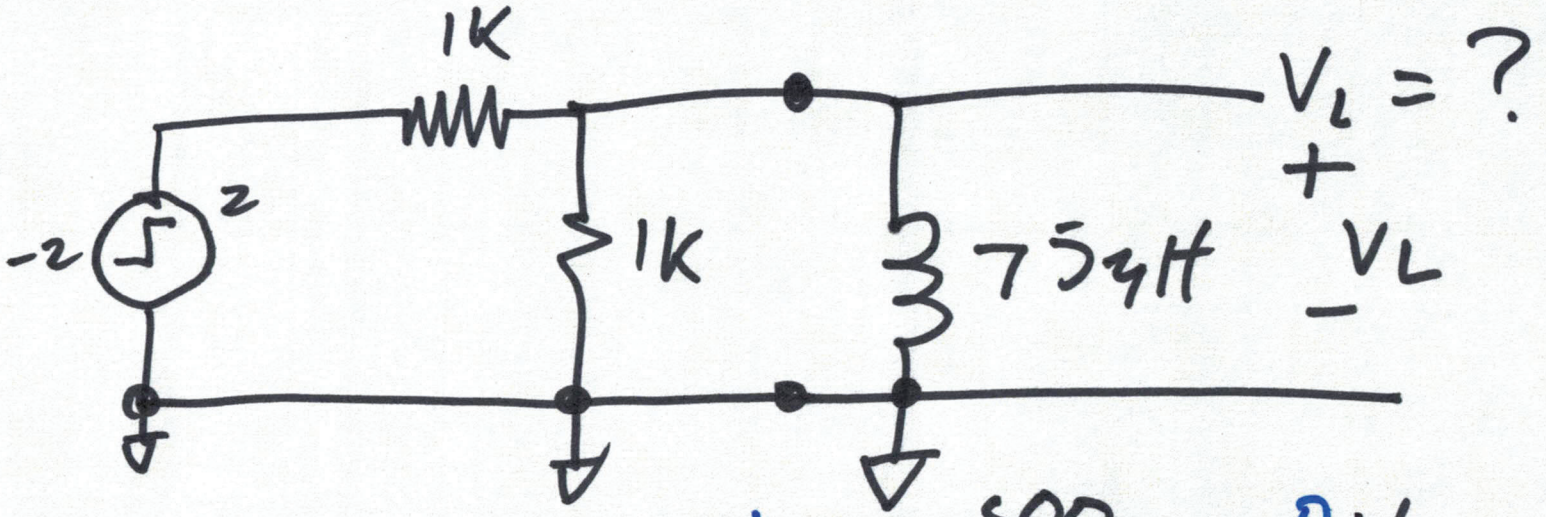
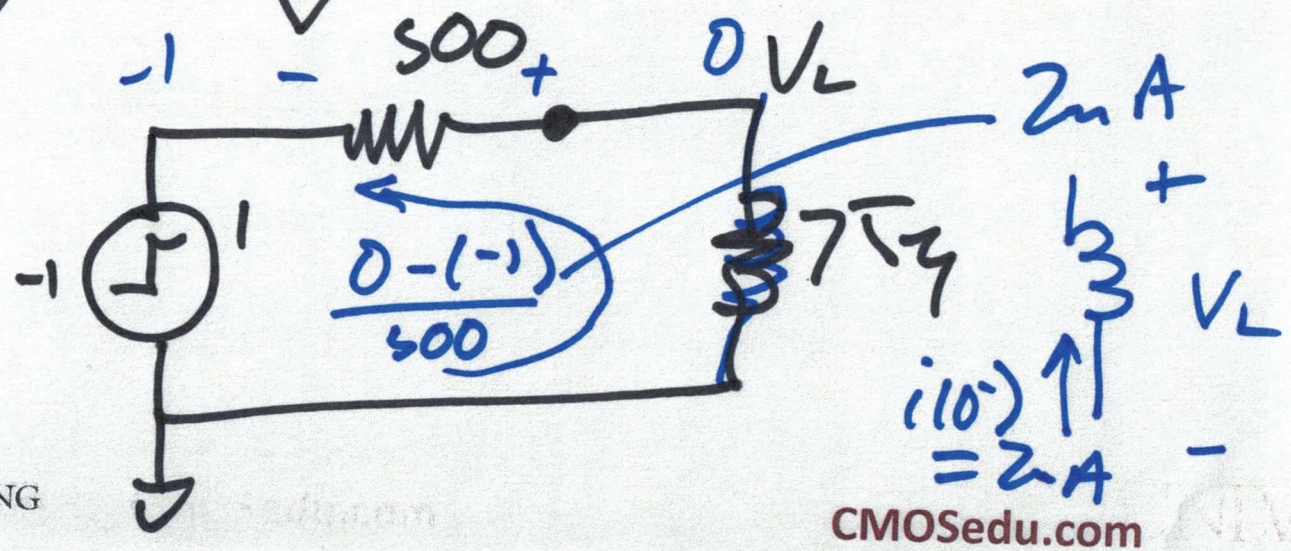
