Chapter 6, Solution 1.

$$i = C\frac{dv}{dt} = 5\left(2e^{-3t} - 6 + e^{-3t}\right) = \underline{10(1 - 3t)e^{-3t}\ A}$$

$$p = vi = 10(1\text{-}3t)e^{-3t} \cdot 2t\ e^{-3t} = \underline{20t(1 - 3t)e^{-6t}\ W}$$

Chapter 6, Solution 2.

$$w_1 = \frac{1}{2}Cv_1^2 = \frac{1}{2}(40)(120)^2$$
$$w_2 = \frac{1}{2}Cv_1^2 = \frac{1}{2}(40)(80)^2$$

$$\Delta w = w_1 - w_2 = 20\left(120^2 - 80^2\right) = \underline{\mathbf{160\ kW}}$$

Chapter 6, Solution 3.

$$i = C\frac{dv}{dt} = 40x10^{-3}\,\frac{280 - 160}{5} = \underline{\mathbf{480\ mA}}$$

Chapter 6, Solution 4.

$$v = \frac{1}{C}\int_o^t idt + v(0)$$

$$= \frac{1}{2}\int 6\sin 4tdt + 1$$

$$= \underline{\mathbf{1 - 0.75\cos 4t}}$$

Chapter 6, Solution 5.

$$v = \frac{1}{C}\int_o^t idt + v(0)$$

For $0 < t < 1$, $i = 4t$,

$$v = \frac{1}{20x10^{-6}}\int_o^t 4t\,dt + 0 = 100t^2\ kV$$

$$v(1) = 100\ kV$$

For 1 < t < 2, i = 8 - 4t,

$$v = \frac{1}{20x10^{-6}}\int_1^t (8-4t)dt + v(1)$$

$$= 100\,(4t - t^2 - 3) + 100\text{ kV}$$

Thus $$v\,(t) = \begin{cases} 100t^2\text{kV}, & 0 < t < 1 \\ 100(4t - t^2 - 2)\text{kV}, & 1 < t < 2 \end{cases}$$

Chapter 6, Solution 6.

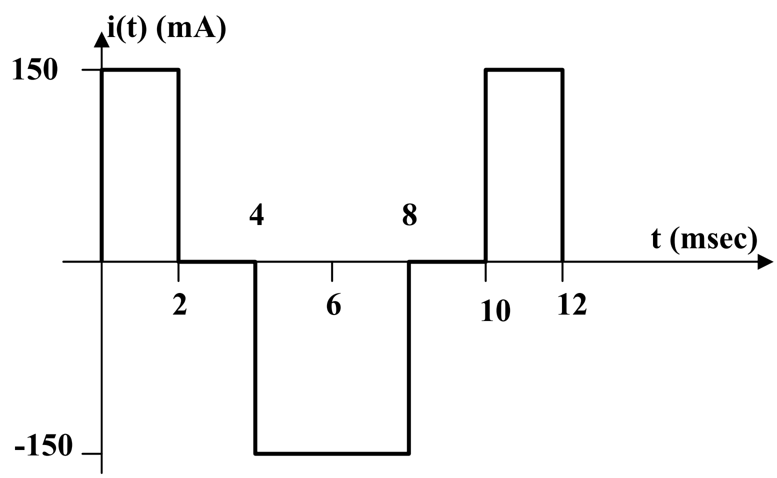
$i = C\dfrac{dv}{dt} = 30x10^{-6}$ x slope of the waveform.

For example, for 0 < t < 2,

$$\frac{dv}{dt} = \frac{10}{2x10^{-3}}$$

$$i = C\frac{dv}{dt} = 30x10^{-6}x\frac{10}{2x10^{-3}} = 150mA$$

Thus the current i is sketched below.



Chapter 6, Solution 7.

$$v = \frac{1}{C}\int idt + v(t_o) = \frac{1}{50x10^{-3}}\int_o^t 4tx10^{-3}dt + 10$$

$$= \frac{2t^2}{50} + 10 = \underline{\mathbf{0.04k^2 + 10\ V}}$$

Chapter 6, Solution 8.

(a) $i = C\dfrac{dv}{dt} = -100ACe^{-100t} - 600BCe^{-600t}$ (1)

$i(0) = 2 = -100AC - 600BC \longrightarrow 5 = -A - 6B$ (2)

$v(0^+) = v(0^-) \longrightarrow 50 = A + B$ (3)

Solving (2) and (3) leads to

A=61, B=-11

(b) $\text{Energy} = \dfrac{1}{2}Cv^2(0) = \dfrac{1}{2}x4x10^{-3}x2500 = \underline{5\text{ J}}$

(c) From (1),

$$i = -100x61x4x10^{-3}e^{-100t} - 600x11x4x10^{-3}e^{-600t} = \underline{-24.4e^{-100t} - 26.4e^{-600t}\ \text{A}}$$

Chapter 6, Solution 9.

$$\text{v(t)} = \frac{1}{1/2}\int_o^t 6\left(1 - e^{-t}\right)dt + 0 = 12\left(t + e^{-t}\right)\text{V}$$

$v(2) = 12(2 + e^{-2}) = \underline{\mathbf{25.62\ V}}$

$p = iv = 12\ (t + e^{-t})\ 6\ (1-e^{-t}) = 72(t-e^{-2t})$

$p(2) = 72(2-e^{-4}) = \underline{\mathbf{142.68\ W}}$

Chapter 6, Solution 10

$$i = C\frac{dv}{dt} = 2x10^{-3}\frac{dv}{dt}$$

$$v = \begin{cases} 16t, & 0 < t < 1\mu\text{s} \\ 16, & 1 < \text{t} < 3\ \mu\text{s} \\ 64 - 16\text{t}, & 3 < \text{t} < 4\mu\text{s} \end{cases}$$

$$\frac{dv}{dt} = \begin{cases} 16x10^6, & 0 < t < 1\mu s \\ 0, & 1 < t < 3\ \mu s \\ -16x10^6, & 3 < t < 4\mu s \end{cases}$$

$$i(t) = \begin{cases} 32\,kA, & 0 < t < 1\mu s \\ 0, & 1 < t < 3\ \mu s \\ -32\,kA, & 3 < t < 4\mu s \end{cases}$$

Chapter 6, Solution 11.

$$v = \frac{1}{C}\int_o^t idt + v(0)$$

For $0 < t < 1$,

$$v = \frac{1}{4x10^{-6}}\int_o^t 40x10^{-3}dt = 10t\ \ kV$$

$$v(1) = 10\ kV$$

For $1 < t < 2$,

$$v = \frac{1}{C}\int_1^t vdt + v(1) = 10kV$$

For $2 < t < 3$,

$$v = \frac{1}{4x10^{-6}}\int_2^t (-40x10^{-3})dt + v(2)$$

$$= -10t + 30kV$$

Thus

$$v(t) = \begin{bmatrix} 10t \cdot kV, & 0 < t < 1 \\ 10kV, & 1 < t < 2 \\ -10t + 30kV, & 2 < t < 3 \end{bmatrix}$$

Chapter 6, Solution 12.

$$i = C\frac{dv}{dt} = 3x10^{-3}x60(4\pi)(-\sin 4\pi\, t)$$

$$= \underline{\mathbf{-\ 0.7e\ \pi\ sin\ 4\pi t\ A}}$$

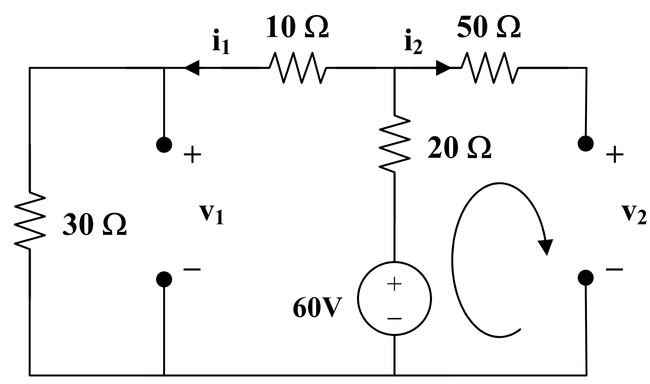
$$P = vi = 60(-0.72)\pi\ \cos 4\pi\ t\ \sin 4\pi\ t = -21.6\pi\ \sin 8\pi\ t\ W$$

$$W = \int_o^t pdt = -\int_o^{\frac{1}{8}} 21.6\pi \sin 8\pi\, t\ dt$$

$$= \frac{21.6\pi}{8\pi}\cos 8\pi\Big|_o^{1/8} = \underline{\mathbf{-5.4J}}$$

Chapter 6, Solution 13.

Under dc conditions, the circuit becomes that shown below:



$i_2 = 0$, $i_1 = 60/(30+10+20) = 1A$

$v_1 = 30i_2 = 30V$, $v_2 = 60\text{-}20i_1 = 40V$

Thus, **$\underline{v_1 = 30V, v_2 = 40V}$**

Chapter 6, Solution 14.

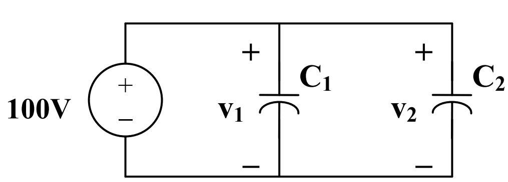
(a) $C_{eq} = 4C =$ **$\underline{120\text{ mF}}$**

(b) $\dfrac{1}{C_{eq}} = \dfrac{4}{C} = \dfrac{4}{30} \longrightarrow C_{eq} =$ **$\underline{7.5\text{ mF}}$**

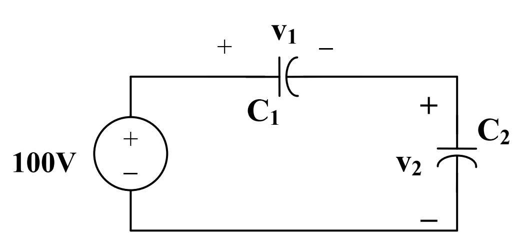
Chapter 6, Solution 15.

