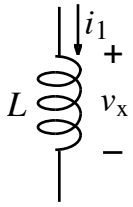
HOMEWORK #9 solution

Ex: In (a)-(c), the current $i_L(t)$ flowing into a 0.5 mH inductor is listed. Find the voltage, $v_L(t)$, across the inductor in each case as a function of time:



a) $i_L(t) = 5$ mA
b) $i_L(t) = 5t$ mA/s
c) $i_L(t) = 5\sin(2\pi \cdot 100t)$ mA

Sol'n: We use the defining equation for an inductor in each case:

$$v_L = L\frac{di_L}{dt}$$

a)

$$v_L = L\frac{d}{dt}5 \text{ mA} = L \cdot 0 \text{ A/s} = 0 \text{ V}$$

b)

$$v_L = L\frac{d}{dt}5t \text{ mA/s} = 0.5 \text{ mH} \cdot 5 \text{ mA/s} = 2.5 \text{ μV}$$

c)

$$v_L = L\frac{d}{dt}5\sin(2\pi \cdot 100t) \text{ mA} = 0.5 \text{ mH} \cdot 5\cos(2\pi \cdot 100t)200\pi \text{ mA/s}$$

$$v_L = \frac{\pi}{2}\cos(2\pi \cdot 100t) \text{ mV}$$