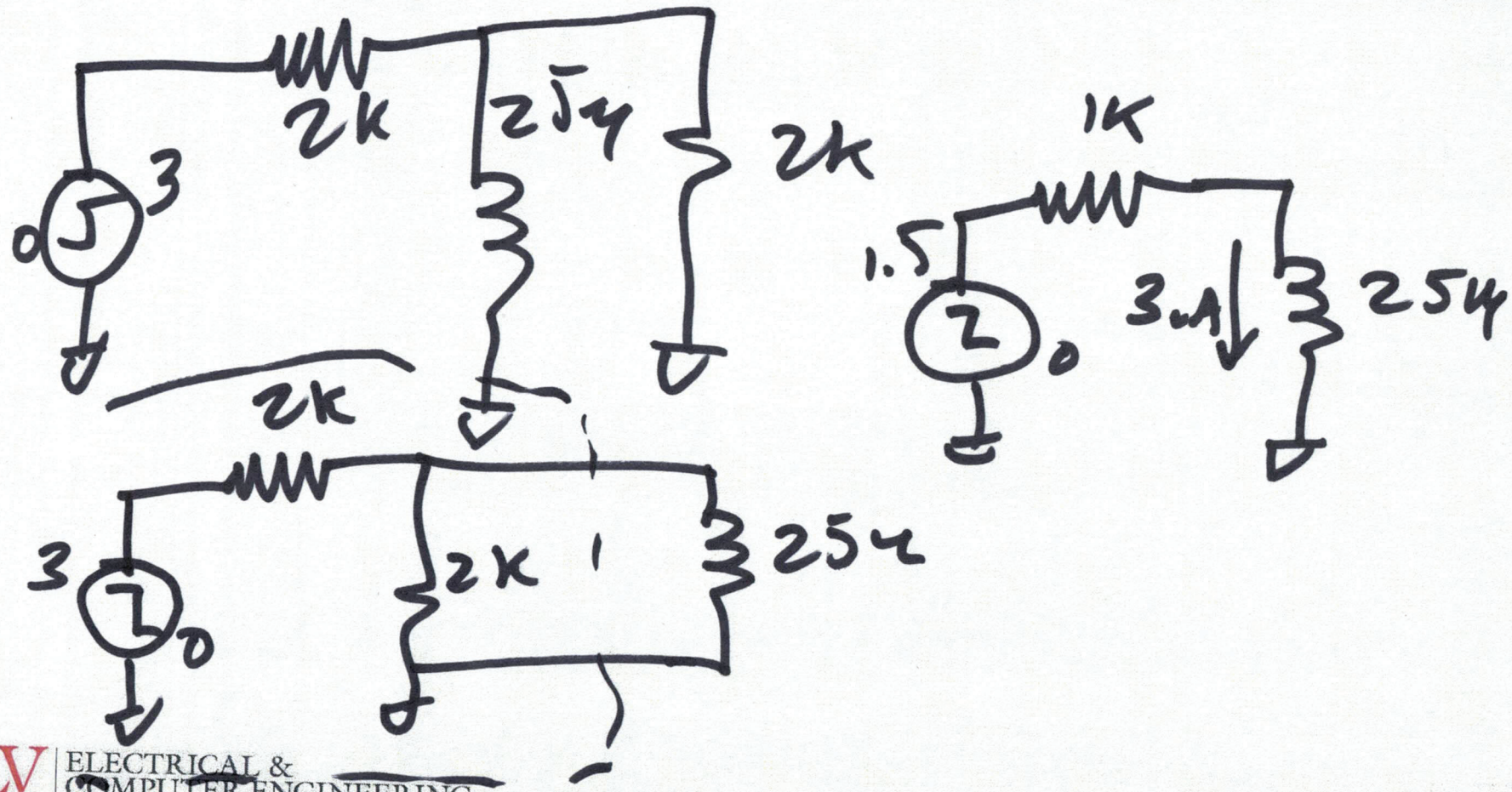
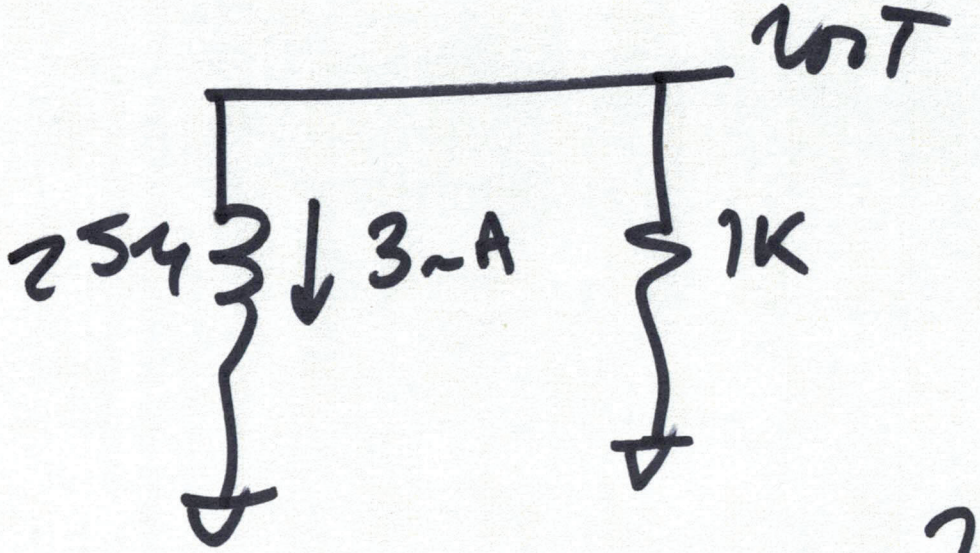
EE 221 Circuits II