In parallel, as in Fig. (a),

$v_1 = v_2 = 100$



(a)



(b)

$$w_{20} = \frac{1}{2}Cv^2 = \frac{1}{2}x20x10^{-6}x100^2 = \underline{\mathbf{0.1J}}$$

$$w_{30} = \frac{1}{2}x30x10^{-6}x100^2 = \underline{\mathbf{0.15J}}$$

(b) When they are connected in series as in Fig. (b):

$$v_1 = \frac{C_2}{C_1 + C_2}V = \frac{30}{50}x100 = 60,\ v_2 = 40$$

$$w_{20} = \frac{1}{2}x30x10^{-6}x60^2 = \underline{\mathbf{36\ mJ}}$$

$$w_{30} = \frac{1}{2}x30x10^{-6}x40^2 = \underline{\mathbf{24\ mJ}}$$

Chapter 6, Solution 16

$$C_{eq} = 14 + \frac{Cx80}{C+80} = 30 \quad \longrightarrow \quad \underline{C = 20\ \mu F}$$

Chapter 6, Solution 17.

(a) 4F in series with 12F = 4 x 12/(16) = 3F
3F in parallel with 6F and 3F = 3+6+3 = 12F
4F in series with 12F = 3F
i.e. C_{eq} = **3F**

(b) $C_{eq} = 5 + [6 \| (4 + 2)] = 5 + (6 \| 6) = 5 + 3 =$ **8F**

(c) 3F in series with 6F = (3 x 6)/9 = 6F

$$\frac{1}{C_{eq}} = \frac{1}{2} + \frac{1}{6} + \frac{1}{3} = 1$$

C_{eq} = **1F**

Chapter 6, Solution 18.

For the capacitors in parallel

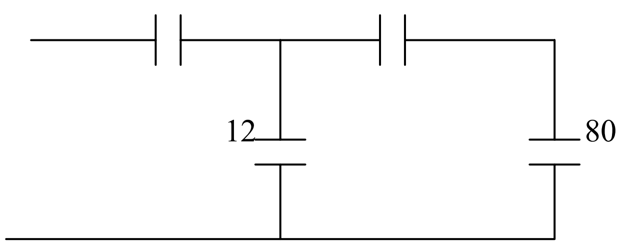
$C^1_{eq} = 15 + 5 + 40 = 60\ \mu F$

Hence $\quad \dfrac{1}{C_{eq}} = \dfrac{1}{20} + \dfrac{1}{30} + \dfrac{1}{60} = \dfrac{1}{10}$

$C_{eq} =$ **$\underline{10\ \mu F}$**

Chapter 6, Solution 19.

We combine 10-, 20-, and 30- μF capacitors in parallel to get 60 μF. The 60 - μF capacitor in series with another 60- μF capacitor gives 30 μF.
30 + 50 = 80 μF, 80 + 40 = 120 μF
The circuit is reduced to that shown below.

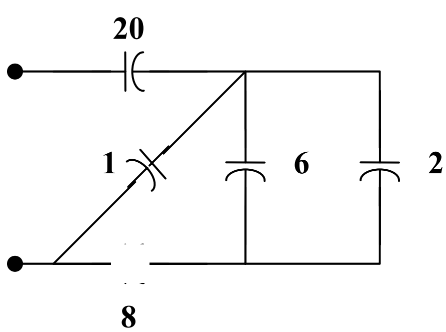


120- μF capacitor in series with 80 μF gives (80x120)/200 = 48
48 + 12 = 60
60- μF capacitor in series with 12 μF gives (60x12)/72 = $\underline{10\ \mu F}$

Chapter 6, Solution 20.

3 in series with 6 = $6x^3/(9) = 2$
2 in parallel with 2 = 4
4 in series with 4 = (4x4)/8 = 2

The circuit is reduced to that shown below:



6 in parallel with 2 = 8
8 in series with 8 = 4
4 in parallel with 1 = 5
5 in series with 20 = (5x20)/25 = 4

Thus C_{eq} = **4 mF**

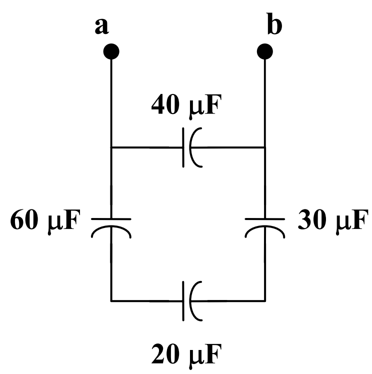
Chapter 6, Solution 21.

4μF in series with 12μF = (4x12)/16 = 3μF
3μF in parallel with 3μF = 6μF
6μF in series with 6μF = 3μF
3μF in parallel with 2μF = 5μF
5μF in series with 5μF = 2.5μF

Hence C_{eq} = **2.5μF**

Chapter 6, Solution 22.

Combining the capacitors in parallel, we obtain the equivalent circuit shown below:



Combining the capacitors in series gives C^1_{eq}, where

$$\frac{1}{C^1_{eq}} = \frac{1}{60} + \frac{1}{20} + \frac{1}{30} = \frac{1}{10} \longrightarrow C^1_{eq} = 10\mu F$$

Thus

C_{eq} = 10 + 40 = **50 μF**

Chapter 6, Solution 23.

(a) 3μF is in series with 6μF   3x6/(9) = 2μF

$v_{4\mu F}$ = 1/2 x 120 = **60V**

$v_{2\mu F}$ = **60V**

$$v_{6\mu F} = \frac{3}{6+3}(60) = \mathbf{20V}$$

$v_{3\mu F}$ = 60 - 20 = **40V**

(b) Hence w = 1/2 Cv^2

$w_{4\mu F}$ = 1/2 x 4 x 10^{-6} x 3600 = **7.2mJ**

$w_{2\mu F}$ = 1/2 x 2 x 10^{-6} x 3600 = **3.6mJ**

$w_{6\mu F}$ = 1/2 x 6 x 10^{-6} x 400 = **1.2mJ**

$w_{3\mu F}$ = 1/2 x 3 x 10^{-6} x 1600 = **2.4mJ**

Chapter 6, Solution 24.

20μF is series with 80μF = 20x80/(100) = 16μF

14μF is parallel with 16μF = 30μF

(a) $v_{30\mu F}$ = **90V**

$v_{60\mu F}$ = **30V**

$v_{14\mu F}$ = **60V**

$$v_{20\mu F} = \frac{80}{20+80} x60 = \mathbf{48V}$$

$v_{80\mu F}$ = 60 - 48 = **12V**

(b) Since $w = \frac{1}{2}Cv^2$

$w_{30\mu F}$ = 1/2 x 30 x 10^{-6} x 8100 = **121.5mJ**

$w_{60\mu F}$ = 1/2 x 60 x 10^{-6} x 900 = **27mJ**

$w_{14\mu F}$ = 1/2 x 14 x 10^{-6} x 3600 = **25.2mJ**

$w_{20\mu F}$ = 1/2 x 20 x 10^{-6} x $(48)^2$ = **23.04mJ**

$w_{80\mu F}$ = 1/2 x 80 x 10^{-6} x 144 = **5.76mJ**

Chapter 6, Solution 25.

(a) For the capacitors in series,

$$Q_1 = Q_2 \longrightarrow C_1 v_1 = C_2 v_2 \longrightarrow \frac{v_1}{v_2} = \frac{C_2}{C_1}$$

$$v_s = v_1 + v_2 = \frac{C_2}{C_1} v_2 + v_2 = \frac{C_1 + C_2}{C_1} v_2 \longrightarrow \underline{v_2 = \frac{C_1}{C_1 + C_2} v_s}$$

Similarly, $\underline{v_1 = \frac{C_2}{C_1 + C_2} v_s}$

(b) For capacitors in parallel

$$v_1 = v_2 = \frac{Q_1}{C_1} = \frac{Q_2}{C_2}$$

$$Q_s = Q_1 + Q_2 = \frac{C_1}{C_2} Q_2 + Q_2 = \frac{C_1 + C_2}{C_2} Q_2$$

or

$$Q_2 = \frac{C_2}{C_1 + C_2}$$

$$Q_1 = \frac{C_1}{C_1 + C_2} Q_s$$

$$i = \frac{dQ}{dt} \longrightarrow \underline{i_1 = \frac{C_1}{C_1 + C_2} i_s}, \quad \underline{i_2 = \frac{C_2}{C_1 + C_2} i_s}$$

Chapter 6, Solution 26.

(a) $C_{eq} = C_1 + C_2 + C_3 =$ **<u>35μF</u>**

(b) $Q_1 = C_1 v = 5 \text{ x } 150\mu C =$ **<u>0.75mC</u>**
$Q_2 = C_2 v = 10 \text{ x } 150\mu C =$ **<u>1.5mC</u>**
$Q_3 = C_3 v = 20 \text{ x } 150 =$ **<u>3mC</u>**

(c) $w = \frac{1}{2} C_{eq} v^2 = \frac{1}{2} x35x150^2 \mu J =$ **<u>393.8mJ</u>**

Chapter 6, Solution 27.

(a) $$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} = \frac{1}{5} + \frac{1}{10} + \frac{1}{20} = \frac{7}{20}$$

$$C_{eq} = \frac{20}{7}\mu F = \underline{\mathbf{2.857\mu F}}$$

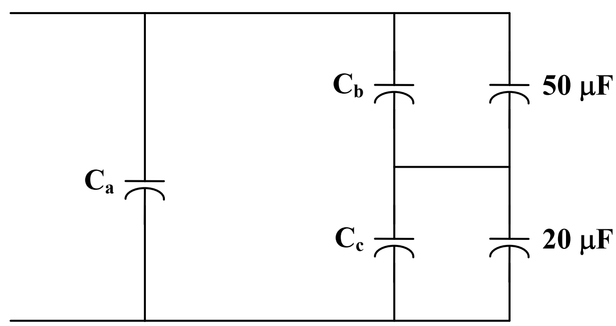
(b) Since the capacitors are in series,

$$Q_1 = Q_2 = Q_3 = Q = C_{eq}v = \frac{20}{7} x200\mu V = \underline{\mathbf{0.5714mV}}$$

(c) $$w = \frac{1}{2}C_{eq}v^2 = \frac{1}{2} x \frac{20}{7} x 200^2 \mu J = \underline{\mathbf{57.143mJ}}$$

Chapter 6, Solution 28.

