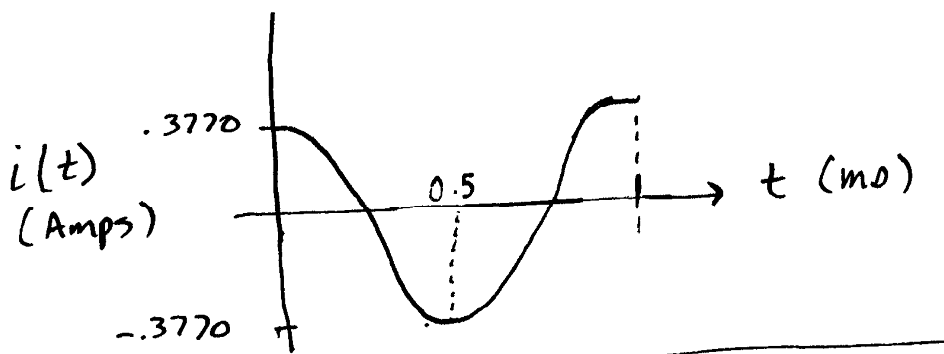
Solutions – Chapter 6

6.14. Note that $v(t) = 10\sin(2\pi \cdot 1000\, t)$

$$i(t) = C\frac{dv(t)}{dt} = (6\times 10^{-6})(10)(2\pi\cdot 1000)\cdot \cos(2\pi\cdot 1000t)$$

$$= 0.3770 \cos(2\pi \cdot 1000t) \text{ A}$$

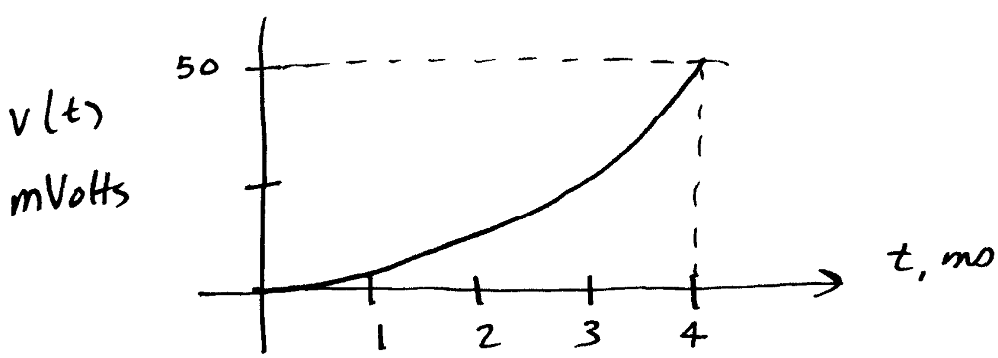


6.15 Using $v(t) = \frac{1}{C}\int_{-\infty}^{t} i(x)\,dx$

for $t = 0 \ldots 4$ ms, $v(t) = \frac{1}{200e^{-6}}\int_0^t \frac{5}{4}x\,dx$

$$= \frac{1}{2e^{-4}}\left(\frac{5}{4}\right)\frac{x^2}{2}\Big|_0^t$$

$$= \frac{5}{1.6e^{-3}}t^2 = 3125t^2$$



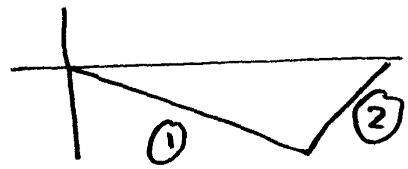
6.16 $\dfrac{di}{dt} = \dfrac{200\,mA}{4\,ms} = 50\,\dfrac{A}{s}$