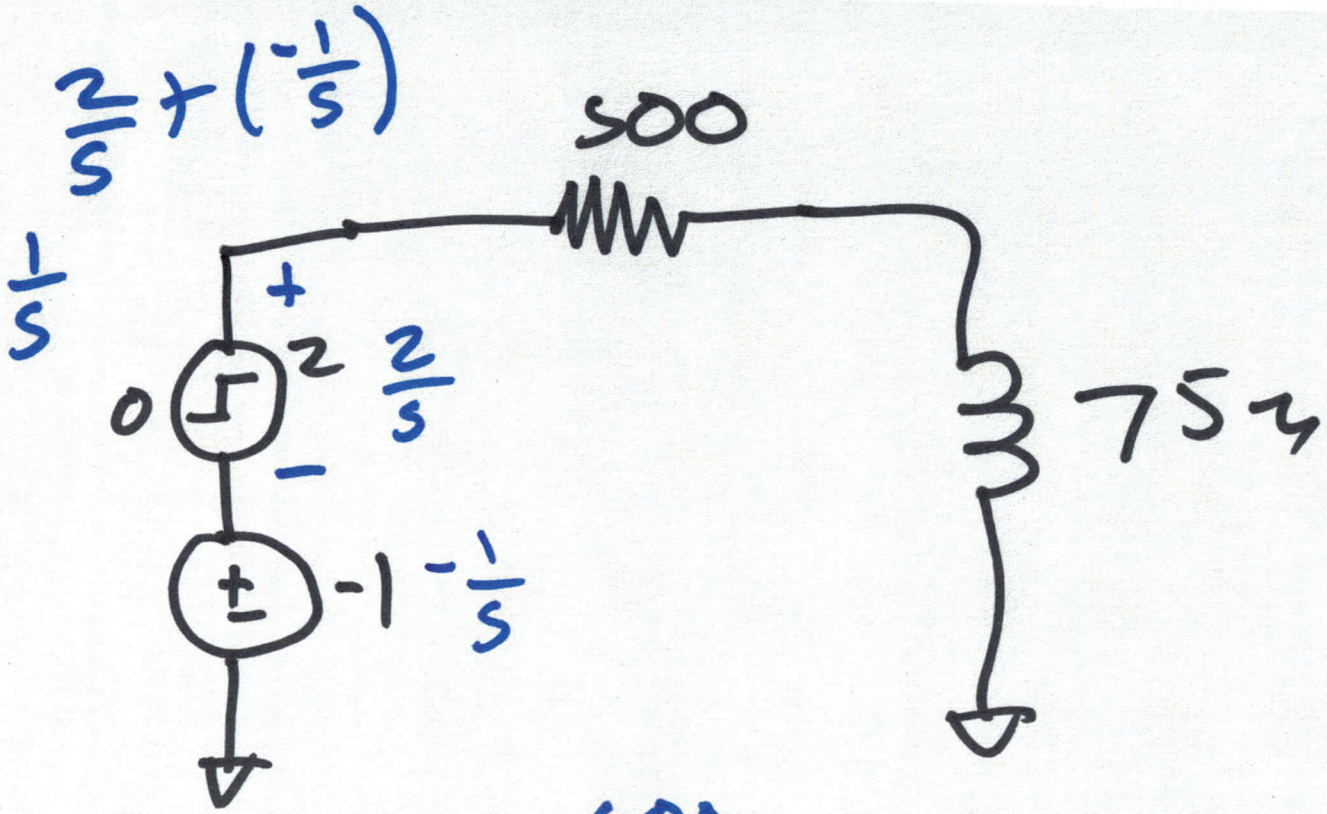
EE 220 Circuits II