We may treat this like a resistive circuit and apply delta-wye transformation, except that R is replaced by 1/C.



$$\frac{1}{C_a} = \frac{\left(\frac{1}{10}\right)\left(\frac{1}{40}\right) + \left(\frac{1}{10}\right)\left(\frac{1}{30}\right) + \left(\frac{1}{30}\right)\left(\frac{1}{40}\right)}{\frac{1}{30}}$$

$$= \frac{3}{40} + \frac{1}{10} + \frac{1}{40} = \frac{2}{10}$$

$C_a = 5\mu F$

$$\frac{1}{C_6} = \frac{\frac{1}{400} + \frac{1}{300} + \frac{1}{1200}}{\frac{1}{10}} = \frac{2}{30}$$

$C_b = 15\mu F$

$$\frac{1}{C_c} = \frac{\frac{1}{400}+\frac{1}{300}+\frac{1}{1200}}{\frac{1}{40}} = \frac{4}{15}$$

$C_c = 3.75\mu F$

C_b in parallel with $50\mu F = 50 + 15 = 65\mu F$
C_c in series with $20\mu F = 23.75\mu F$
$65\mu F$ in series with $23.75\mu F = \frac{65x23.75}{88.75} = 17.39\mu F$
$17.39\mu F$ in parallel with $C_a = 17.39 + 5 = 22.39\mu F$

Hence C_{eq} = **<u>22.39µF</u>**

Chapter 6, Solution 29.

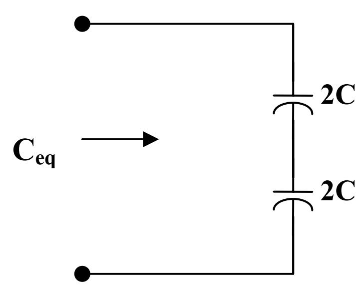
(a) C in series with C = C/(2)

C/2 in parallel with C = 3C/2

$$\frac{3C}{2} \text{ in series with } C = \frac{Cx\frac{3C}{2}}{5\frac{C}{2}} = \frac{3C}{5}$$

$$3\frac{C}{5} \text{ in parallel with } C = C + 3\frac{C}{5} = \underline{\mathbf{1.6\ C}}$$

(b)



$$\frac{1}{C_{eq}} = \frac{1}{2C} + \frac{1}{2C} = \frac{1}{C}$$

C_{eq} = **<u>C</u>**

Chapter 6, Solution 30.

$$v_o = \frac{1}{C}\int_o^t i dt + i(0)$$

For $0 < t < 1$, $i = 60t$ mA,

$$v_o = \frac{10^{-3}}{3x10^{-6}}\int_o^t 60t dt + 0 = 10t^2 kV$$

$v_o(1) = 10kV$

For $1 < t < 2$, $i = 120 - 60t$ mA,

$$v_o = \frac{10^{-3}}{3x10^{-6}}\int_1^t (120 - 60t)dt + v_o(1)$$

$$= [40t - 10t^2]\Big|_1^t + 10kV$$

$$= 40t - 10t^2 - 20$$

$$v_o(t) = \begin{cases} 10t^2 kV, & 0 < t < 1 \\ 40t - 10t^2 - 20kV, & 1 < t < 2 \end{cases}$$

Chapter 6, Solution 31.

$$i_s(t) = \begin{cases} 20tmA, & 0 < t < 1 \\ 20mA, & 1 < t < 3 \\ -50 + 10t, & 3 < t < 5 \end{cases}$$

$C_{eq} = 4 + 6 = 10\mu F$

$$v = \frac{1}{C_{eq}}\int_o^t i dt + v(0)$$

For $0 < t < 1$,

$$v = \frac{10^{-3}}{10x10^{-6}}\int_o^t 20t\, dt + 0 = t^2\ kV$$

For $1 < t < 3$,

$$v = \frac{10^3}{10}\int_1^t 20dt + v(1) = 2(t-1) + 1kV$$

$$= 2t - 1kV$$

For $3 < t < 5$,

$$v = \frac{10^3}{10}\int_3^t 10(t-5)dt + v(3)$$

$$= t^2 - 5 + \Big|_3^t + 5\text{kV} = t^2 - 5t + 11\text{kV}$$

$$v(t) = \begin{cases} t^2\text{kV}, & 0 < t < 1 \\ 2t - 1\text{kV}, & 1 < t < 3 \\ t^2 - 5t + 11\text{kV}, & 3 < t < 5 \end{cases}$$

$$i_1 = C_1 \frac{dv}{dt} = 6x10^{-6}\frac{dv}{dt}$$

$$= \begin{cases} 12t\text{mA}, & 0 < t < 1 \\ 12\text{mA}, & 1 < t < 3 \\ 12 - 30\text{mA}, & 3 < t < 5 \end{cases}$$

$$i_1 = C_2 \frac{dv}{dt} = 4x10^{-6}\frac{dv}{dt}$$

$$= \begin{cases} 8t\text{mA}, & 0 < t < 1 \\ 8\text{mA}, & 1 < t < 3 \\ 8t - 20\text{mA}, & 3 < t < 5 \end{cases}$$

Chapter 6, Solution 32.

(a) $C_{eq} = (12x60)/72 = 10\ \mu F$

$$v_1 = \frac{10^{-3}}{12x10^{-6}}\int_0^t 30e^{-2t}dt + v_1(0) = \underline{-1250e^{-2t}\Big|_0^t + 50} = \underline{-1250e^{-2t} + 1300}$$

$$v_2 = \frac{10^{-3}}{60x10^{-6}}\int_0^t 30e^{-2t}dt + v_2(0) = \underline{250e^{-2t}\Big|_0^t + 20} = \underline{250e^{-2t} - 230}$$

(b) At t=0.5s,

$$v_1 = -1250e^{-1} + 1300 = 840.15, \qquad v_2 = 250e^{-1} - 230 = -138.03$$

$$w_{12\mu F} = \frac{1}{2}x12x10^{-6}x(840.15)^2 = \underline{4.235\ \text{J}}$$

$$w_{20\mu F} = \frac{1}{2}x20x10^{-6}x(-138.03)^2 = \underline{0.1905\ \text{J}}$$

$$w_{40\mu F} = \frac{1}{2}x40x10^{-6}x(-138.03)^2 = \underline{0.381\ \text{J}}$$

Chapter 6, Solution 33

Because this is a totally capacitive circuit, we can combine all the capacitors using the property that capacitors in parallel can be combined by just adding their values and we combine capacitors in series by adding their reciprocals.

3F + 2F = 5F

1/5 +1/5 = 2/5 or 2.5F

The voltage will divide equally across the two 5F capacitors. Therefore, we get:

$$V_{Th} = \underline{7.5\ V},\quad C_{Th} = \underline{2.5\ F}$$

Chapter 6, Solution 34.

$i = 6e^{-t/2}$

$$v = L\frac{di}{dt} = 10x10^{-3}(6)\left(\frac{1}{2}\right)e^{-t/2}$$

$= -30e^{-t/2}$ mV

$v(3) = -300e^{-3/2}$ mV = $\underline{\mathbf{-0.9487\ mV}}$

$p = vi = -180e^{-t}$ mW

$p(3) = -180e^{-3}$ mW = $\underline{\mathbf{-0.8\ mW}}$

Chapter 6, Solution 35.

$$v = L\frac{di}{dt} \qquad L = \frac{V}{\Delta i/\Delta t} = \frac{60x10^{-3}}{0.6/(2)} = \underline{200\ mH}$$

Chapter 6, Solution 36.

$$v = L\frac{di}{dt} = \frac{1}{4}x10^{-3}(12)(2)(-\sin 2t)V$$
$$= \underline{\textbf{- 6 sin 2t mV}}$$

p = vi = -72 sin 2t cos 2t mW

But 2 sin A cos A = sin 2A

p = -36 sin 4t mW

Chapter 6, Solution 37.

$$v = L\frac{di}{dt} = 12x10^{-3}x4(100)\cos 100t$$
$$= 4.8 \cos 100t \text{ V}$$

p = vi = 4.8 x 4 sin 100t cos 100t = 9.6 sin 200t

$$w = \int_o^t pdt = \int_o^{11/200} 9.6\sin 200t$$
$$= -\frac{9.6}{200}\cos 200t\Big|_o^{11/200} J$$
$$= -48(\cos\pi - 1)mJ = \underline{\textbf{96 mJ}}$$

Chapter 6, Solution 38.

$$v = L\frac{di}{dt} = 40x10^{-3}\left(e^{-2t} - 2te^{-2t}\right)dt$$
$$= \underline{40(1-2t)e^{-2t}mV, t > 0}$$

Chapter 6, Solution 39

$$v = L\frac{di}{dt} \longrightarrow i = \frac{1}{L}\int_0^t i dt + i(0)$$

$$i = \frac{1}{200x10^{-3}}\int_0^t (3t^2 + 2t + 4)dt + 1$$

$$= 5(t^3 + t^2 + 4t)\Big|_0^t + 1$$

i(t) = **$5t^3 + 5t^2 + 20t + 1$ A**

Chapter 6, Solution 40

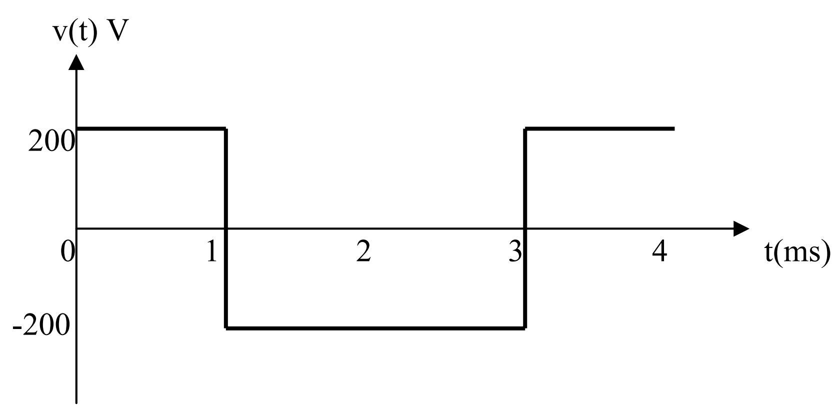
$$v = L\frac{di}{dt} = 20x10^{-3}\frac{di}{dt}$$

$$i = \begin{cases} 10t, & 0 < t < 1\,\text{ms} \\ 20 - 10t, & 1 < t < 3\,\text{ms} \\ -40 + 10t, & 3 < t < 4\,\text{ms} \end{cases}$$

$$\frac{di}{dt} = \begin{cases} 10x10^3, & 0 < t < 1\,\text{ms} \\ -10x10^3, & 1 < t < 3\,\text{ms} \\ 10x10^3, & 3 < t < 4\,\text{ms} \end{cases}$$

$$v = \begin{cases} 200\text{ V}, & 0 < t < 1\,\text{ms} \\ -200\text{ V}, & 1 < t < 3\,\text{ms} \\ 200\text{ V}, & 3 < t < 4\,\text{ms} \end{cases}$$

which is sketched below.



