.34 The current in the circuit in Fig. P6.34 is known to be
\[ i_o = 5e^{-2000t} (2 \cos 4000t + \sin 4000t) \text{ A} \]
for \( t \geq 0^+ \). Find \( v_1(0^+) \) and \( v_2(0^+) \).

Figure P6.34

6.35 At \( t = 0 \), a series-connected capacitor and inductor are placed across the terminals of a black box, as shown in Fig. P6.35. For \( t > 0 \), it is known that
\[ i_o = 1.5e^{-15000t} - 0.5e^{-4000t} \text{ A}. \]
If \( v_o(0) = -50 \text{ V} \) find \( v_o \) for \( t \geq 0 \).

Figure P6.35