Since $V = L\,\dfrac{di}{dt}$

$100\,mV = L\ 50\,A/s$

$\underline{L = 2\,mH}$

6.22. Given

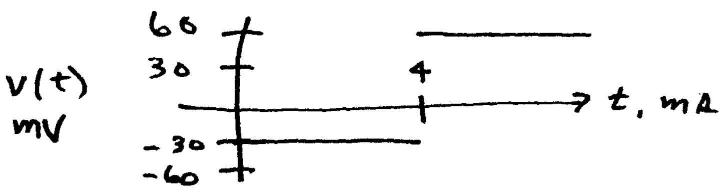


in region 1 $\dfrac{di}{dt} = -\dfrac{12\,mA}{4\,ms} = -3\,\dfrac{A}{s}$

2 $\dfrac{di}{dt} = \dfrac{12\,mA}{2\,ms} = 6\,\dfrac{A}{s}$

1 $v = L\ di/dt = (10\times10^{-3})\cdot(-3) = -30\,mV$

2 $v = L\ di/dt = (10\times10^{-3})\ (6) = 60\,m$



6.23 There are 4 regions

1 $\dfrac{di}{dt} = 0$

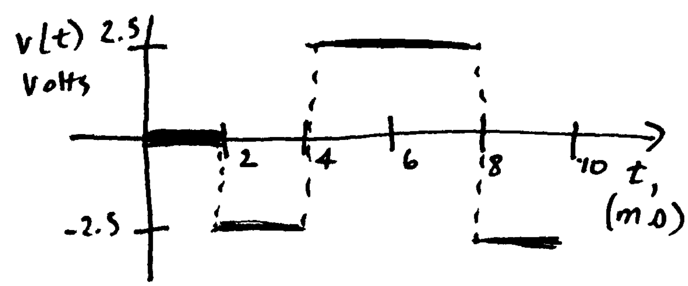
2 $\dfrac{di}{dt} = \dfrac{-100\,mA}{2\,ms} = -50$

3 $\dfrac{di}{dt} = \dfrac{200\,mA}{4\,ms} = 50$

4 $\dfrac{di}{dt} = \dfrac{-100\,mA}{2\,ms} = -50$

$V = L\ di/dt$

$= (50\times10^{-3})\ di/dt\ V$

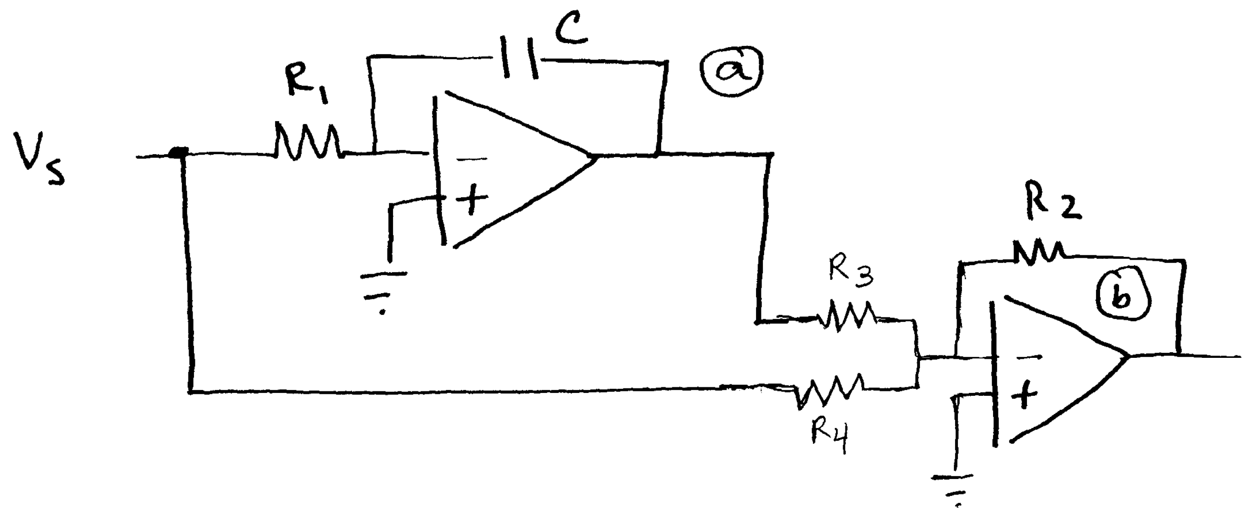


6.47 we know an integrating opamp has $V_{out}(t) = -\frac{1}{RC}\int_{-\infty}^{t} V_{in}(x)\,dx$

here $R = 80\,K\Omega$

we want $\frac{-1}{RC} = -10$, $C = \frac{1}{10R} = \underline{1.25\mu F}$

6.48 $V_o = \int V_s\,dt - 10\,V_s$



opamp (a) output $= -\frac{1}{RC}\int V_s\,dt$

Choose $\frac{-1}{RC} = -1$ $R_1C = 1$ (e.g. $R_1 = 100K\Omega$, $C = 10\mu F$)

opamp (b) output $= -\left(\frac{R_3}{R_2}\right)\left(-\int V_s\,dt\right) - \left(\frac{R_4}{R_2}\right)V_S$

Choose $R_3 = R_2 = 10K\,\Omega$

Choose $R_4 = 100K\Omega$

output $= \int V_s\,dt - 10\,V_s$