Chapter 6, Solution 41.

$$i = \frac{1}{L}\int_0^t v\,dt + i(0) = \left(\frac{1}{2}\right)\int_o^t 20\left(1 - 2^{-2t}\right)dt + 0.3$$

$$= 10\left(t + \frac{1}{2}e^{-2t}\right)\Big|_o^t + 0.3 = 10t + 5e^{-2t} - 4.7A$$

At t = ls, i = 10 - 4.7 + 5e^{-2} = **5.977 A**

$$w = \frac{1}{2}L\,i^2 = \underline{\mathbf{35.72J}}$$

Chapter 6, Solution 42.

$$i = \frac{1}{L}\int_o^t v\,dt + i(0) = \frac{1}{5}\int_o^t v(t)dt - 1$$

For $0 < t < 1$, $i = \frac{10}{5}\int_0^t dt - 1 = 2t - 1$ A

For 1 < t < 2, i = 0 + i(1) = 1A

For 2 < t < 3, $i = \frac{1}{5}\int 10dt + i(2) = 2t\Big|_t^2 + 1$
= 2t - 3 A

For 3 < t < 4, i = 0 + i(3) = 3 A

For 4 < t < 5, $i = \frac{1}{5}\int_4^t 10dt + i(4) = 2t\Big|_4^t + 3$
= 2t - 5 A

$$\text{Thus,} \quad i(t) = \underline{\begin{cases} 2t - 1A, & 0 < t < 1 \\ 1A, & 1 < t < 2 \\ 2t - 3A, & 2 < t < 3 \\ 3A, & 3 < t < 4 \\ 2t - 5, & 4 < t < 5 \end{cases}}$$

Chapter 6, Solution 43.

$$w = L\int_{-\infty}^{t} i dt = \frac{1}{2}Li(t) - \frac{1}{2}Li^{2}(-\infty)$$
$$= \frac{1}{2}x80x10^{-3}x\left(60x10^{-3}\right) - 0$$
$$= \underline{\mathbf{144\ \mu J}}$$

Chapter 6, Solution 44.

$$i = \frac{1}{L}\int_{t_o}^{t} v dt + i\left(t_o\right) = \frac{1}{5}\int_{o}^{t}(4 + 10\cos 2t)dt - 1$$

$$= \underline{\mathbf{0.8t + \sin 2t -1}}$$

Chapter 6, Solution 45.

$$i(t) = \frac{1}{L}\int_{o}^{t} v(t) + i(0)$$

For $0 < t < 1$, $v = 5t$

$$i = \frac{1}{10x10^{-3}}\int_{o}^{t} 5t\, dt + 0$$

$$= 0.25t^2 \text{ kA}$$

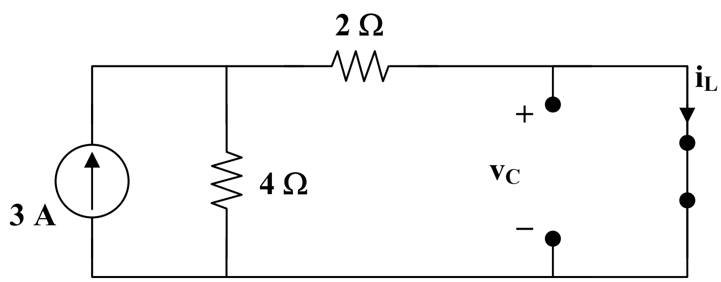
For $1 < t < 2$, $v = -10 + 5t$

$$i = \frac{1}{10x10^{-3}}\int_{1}^{t}(-10 + 5t)dt + i(1)$$
$$= \int_{1}^{t}(0.5t - 1)dt + 0.25kA$$
$$= 1 - t + 0.25t^2 \text{ kA}$$

$$\underline{i(t) = \begin{bmatrix} 0.25t^2 kA, & 0 < t < 1 \\ 1 - t + 0.25t^2 kA, & 1 < t < 2 \end{bmatrix}}$$

Chapter 6, Solution 46.

Under dc conditions, the circuit is as shown below:



By current division,

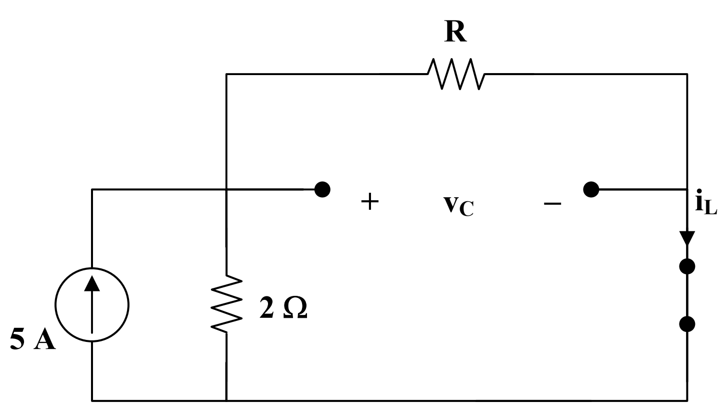
$$i_L = \frac{4}{4+2}(3) = \underline{\mathbf{2A}}, \quad v_c = \underline{\mathbf{0V}}$$

$$w_L = \frac{1}{2} L\, i_L^2 = \frac{1}{2}\left(\frac{1}{2}\right)(2)^2 = \underline{\mathbf{1J}}$$

$$w_c = \frac{1}{2} C\, v_c^2 = \frac{1}{2}(2)(v) = \underline{\mathbf{0J}}$$

Chapter 6, Solution 47.

Under dc conditions, the circuit is equivalent to that shown below:



$$i_L = \frac{2}{R+2}(5) = \frac{10}{R+2}, \quad v_c = Ri_L = \frac{10R}{R+2}$$

$$w_c = \frac{1}{2}Cv_c^2 = 80x10^{-6}x\frac{100R^2}{(R+2)^2}$$

$$w_L = \frac{1}{2}Li_1^2 = 2x10^{-3}x\frac{100}{(R+2)^2}$$

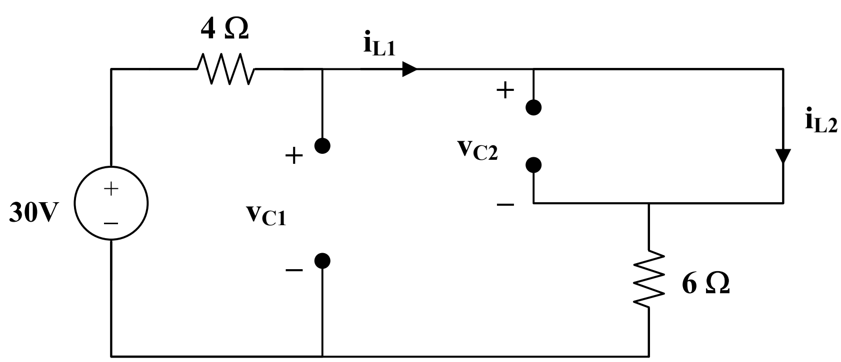
If $w_c = w_L$,

$$80x10^{-6}x\frac{100R^2}{(Rx2)^2} = \frac{2x10^{-3}x100}{(R+2)^2} \longrightarrow 80 \text{ x } 10^{-3}R^2 = 2$$

$$R = \underline{\mathbf{5\Omega}}$$

Chapter 6, Solution 48.

Under dc conditions, the circuit is as shown below:



$$i_{L_1} = i_{L_2} = \frac{30}{4+6} = \underline{\mathbf{3A}}$$

$$v_{C_1} = 6i_{L_1} = \underline{\mathbf{18V}}$$

$$v_{C_2} = \underline{\mathbf{0V}}$$

Chapter 6, Solution 49.

(a) $$L_{eq} = 5 + 6\|(1 + 4\|4) = 5 + 6\|3 = \underline{\mathbf{7H}}$$

(b) $$L_{eq} = 12\|(1 + 6\|6) = 12\|4 = \underline{\mathbf{3H}}$$

(c) $$L_{eq} = 4\|(2 + 3\|6) = 4\|4 = \underline{\mathbf{2H}}$$

Chapter 6, Solution 50.

$$L_{eq} = 10 + 5\|(4\|12 + 3\|6)$$

= 10 + 5||(3 + 2) = 10 + 2.5 = **12.5 mH**

Chapter 6, Solution 51.

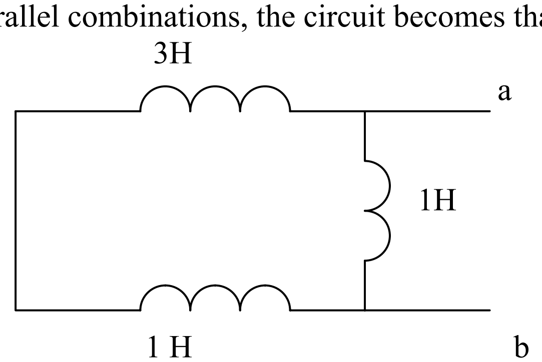
$$\frac{1}{L} = \frac{1}{60} + \frac{1}{20} + \frac{1}{30} = \frac{1}{10} \qquad L = 10 \text{ mH}$$

$$L_{eq} = 10\|(25 + 10) = \frac{10x35}{45}$$

= **7.778 mH**

Chapter 6, Solution 52.