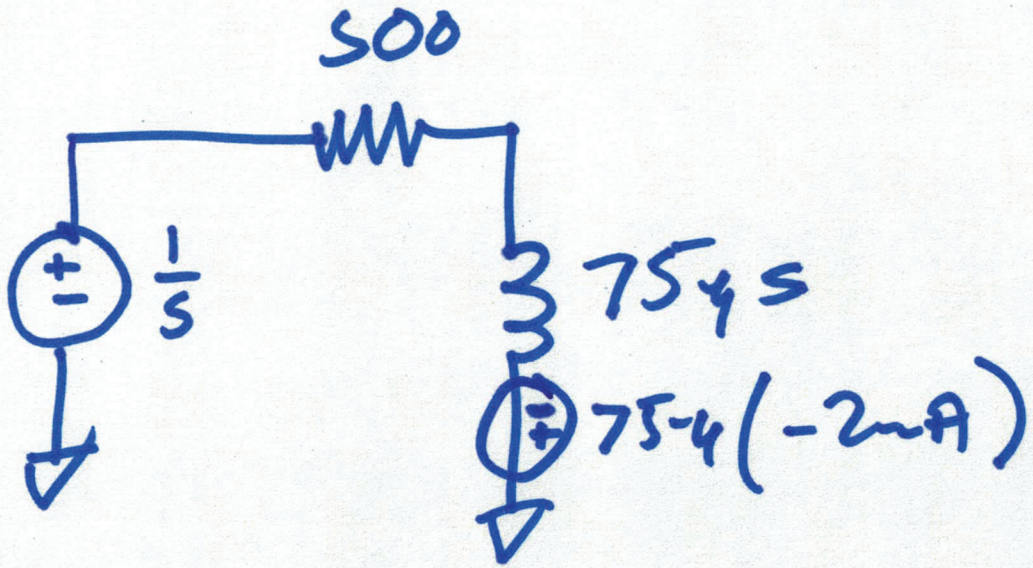
Lecture 22

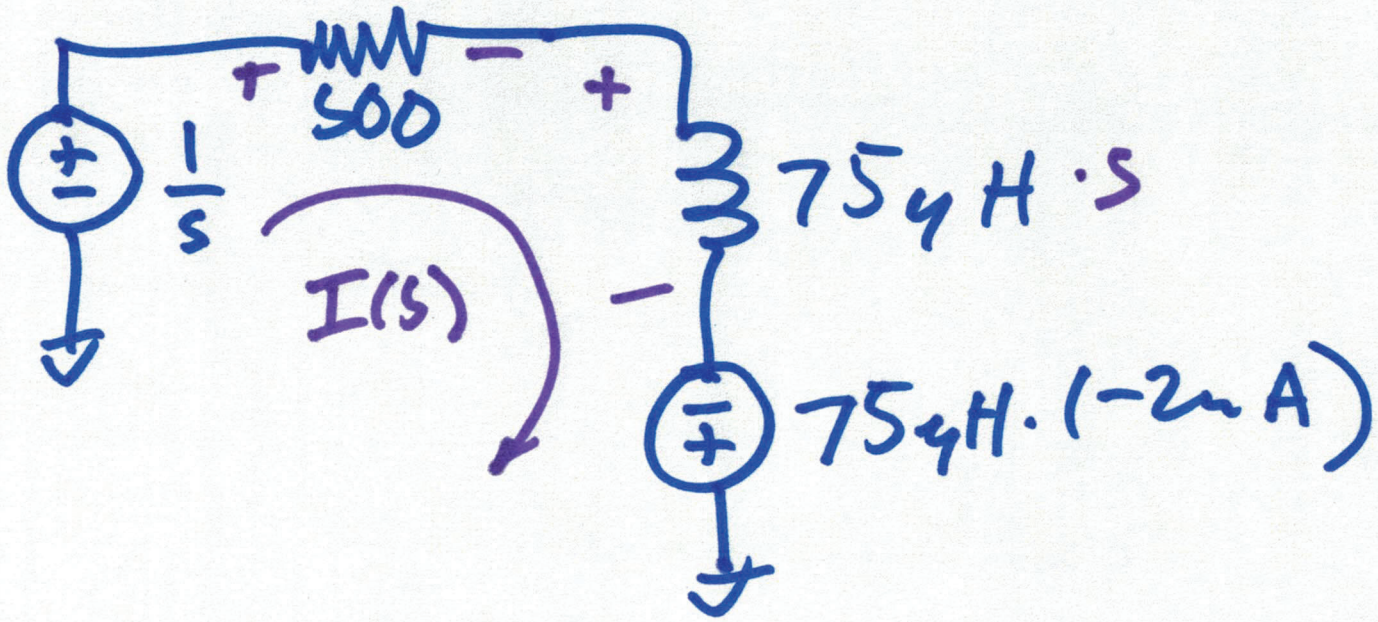
April 17, 2023






2/s + (-1/s)
500
1/s
+
0
2
2/s
−
-1
-1/s
75Ω


500
1/s
75Ω s
75Ω(-2mA)



$$\frac{1}{s} - I(s)\cdot 500 - I(s)\cdot s\cdot 75\mu + 75\mu(-2m) = 0$$

$$I(s)(500 + s\cdot 75\mu) = \frac{1}{s} - 75\mu\cdot 2m$$

$$I(s) = \frac{\frac{1}{s} - 75\mu\cdot 2m}{s\cdot 75\mu + 500}$$

$$\frac{\frac{s}{75\mu}\left(\frac{1}{s} - 75\mu \cdot 2m\right)}{\frac{s}{75\mu}\left(s \cdot 75\mu + 500\right)} = \frac{\frac{1}{75\mu} - 2m \cdot s}{s\left(s + \frac{500}{75\mu}\right)}$$

$$\left(\frac{\frac{1}{75\mu} - 2m \cdot s}{s\left(s + \frac{500}{75\mu}\right)}\right) s \Bigg|_{s=0} = \left(\frac{A}{s}\right) s + \left(\frac{B}{s + \frac{500}{75\mu}}\right) s \Bigg|_{s=0}$$

$$\frac{\frac{1}{75\mu} - 2m \cdot 0}{0 + \frac{500}{75\mu}} = A = \frac{1}{500} = \frac{2}{1000}$$

$$\boxed{A = 2mA}$$

$$\left(\frac{\frac{1}{754} - 2m \cdot s}{s\left(s + \frac{500}{754}\right)}\right)\left(s + \frac{500}{754}\right) = \frac{A}{s}\left(s + \frac{500}{754}\right) + \frac{B}{s + \frac{500}{754}}\left(s + \frac{500}{754}\right)$$

