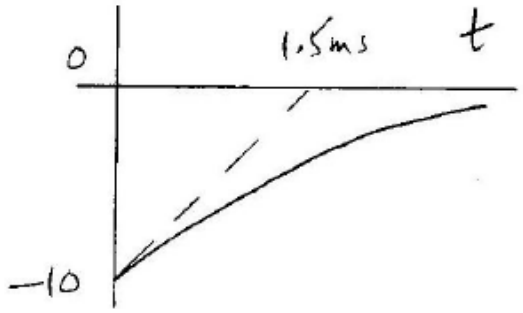
P3.17 $\tau = \frac{L}{R} = \frac{1.5}{1000} = 1.5\text{ms}$ $v_L(\infty) = 0$, $v_L(0) = -10\text{mA} \times 1000\Omega = -10\text{V}$

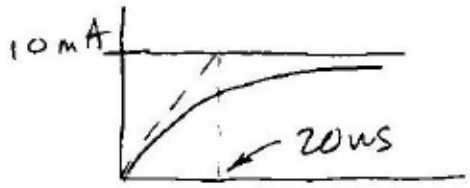
$$v_L(t) = 0 + (-10-0)e^{-t/1.5\text{ms}} \quad \text{V}$$



P3.18 (a) $\tau = \frac{L}{R} = \frac{0.2\text{mH}}{10^4} = 2\times10^{-8} = 20\text{ns}$

$i(0) = 10\text{mA}$, $i(\infty) = 0$ so $i = 0 + (10-0)e^{-t/20\text{ns}}$ mA

(b) $i_{sw} = 10(1-e^{-t/20\text{ns}})$ mA



P3.19 (a) $\tau = 1\mu F \times 100\,\Omega = 100\mu s$

$$i(0) = \frac{100V}{100\,\Omega} = 1A \quad , \; i(\infty) = 0$$

$$i(t) = 1\, e^{-t/100\mu s} \; A$$

(b) $p_R = i^2 R = 100\, e^{-2t/100\mu s} \Rightarrow W_R = \int_0^\infty 100\, e^{-2t/100\mu s}\, dt$

$$W_e = \tfrac{1}{2} C v_c^2(0) = \tfrac{1}{2} \times 10^{-6} (100)^2 = \frac{1}{200} \; J$$

$$= \tfrac{1}{2} \times 10^{-2} \; J \quad \longleftarrow \text{SAME}$$

P3.21. (a) $\tau = 1200 \times 5\mu F = 6000\mu s = 6ms$

$v_{sw}(0) = 0$ since capacitor is charged to +10V.

$v_{sw}(\infty) = +10V$ since $v_c \to 0$

$$v_{sw} = 10 + (0 - 10) e^{-t/6ms}$$

P3.35.

$$\tau = 100\mu F \times (10 \| 30) = 0.75 \; ms$$

$v(0) = +50V$

$$v(\infty) = 50 \times \frac{10}{10+30} = +12.5V$$

$$\Rightarrow v(t) = 12.5 + (50 - 12.5) e^{-t/7.5}$$

$$W_e = \tfrac{1}{2} \times 100\mu F \times (37.5)^2 = 70.3 \; mJ$$

P3.38. Switch closed: $\tau = 10\mu F \times (2k\Omega \| 2k\Omega) = 10ms$

$i(0) = 0$

$i(\infty) = \frac{10V}{2+2k\Omega} = 2.5mA$ $\Rightarrow$ $i(t) = 2.5\left(1 - e^{-t/10ms}\right)$ mA

Switch open: $\tau = 10\mu F \times 2k\Omega = 20ms$

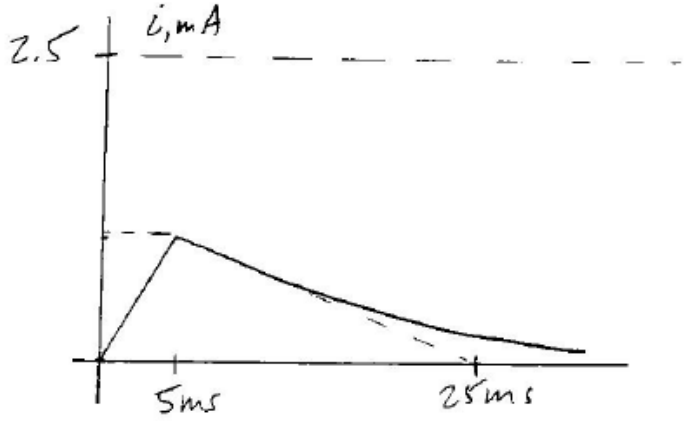
$i(\text{"0"}) = 2.5\left(1 - e^{-5/10}\right) = 0.984mA$

$i(\infty) = 0$

So

$i(t) = 0.984\, e^{-t'/20ms}$ mA

$= 0.984\, e^{-(t-5ms)/20ms}$



P3.39. switch closed $\tau = \frac{0.2}{125 \| 500} = 2\text{ms}$

$v(0) = 120 \times \frac{125}{125+500} = 24\text{V}$

$v(\infty) = 0\ \text{V} \Rightarrow v(t) = 24e^{-t/2\text{ms}}\ \text{V}$

We also need $i_L = \frac{120}{500}(1 - e^{-t/2\text{ms}}) = 0.0944\text{ A at } t = 1\text{ms}$

Switch open: $\tau = \frac{0.2}{125} = 1.6\text{ms}$

$v(\text{"0"}) = -0.944 \times 125 = -11.8\text{V}$

$v(\infty) = 0 \Rightarrow v(t') = -11.8e^{-t'/1.6\text{ms}}$