3//2//6 = 1H, 4//12 = 3H
After the parallel combinations, the circuit becomes that shown below.



L_{ab} = (3+1)//1 = (4x1)/5 = **0.8 H**

Chapter 6, Solution 53.

$$L_{eq} = 6 + 10 + 8 \| [5 \| (8+12) + 6 \| (8+4)]$$

$$= 16 + 8 \| (4+4) = 16 + 4$$

L_{eq} = **<u>20 mH</u>**

Chapter 6, Solution 54.

$$L_{eq} = 4 + (9+3) \| (10 \| 0 + 6 \| 12)$$

$$= 4 + 12 \| (0+4) = 4 + 3$$

L_{eq} = **<u>7H</u>**

Chapter 6, Solution 55.

(a) L//L = 0.5L, L + L = 2L

$$L_{eq} = L + 2L // 0.5L = L + \frac{2Lx0.5L}{2L + 0.5L} = \underline{1.4L}$$

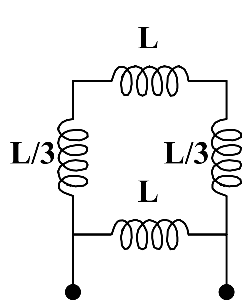
(b) L//L = 0.5L, L//L + L//L = L

L_{eq} = L//L = **<u>0.5L</u>**

Chapter 6, Solution 56.

$$L \| L \| L = \frac{1}{\frac{3}{L}} = \frac{L}{3}$$

Hence the given circuit is equivalent to that shown below:



$$L_{eq} = L \| \left(L + \frac{2}{3}L \right) = \frac{Lx\frac{5}{3}L}{L + \frac{5}{3}L} = \underline{\frac{5}{8}L}$$

Chapter 6, Solution 57.

$$\text{Let } v = L_{eq}\frac{di}{dt} \qquad (1)$$

$$v = v_1 + v_2 = 4\frac{di}{dt} + v_2 \qquad (2)$$

$$i = i_1 + i_2 \longrightarrow i_2 = i - i_1 \qquad (3)$$

$$v_2 = 3\frac{di_1}{dt} \text{ or } \frac{di_1}{dt} = \frac{v_2}{3} \qquad (4)$$

and

$$-v_2 + 2\frac{di}{dt} + 5\frac{di_2}{dt} = 0$$

$$v_2 = 2\frac{di}{dt} + 5\frac{di_2}{dt} \qquad (5)$$

Incorporating (3) and (4) into (5),

$$v_2 = 2\frac{di}{dt} + 5\frac{di}{dt} - 5\frac{di_1}{dt} = 7\frac{di}{dt} - 5\frac{v_2}{3}$$

$$v_2\left(1 + \frac{5}{3}\right) = 7\frac{di}{dt}$$

$$v_2 = \frac{35}{8}\frac{di}{dt}$$

Substituting this into (2) gives

$$v = 4\frac{di}{dt} + \frac{35}{8}\frac{di}{dt}$$

$$= \frac{67}{8}\frac{di}{dt}$$

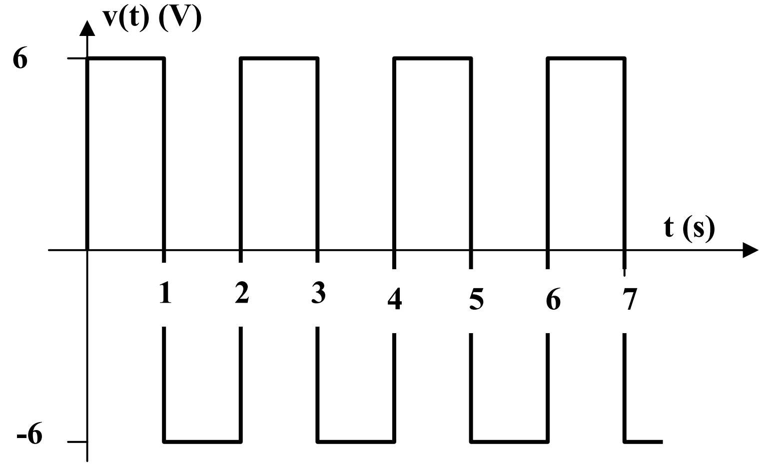
Comparing this with (1),

$$L_{eq} = \frac{67}{8} = \underline{\mathbf{8.375H}}$$

Chapter 6, Solution 58.

$$v = L\frac{di}{dt} = 3\frac{di}{dt} = 3 \text{ x slope of i(t).}$$

Thus v is sketched below:



Chapter 6, Solution 59.

(a) $v_s = (L_1 + L_2)\frac{di}{dt}$

$$\frac{di}{dt} = \frac{v_s}{L_1 + L_2}$$

$$v_1 = L_1\frac{di}{dt},\ \ v_2 = L_2\frac{di}{dt}$$

$$\underline{v_1 = \frac{L_1}{L_1 + L_2}v_s,\ v_L = \frac{L_2}{L_1 + L_2}v_s}$$

(b) $v_i = v_2 = L_1\frac{di_1}{dt} = L_2\frac{di_2}{dt}$

$$i_s = i_1 + i_2$$

$$\frac{di_s}{dt} = \frac{di_1}{dt} + \frac{di_2}{dt} = \frac{v}{L_1} + \frac{v}{L_2} = v\frac{(L_1 + L_2)}{L_1 L_2}$$

$$i_1 = \frac{1}{L_1}\int v dt = \frac{1}{L_1}\int\frac{L_1 L_2}{L_1 + L_2}\frac{di_s}{dt}dt = \underline{\frac{L_2}{L_1 + L_2}i_s}$$

$$i_2 = \frac{1}{L_2}\int v dt = \frac{1}{L_2}\int \frac{L_1 L_2}{L_1 + L_2}\frac{di_s}{dt} dt = \underline{\frac{L_1}{L_1 + L_2} i_s}$$

Chapter 6, Solution 60

$$L_{eq} = 3 // 5 = \frac{15}{8}$$

$$v_o = L_{eq}\frac{di}{dt} = \frac{15}{8}\frac{d}{dt}\left(4e^{-2t}\right) = \underline{-15e^{-2t}}$$

$$i_o = \frac{I}{L}\int_0^t v_o(t)dt + i_o(0) = 2 + \frac{1}{5}\int_0^t (-15)e^{-2t} = 2 + 1.5e^{-2t}\Big|_0^t = \underline{0.5 + 1.5e^{-2t}} \text{ A}$$

Chapter 6, Solution 61.

(a) $i_s = i_1 + i_2$

$i_s(0) = i_1(0) + i_2(0)$

$6 = 4 + i_2(0)$ $\qquad$ $i_2(0) =$ **2mA**

(b) Using current division:

$$i_1 = \frac{20}{30 + 20} i_s = 0.4\left(6e^{-2t}\right) = \mathbf{\underline{2.4e^{-2t}\ mA}}$$

$$i_2 = i_s - i_1 = \mathbf{\underline{3.6e^{-2t}\ mA}}$$

(c) $30 \| 20 = \frac{30x20}{50} = 12mH$

$$v_1 = L\frac{di}{dt} = 10x10^{-3}\frac{d}{dt}\left(6e^{-2t}\right)x10^{-3} = \mathbf{\underline{-120e^{-2t}\ \mu V}}$$

$$v_2 = L\frac{di}{dt} = 12x10^{-3}\frac{d}{dt}\left(6e^{-2t}\right)x10^{-3} = \mathbf{\underline{-144e^{-2t}\ \mu V}}$$

(d)
$$w_{10mH} = \frac{1}{2}x30x10^{-3}\left(36e^{-4t}x10^{-6}\right)$$

$$= 0.8e^{-4t}\Big|_{t=\frac{1}{2}} \mu J$$

$$= \mathbf{\underline{24.36nJ}}$$

$$w_{30mH} = \frac{1}{2}x30x10^{-3}\left(5.76e^{-4t}x10^{-6}\right)\Big|_{t=1/2}$$

$$= \mathbf{\underline{11.693nJ}}$$

$$w_{20mH} = \frac{1}{2}x20x10^{-3}\left(12.96e^{-4t}x10^{-6}\right)\Big|_{t=1/2}$$

$$= \mathbf{\underline{17.54\ nJ}}$$

Chapter 6, Solution 62.

(a) $L_{eq} = 25 + 20 // 60 = 25 + \frac{20x60}{80} = 40 \text{ mH}$

$$v = L_{eq}\frac{di}{dt} \longrightarrow i = \frac{1}{L_{eq}}\int v(t)dt + i(0) = \frac{10^{-3}}{40x10^{-3}}\int_0^t 12e^{-3t}dt + i(0) = -0.1(e^{-3t} - 1) + i(0)$$

Using current division,

$$i_1 = \frac{60}{80}i = \frac{3}{4}i, \quad i_2 = \frac{1}{4}i$$

$$i_1(0) = \frac{3}{4}i(0) \longrightarrow 0.75i(0) = -0.01 \longrightarrow i(0) = -0.01333$$

$$i_2 = \frac{1}{4}(-0.1e^{-3t} + 0.08667) \text{ A} = -25\text{e}^{-3t} + 21.67 \text{ mA}$$

$$i_2(0) = -25 + 21.67 = \underline{-3.33 \text{ mA}}$$

(b) $i_1 = \frac{3}{4}(-0.1e^{-3t} + 0.08667) \text{ A} = \underline{-75\text{e}^{-3t} + 65 \text{ mA}}$

$i_2 = \underline{-25\text{e}^{-3t} + 21.67 \text{ mA}}$

Chapter 6, Solution 63.