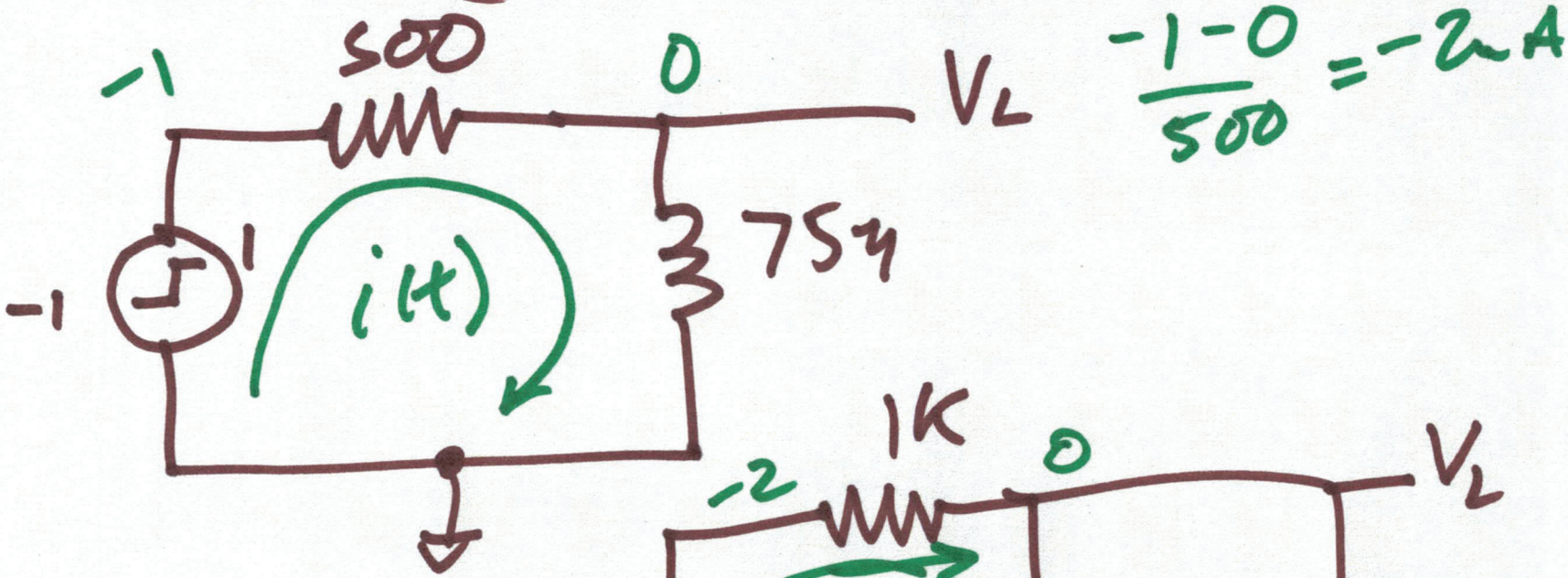
$$\left.\frac{\frac{1}{754} - 2m \cdot s}{s}\right|_{s=\frac{-500}{754}} = \frac{A \cdot \left(s + \frac{500}{754}\right)}{s} + B \qquad \left(\frac{500}{754} \to 0\right)$$

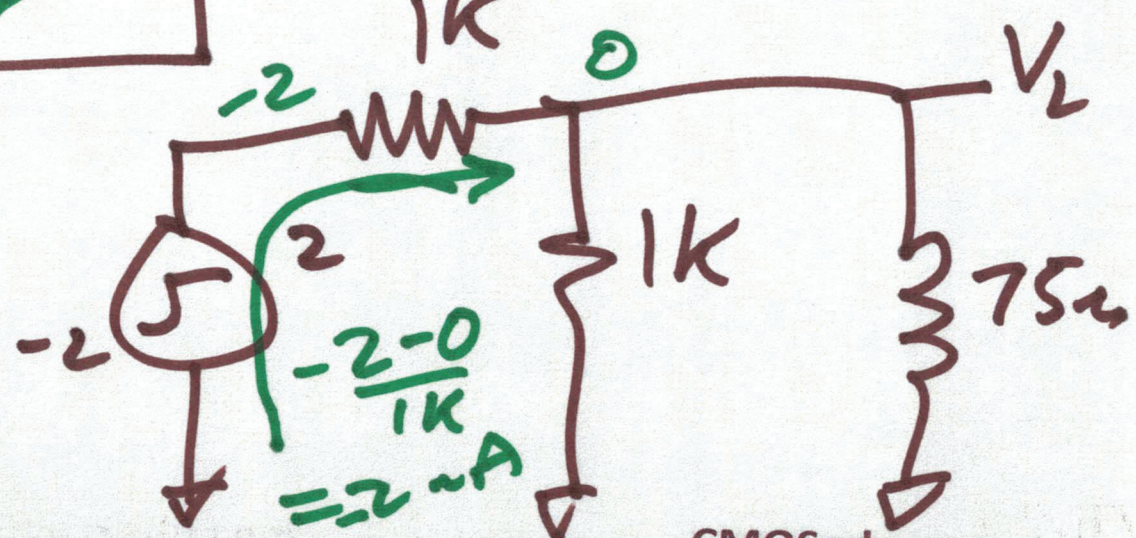
$$\frac{\frac{1}{754} - 2\times10^{-3} \cdot \left(\frac{-500}{754}\right)}{\frac{-500}{754}} = B = \frac{1+1}{-500} = -\frac{4}{1000}$$

