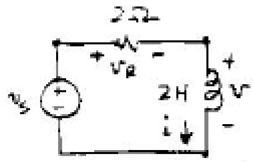
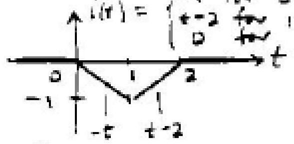
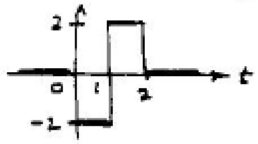
3.2



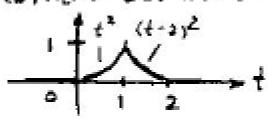
$$i(t) = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ -t & \text{for } 0 < t \le 1\,\text{s} \\ t-2 & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$$



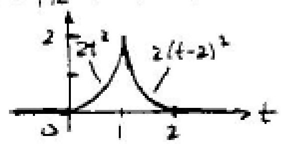
(a) $v(t) = L\dfrac{di(t)}{dt} = 2\dfrac{di(t)}{dt} = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ -2 & \text{for } 0 < t \le 1\,\text{s} \\ 2 & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$



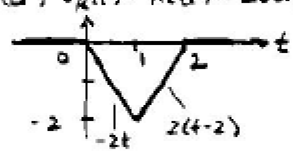
(b) $w_L(t) = \frac{1}{2}Li^2(t) = i^2(t) = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ t^2 & \text{for } 0 < t \le 1\,\text{s} \\ (t-2)^2 & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$



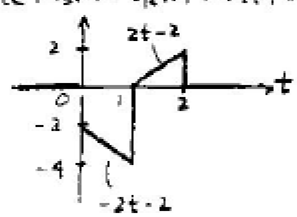
(c) $p_R(t) = Ri^2(t) = 2i^2(t) = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ 2t^2 & \text{for } 0 < t \le 1\,\text{s} \\ 2(t-2)^2 & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$



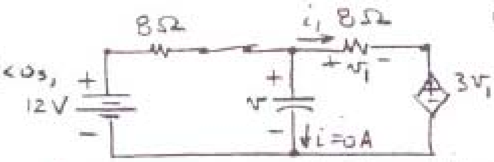
(d) $v_R(t) = Ri(t) = 2i(t) = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ -2t & \text{for } 0 < t \le 1\,\text{s} \\ 2(t-2) & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$



(e) $v_s(t) = v_R(t) + v(t) = \begin{cases} 0 & \text{for } t \le 0\,\text{s} \\ -2t-2 & \text{for } 0 < t \le 1\,\text{s} \\ 2t-2 & \text{for } 1 < t \le 2\,\text{s} \\ 0 & \text{for } t > 2\,\text{s} \end{cases}$



3.37 For $t < 0$ s,



By KCL, $v = v_1 + 3v_1 = 4v_1$

For dc, the capacitor is an open circuit. Thus, $i(t) = \underline{0\,A}$.

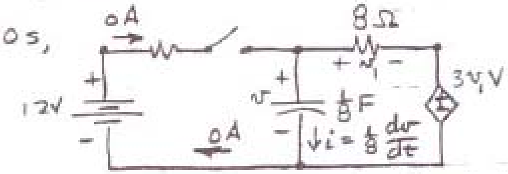
By KVL, $12 = 8i_1 + v_1 + 3v_1 = 8i_1 + 4v_1 = 8i + 4(8i_1) = 40i_1$

$\therefore i_1 = \frac{12}{40} = 0.3\,A \Rightarrow v_1 = 8i_1 = 8(0.3) = 2.4\,A$

$\therefore v(t) = 4v_1(t) = 4(2.4) = \underline{9.6\,V}$

Thus, $v(0) = 9.6$ V

For $t \geq 0$ s,



By KVL, $v - 3v_1 - v_1 = 0$ By Ohm's law, $v_1 = -8i$

$v - 4v_1 = 0$

$v - 4(-8i) = 0$

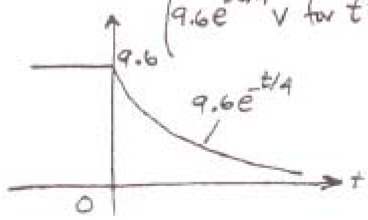
$v + 32\left(\frac{1}{8}\frac{dv}{dt}\right) = 0$

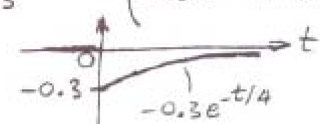
$\frac{dv}{dt} + \frac{1}{4}v = 0 \Rightarrow v(t) = v(0)e^{-t/4} = \underline{9.6e^{-t/4}\ V}$

Thus, $i(t) = \frac{1}{8}\frac{dv(t)}{dt} = \frac{1}{8}\frac{d}{dt}(9.6e^{-t/4}) = \underline{-0.3e^{-t/4}\ A}$

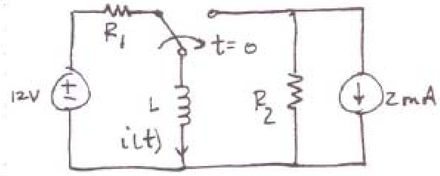
Hence,

$$v(t) = \begin{cases} 9.6\ V & \text{for } t < 0\,s \\ 9.6e^{-t/4}\ V & \text{for } t \geq 0\,s \end{cases} \qquad i(t) = \begin{cases} 0\ A & \text{for } t < 0\,s \\ -0.3e^{-t/4}\ A & \text{for } t \geq 0\,s \end{cases}$$





6.8



$R_1 = 6k\Omega$

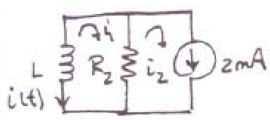
$R_2 = 4k\Omega$

$L = 0.2mH$

When $t < 0$,

$i(0^-) = i(0^+) = \frac{12}{R_1} = 2mA$

For $t > 0$



KVL: $L\frac{di_1(t)}{dt} + R_2(i_1 - i_2) = 0$ & $i_2 = 2mA$

$$\frac{di_1(t)}{dt} + \frac{R_2}{L}i_1 = \frac{R_2}{L}i_2$$

Assume $i_1(t) = K_1 + K_2 e^{-t/\tau}$, now, $-\frac{K_2}{\tau}e^{-t/\tau} + \frac{R_2}{L}K_1 + \frac{R_2}{L}K_2 e^{-t/\tau} = \frac{R_2}{L}i_2$

yields $\tau = L/R_2 = 50ns$ and $K_1 = 2mA$.

$i_1(0) = -i(0) = -2mA = K_1 + K_2 \Rightarrow K_2 = -4mA$. Also, $i(t) = -i_1(t)$

$$i(t) = (4e^{-2\times10^{6}t} - 2)mA \text{ for } t \geq 0 \text{ and } i(t) = 2mA \quad t < 0$$

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