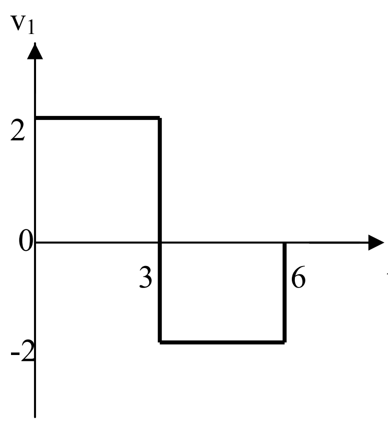
We apply superposition principle and let

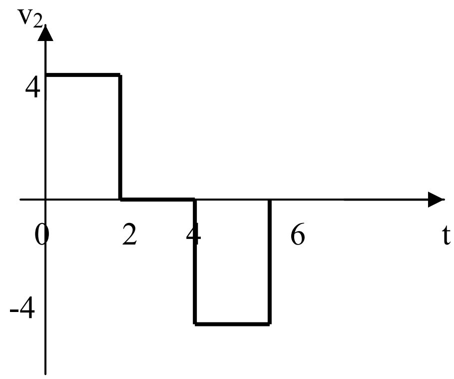
$$v_o = v_1 + v_2$$

where v_1 and v_2 are due to i_1 and i_2 respectively.

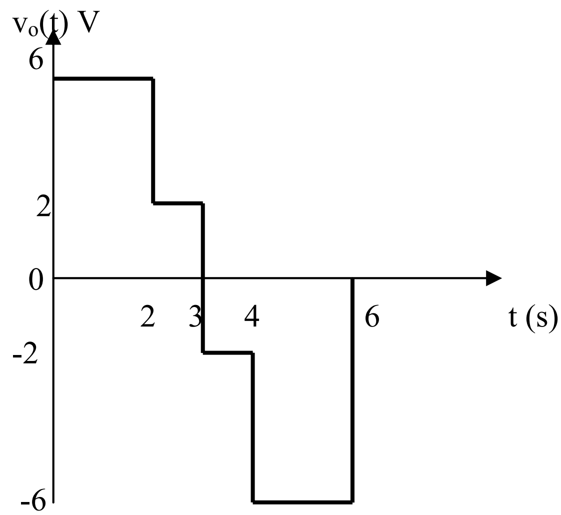
$$v_1 = L\frac{di_1}{dt} = 2\frac{di_1}{dt} = \begin{cases} 2, & 0 < t < 3 \\ -2, & 3 < t < 6 \end{cases}$$

$$v_2 = L\frac{di_2}{dt} = 2\frac{di_2}{dt} = \begin{cases} 4, & 0 < t < 2 \\ 0, & 2 < t < 4 \\ -4, & 4 < t < 6 \end{cases}$$





Adding v_1 and v_2 gives v_o, which is shown below.



Chapter 6, Solution 64.

(a) When the switch is in position A,
$i = -6 = i(0)$
When the switch is in position B,
$i(\infty) = 12/4 = 3, \qquad \tau = L/R = 1/8$

$$i(t) = i(\infty) + [i(0) - i(\infty)]e^{-t/\tau} = \underline{3 - 9e^{-8t} \text{ A}}$$

(b) $-12 + 4i(0) + v = 0$, i.e. $v = 12 - 4i(0) = \underline{36 \text{ V}}$

(c) At steady state, the inductor becomes a short circuit so that
$\underline{v = 0 \text{ V}}$

Chapter 6, Solution 65.

(a) $w_5 = \frac{1}{2} L_1 i_1^2 = \frac{1}{2} x 5 x (4)^2 =$ **40 W**

$w_{20} = \frac{1}{2}(20)(-2)^2 =$ **40 W**

(b) $w = w_5 + w_{20} =$ **80 W**

(c) $i_1 = L_1 \frac{dv}{dt} = 5(-200)\left(50e^{-200t} x 10^{-3}\right)$

$=$ **$-50e^{-200t}$A**

$i_2 = L_2 \frac{dv}{dt} = 20(-200)\left(50e^{-200t} x 10^{-3}\right)$

$=$ **$-200e^{-200t}$A**

$i_2 = L_2 \frac{dv}{dt} = 20(-200)\left(50e^{-200t} x 10^{-3}\right)$

$=$ **$-200e^{-200t}$ A**

(d) $i = i_1 + i_2 =$ **$-250e^{-200t}$ A**

Chapter 6, Solution 66.

$L_{eq} = 20 + 16 + 60 \| 40 = 36 + 24 = 60\text{mH}$

$v = L \frac{di}{dt}$

$i = \frac{1}{L} \int_o^t v dt + i(0)$

$= \frac{1}{60x10^{-3}} \int_o^t 12 \sin 4t \, dt + 0 \text{ mA}$

$i = -50 \cos 4t \Big|_o^t =$ **50(1 - cos 4t) mA**

$60 \| 40 = 24\text{mH}$

$v = L \frac{di}{dt} = 24x10^{-3} \frac{d}{dt}(50)(1 - \cos 4t)\text{mV}$

$=$ **4.8 sin 4t mV**

Chapter 6, Solution 67.

$$v_o = -\frac{1}{RC}\int vi\,dt, \text{ RC = 50 x } 10^3 \text{ x 0.04 x } 10^{-6} = 2 \text{ x } 10^{-3}$$

$$v_o = \frac{-10^3}{2}\int 10\sin 50t\,dt$$

v_o = **100 cos 50t mV**

Chapter 6, Solution 68.

$$v_o = -\frac{1}{RC}\int vi\,dt + v(0), \text{ RC = 50 x } 10^3 \text{ x 100 x } 10^{-6} = 5$$

$$v_o = -\frac{1}{5}\int_o^t 10dt + 0 = -2t$$

The op amp will saturate at $v_o = \pm 12$

-12 = -2t ⟶ **t = 6s**

Chapter 6, Solution 69.

RC = 4 x 10^6 x 1 x 10^{-6} = 4

$$v_o = -\frac{1}{RC}\int v_i dt = -\frac{1}{4}\int v_i dt$$

For 0 < t < 1, v_i = 20, $v_o = -\frac{1}{4}\int_o^t 20dt$ = -5t mV

For 1 < t < 2, v_i = 10, $v_o = -\frac{1}{4}\int_1^t 10dt + v(1) = -2.5(t-1) - 5$

= -2.5t - 2.5mV

For 2 < t < 4, v_i = - 20, $v_o = +\frac{1}{4}\int_2^t 20dt + v(2) = 5(t-2) - 7.5$

= 5t - 17.5 mV

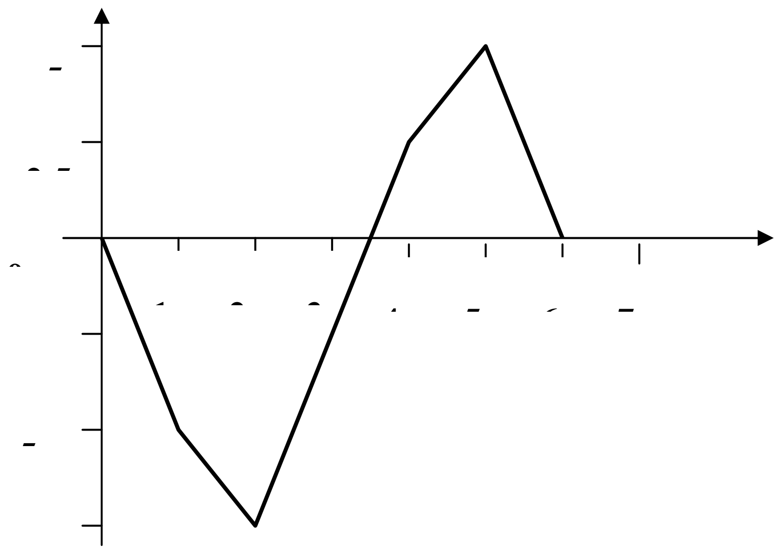
For 4 < t < 5m, v_i = -10, $v_o = \frac{1}{4}\int_4^t 10dt + v(4) = 2.5(t-4) + 2.5$

= 2.5t - 7.5 mV

For 5 < t < 6, v_i = 20, $v_o = -\frac{1}{4}\int_5^t 20dt + v(5) = -5(t-5) + 5$

= - 5t + 30 mV

Thus $v_o(t)$ is as shown below:



Chapter 6, Solution 70.

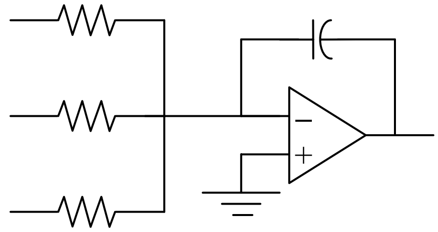
One possibility is as follows:

$$\frac{1}{RC} = 50$$

Let R = 100 kΩ, $C = \frac{1}{50x100x10^3} = 0.2\mu F$

Chapter 6, Solution 71.

By combining a summer with an integrator, we have the circuit below:



$$v_o = -\frac{1}{R_1C}\int v_1dt - \frac{1}{R_2C}\int v_2dt - \frac{1}{R_2C}\int v_2dt$$

For the given problem, C = 2μF,

$R_1C = 1 \longrightarrow R_1 = 1/(C) = 100^6/(2) =$ **<u>500 kΩ</u>**
$R_2C = 1/(4) \longrightarrow R_2 = 1/(4C) = 500k\Omega/(4) =$ **<u>125 kΩ</u>**
$R_3C = 1/(10) \longrightarrow R_3 = 1/(10C) =$ **<u>50 kΩ</u>**

Chapter 6, Solution 72.