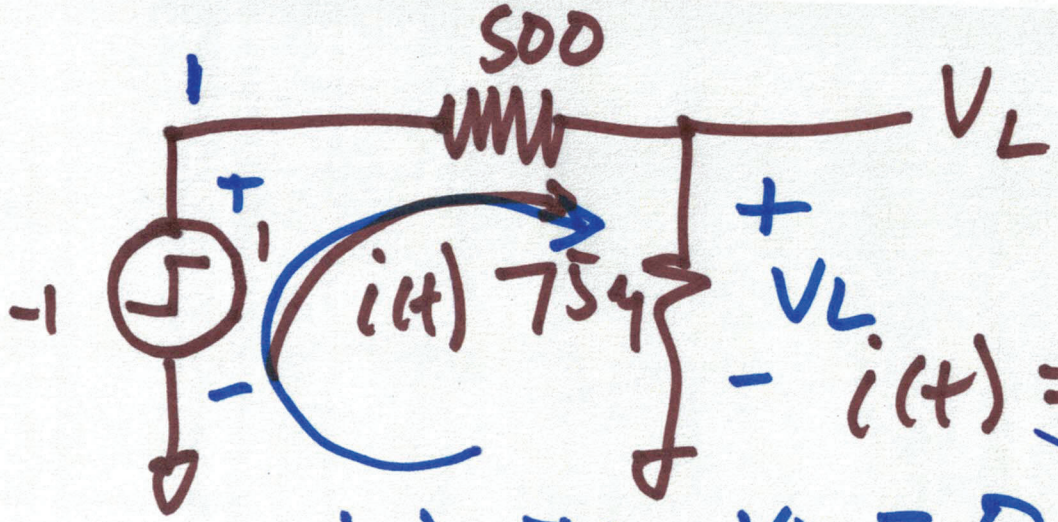
$$\boxed{B = -4m\,A}$$

$$I(s) = \frac{2mA}{s} + \frac{-4mA}{s + \frac{1}{75\mu / 500}}$$

$$i(t) = \left(2mA - 4mA\, e^{-t/75\mu/500}\right) u(t)$$







$$1V - i(t)\cdot 500 - V_L = 0$$

$$V_L = 1 - 500\cdot i(t)$$

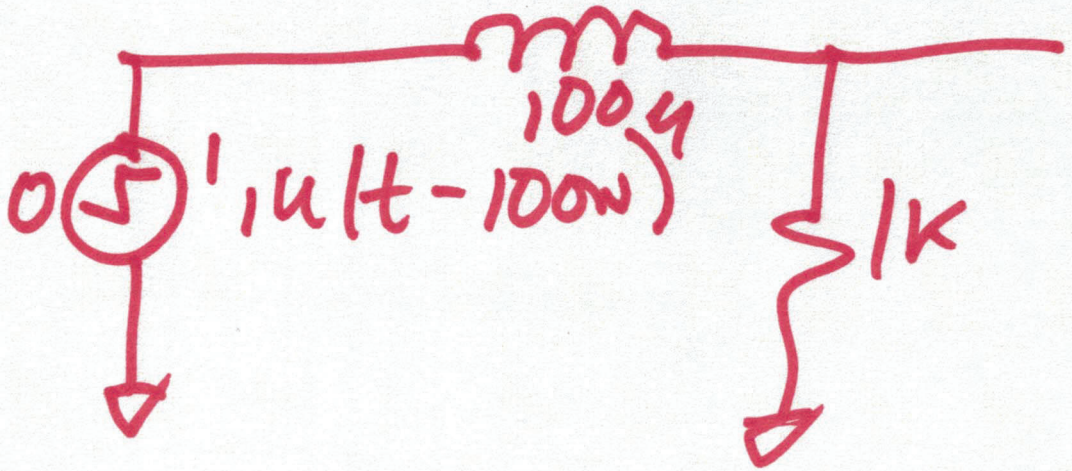
$$i(t) = (2mA - 4mA\,e^{-t/\tau})u(t)$$

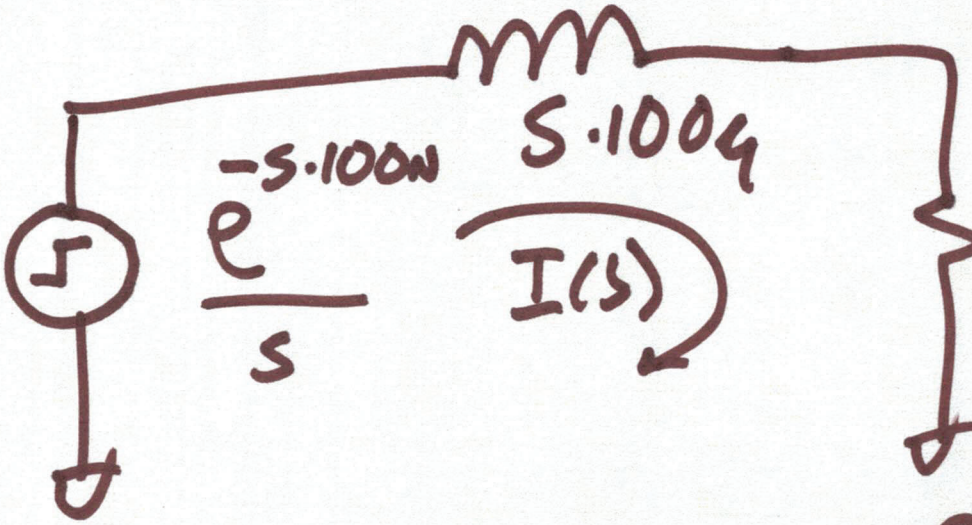
$$\tau = \frac{L}{R} = \frac{75\mu}{500}$$

$$v_L(t) = 1 - \frac{1}{2}k\left(+2mA - 4mA\,e^{-t/\tau}\right)u(t)$$

$$= 1 - 1 + 2e^{-t/\tau}$$

$$v_L(t) = 2e^{-t/\tau}\cdot u(t)$$





$$I(s) = \frac{\frac{e^{-s\cdot 100n}}{s}}{s\cdot 100\cdot 10^{-6} + 10^{3}}$$

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$$I(s) = \frac{e^{-s\cdot 100n} \cdot \frac{1}{10^{-4}}}{s\left(s\cdot 10^{-4} + 10^{3}\right)\cdot \frac{1}{10^{-4}}}$$

$$= \frac{\frac{1}{10^{-4}} e^{-s\cdot 100n}}{s(s + 10^{7})}$$