The output of the first op amp is

$$v_1 = -\frac{1}{RC}\int v_i \, dt = -\frac{1}{10x10^3 x2x10^{-6}}\int_o^t idt = -\frac{100t}{2}$$

$$= - 50t$$

$$v_o = -\frac{1}{RC}\int v_i \, dt = -\frac{1}{20x10^3 x0.5x10^{-6}}\int_o^t (-50t)dt$$

$$= 2500t^2$$

At t = 1.5ms,

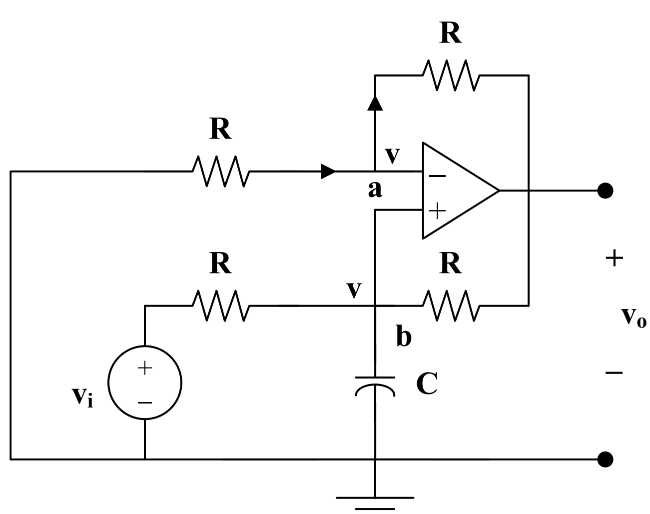
$$v_o = 2500(1.5)^2 x10^{-6} = \underline{\mathbf{5.625\ mV}}$$

Chapter 6, Solution 73.

Consider the op amp as shown below:

Let $v_a = v_b = v$

At node a, $\frac{0 - v}{R} = \frac{v - v_o}{R} \longrightarrow 2v - v_o = 0$ (1)



At node b, $\frac{v_i - v}{R} = \frac{v - v_o}{R} + C\frac{dv}{dt}$

$$v_i = 2v - v_o + RC\frac{dv}{dt} \qquad (2)$$

Combining (1) and (2),

$$v_i = v_o - v_o + \frac{RC}{2}\frac{dv_o}{dt}$$

or

$$v_o = \frac{2}{RC}\int v_i \, dt$$

showing that the circuit is a noninverting integrator.

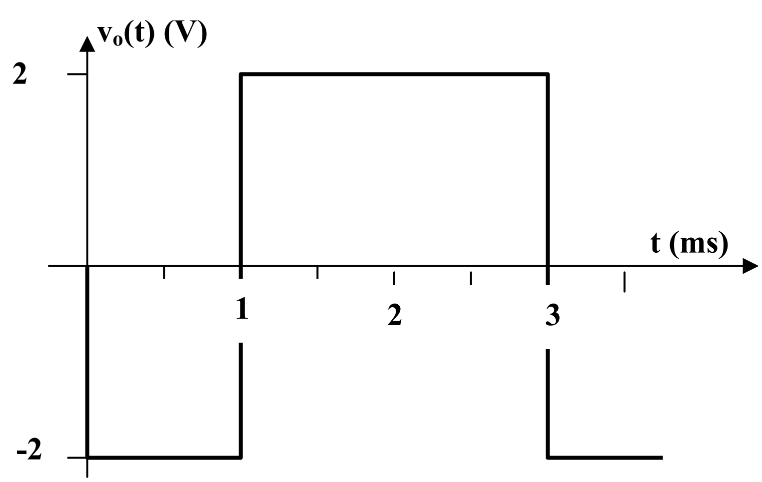
Chapter 6, Solution 74.

RC = 0.01 x 20 x 10^{-3} sec

$$v_o = -RC\frac{dv_i}{dt} = -0.2\frac{dv}{dt}\, m\sec$$

$$v_o = \begin{cases} -2V, & 0 < t < 1 \\ 2V, & 1 < t < 3 \\ -2V, & 3 < t < 4 \end{cases}$$

Thus $v_o(t)$ is as sketched below:



Chapter 6, Solution 75.

$$v_0 = -RC\frac{dv_i}{dt}, \quad RC = 250x10^3 x10x10^{-6} = 2.5$$

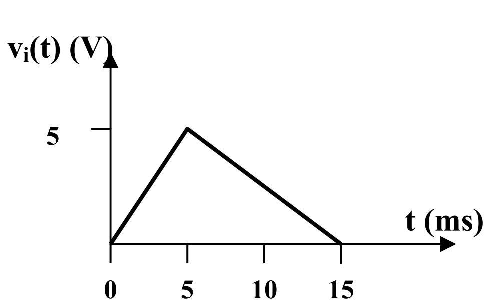
$$v_o = -2.5\frac{d}{dt}(12t) = \underline{-30 \text{ mV}}$$

Chapter 6, Solution 76.

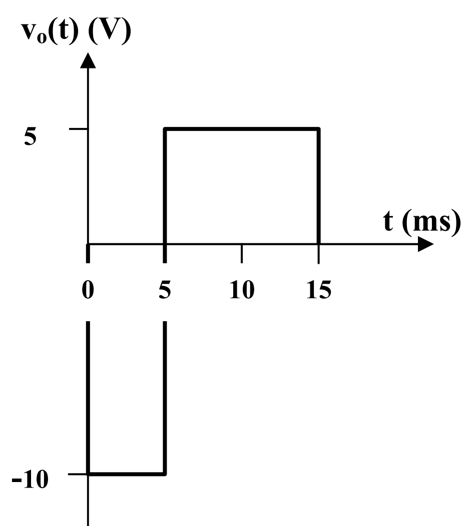
$$v_o = -RC\frac{dv_i}{dt}, \text{ RC} = 50 \text{ x } 10^3 \text{ x } 10 \text{ x } 10^{-6} = 0.5$$

$$v_o = 0.5\frac{dv_i}{dt} = \begin{bmatrix} -10, & 0 < t < 5 \\ 5, & 5 < t < 5 \end{bmatrix}$$

The input is sketched in Fig. (a), while the output is sketched in Fig. (b).



(a)



(b)

Chapter 6, Solution 77.

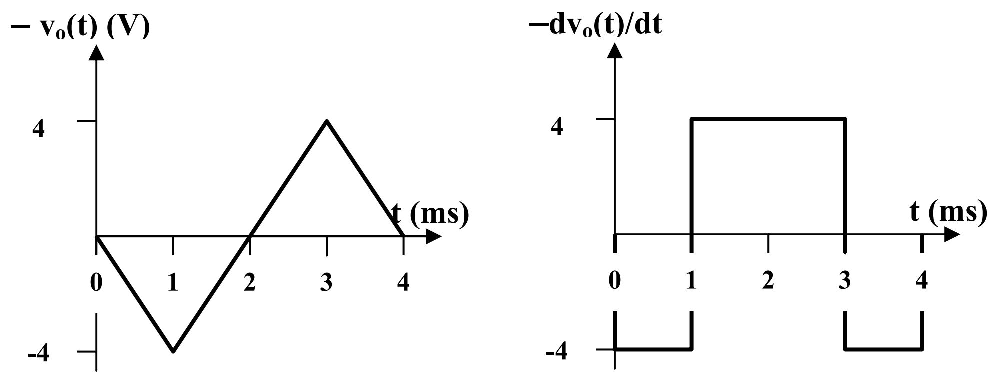
$i = i_R + i_C$

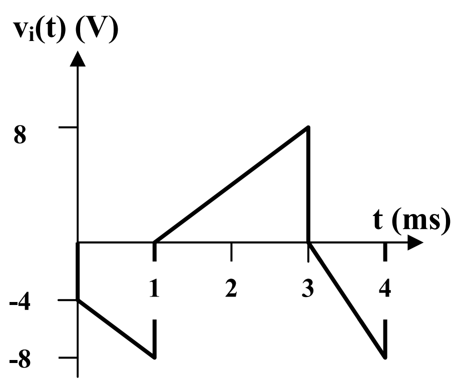
$$\frac{v_i - 0}{R} = \frac{0 - v_0}{R_F} + C\frac{d}{dt}\left(0 - v_o\right)$$

$$R_F C = 10^6 x10^{-6} = 1$$

Hence $v_i = -\left(v_o + \frac{dv_o}{dt}\right)$

Thus v_i is obtained from v_o as shown below:

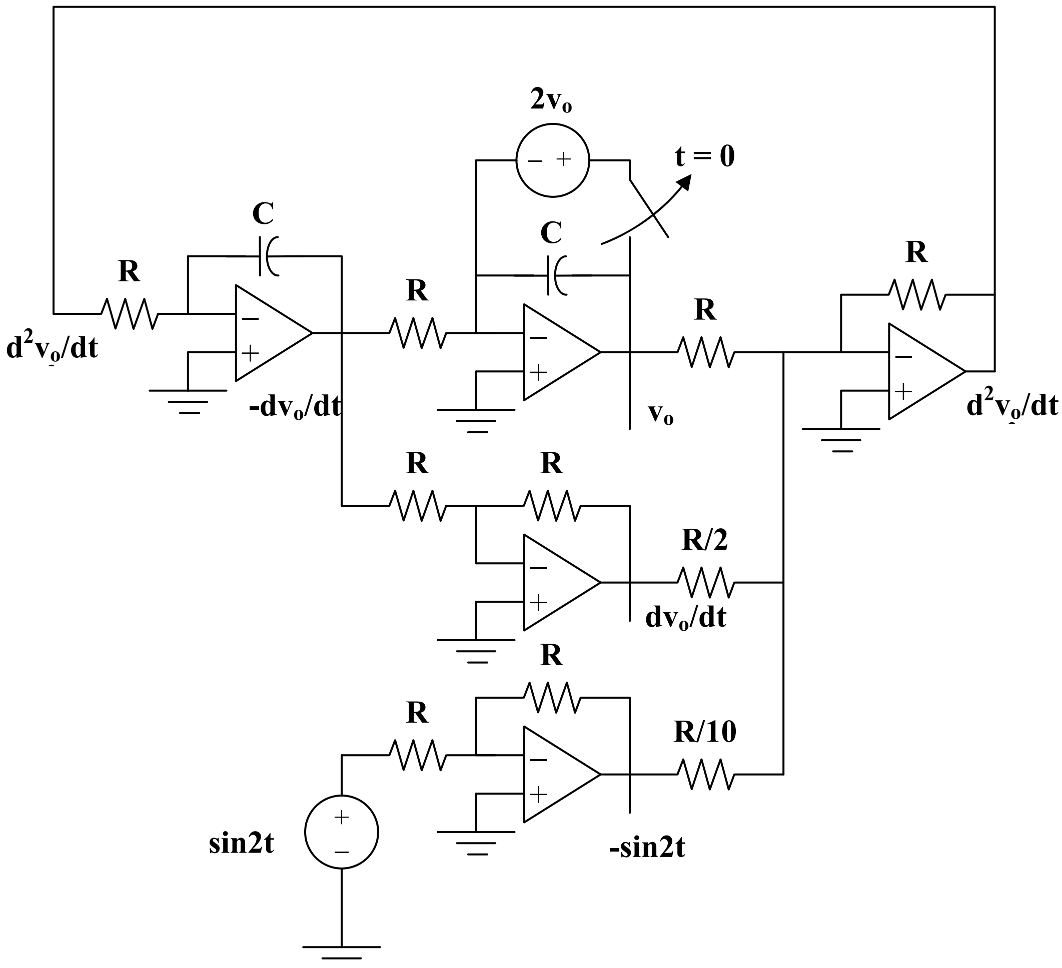




Chapter 6, Solution 78.

$$\frac{d^2v_o}{dt} = 10\sin 2t - \frac{2dv_o}{dt} - v_o$$

Thus, by combining integrators with a summer, we obtain the appropriate analog computer as shown below:

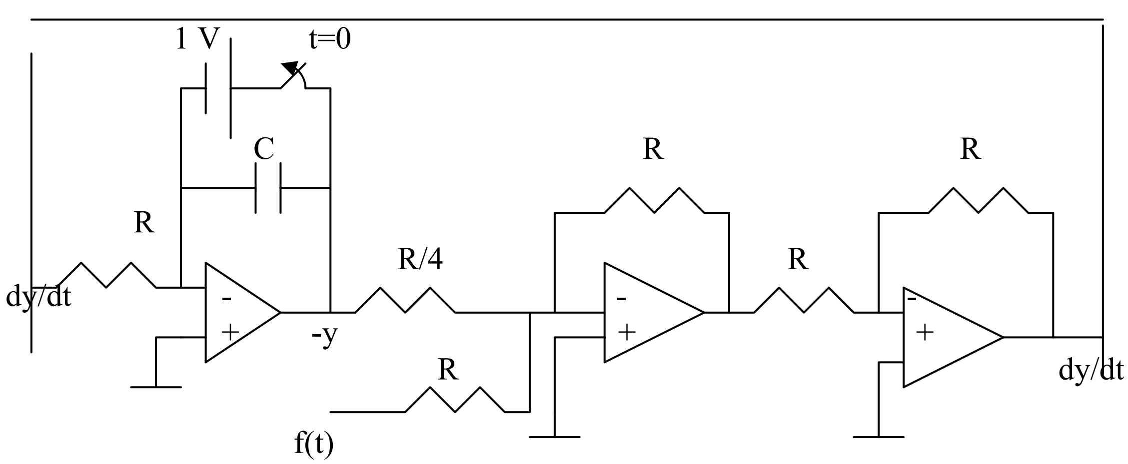


Chapter 6, Solution 79.

We can write the equation as

$$\frac{dy}{dt} = f(t) - 4y(t)$$

which is implemented by the circuit below.



Chapter 6, Solution 80.

From the given circuit,

$$\frac{d^2v_o}{dt^2} = f(t) - \frac{1000k\Omega}{5000k\Omega}v_o - \frac{1000k\Omega}{200k\Omega}\frac{dv_o}{dt}$$

or

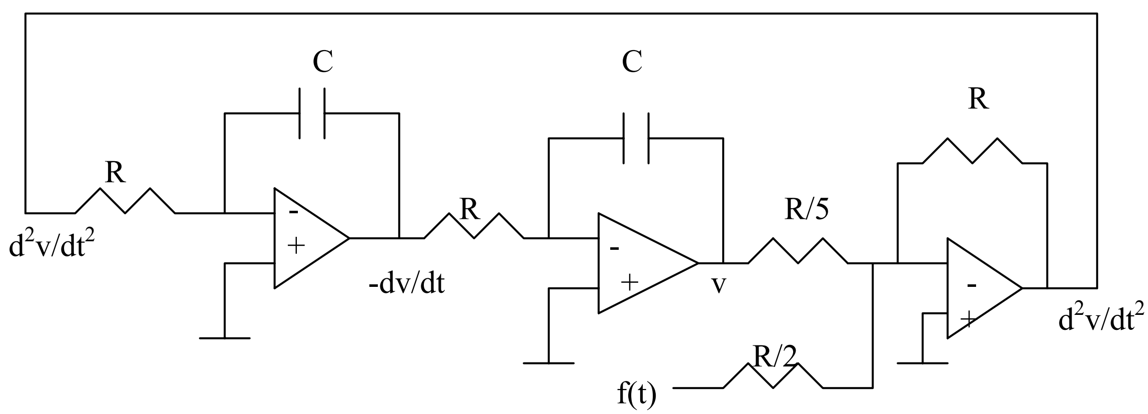
$$\underline{\frac{d^2v_o}{dt^2} + 5\frac{dv_o}{dt} + 2v_o = f(t)}$$

Chapter 6, Solution 81

We can write the equation as

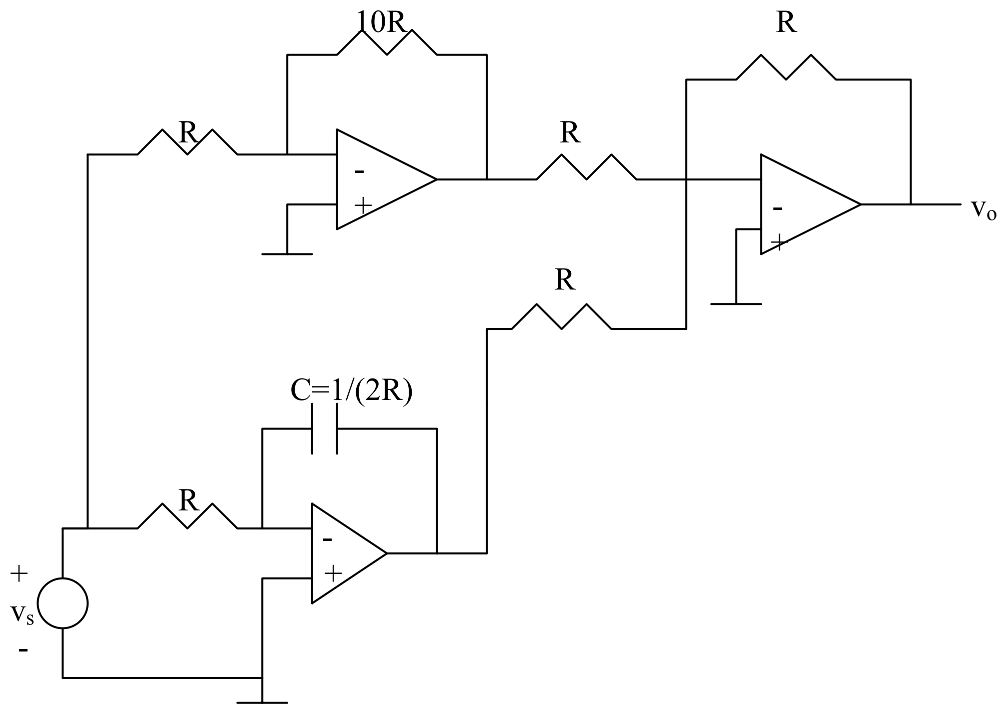
$$\frac{d^2v}{dt^2} = -5v - 2f(t)$$

which is implemented by the circuit below.



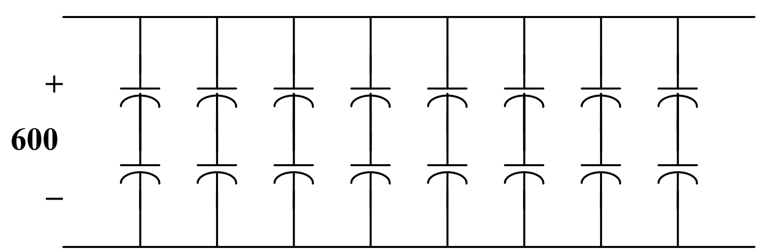
Chapter 6, Solution 82

The circuit consists of a summer, an inverter, and an integrator. Such circuit is shown below.



Chapter 6, Solution 83.

Since two 10μF capacitors in series gives 5μF, rated at 600V, it requires 8 groups in parallel with each group consisting of two capacitors in series, as shown below:



Answer: **<u>8 groups in parallel with each group made up of 2 capacitors in series.</u>**

Chapter 6, Solution 84.

$$\Delta I = \frac{\Delta q}{\Delta t} \qquad \Delta I \text{ x } \Delta t = \Delta q$$

$$\Delta q = 0.6 \text{ x } 4 \text{ x } 10^{-6}$$
$$= 2.4\mu C$$

$$C = \frac{\Delta q}{\Delta v} = \frac{2.4x10^{-6}}{(36-20)} = \underline{150nF}$$

Chapter 6, Solution 85.

It is evident that differentiating i will give a waveform similar to v. Hence,

$$v = L\frac{di}{dt}$$

$$i = \begin{bmatrix} 4t, 0 < t < 1 \\ 8 - 4t, 1 < t < 2 \end{bmatrix}$$

$$v = L\frac{di}{dt} = \begin{bmatrix} 4L, 0 < t < 1 \\ -4L, 1 < t < 2 \end{bmatrix}$$

But, $$v = \begin{bmatrix} 5mV, 0 < t < 1 \\ -5mV, 1 < t < 2 \end{bmatrix}$$

Thus, $4L = 5 \text{ x } 10^{-3} \longrightarrow$ L = 1.25 mH in a **<u>1.25 mH inductor</u>**

Chapter 6, Solution 86.

(a) For the series-connected capacitor

$$C_s = \frac{1}{\frac{1}{C} + \frac{1}{C} + ... + \frac{1}{C}} = \frac{C}{8}$$

For the parallel-connected strings,

$$C_{eq} = 10C_s = \frac{10C_s}{8} = 10x\frac{1000}{3}\mu F = \underline{\mathbf{1250\mu F}}$$

(b) $v_T = 8 \times 100V = 800V$

$$w = \frac{1}{2}C_{eq}v_T^2 = \frac{1}{2}\left(1250x10^{-6}\right)(800)^2$$

$= \underline{\mathbf{400J}}$