$\tau = \frac{L}{R} = \frac{100n}{1K}$

$= 10^{-7}$

$= \frac{1}{10^{7}}$

$$\frac{\frac{1}{10^{-4}} e^{-s\cdot 100n} \cdot s}{s(s+10^{7})} = \frac{A \cdot e^{-s\cdot 100n} \cdot s}{s} + \frac{B e^{-s\cdot 100n} \cdot s}{s+10^{7}}$$

$$A = \frac{1}{10^{-4}} \cdot \frac{1}{10^{7}}$$

i)

$$\frac{\frac{1}{10^{-4}}}{s(s+10^7)}$$

$s = -10^{+7}$

$$= B = \frac{-1}{10^{-4}} \frac{1}{10^7}$$

$$\frac{\frac{1}{10^{-4}} \cdot e^{-s \cdot 100n}}{s(s+10^7)} = \frac{A}{s} + \frac{B}{s+10^7}$$

-10^7 → 0

$-s \cdot 100n$

$-s \cdot 100n$

$$\frac{\frac{1}{10^{-4}}}{-10^7} = B = \frac{-1}{10^7} \cdot \frac{1}{10^{-4}}$$

$$I(s) = \frac{+\frac{1}{10^7}\cdot\frac{1}{10^{-4}}e^{-5100N}}{s} - \frac{\frac{71}{10^7}\cdot\frac{1}{10^4}e^{-5100N}}{s+10^7}$$

$$i(t) = \frac{1}{10^7}\cdot\frac{1}{10^{-4}}\left(u(t-100N) - e^{\frac{-(t-100N)}{10^{-7}}}u(t-100N)\right)$$

$$= 1mA\left(1 - e^{-(t-100N)/10^{-7}}\right)u(t-100N)$$

100N