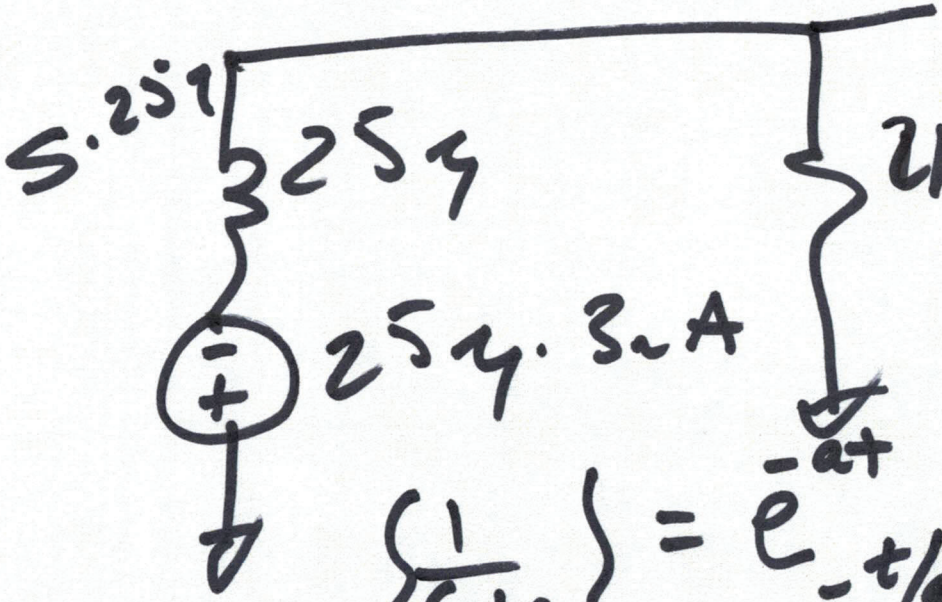
Lecture 19

April 5, 2023





$20nT \equiv 25\mu \cdot 3mA \cdot \dfrac{2k}{2k + 25\mu \cdot s}$



$$= \frac{-3mA \cdot 2k}{s + \frac{2k}{25\mu}}$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s+a}\right\} = e^{-at} \quad \mathcal{L}^{-1}$$

$$= e^{-t/a^{-1}} \Rightarrow -6V\, e^{-t/12.5n}$$

$$\frac{3s^3 + 36s^2 + 131s + 144}{s(s+4)(s^2+6s+9)}$$

$$= \frac{A}{s} + \frac{B}{s+4} + \frac{C}{s+3} + \frac{D}{(s+3)^2}$$

$$A = \left| \frac{3s^3 + 36s^2 + 131s + 144}{(s+4)(s^2+6s+9)} \right|_{s=0}$$

$$A = \frac{144}{4 \cdot 9} = \frac{144}{36} = \boxed{4 = A}$$

$$B = \left| \frac{3(-4)^3 + 36(4)^2 + 131(-4) + 144}{((-4)^2 + 6 \cdot (-4) + 9} \right|_{s=-4}$$

$$D = \left| \frac{3s^3 + 36s^2 + 131s + 144}{s(s+4)} \right|_{s=-3}$$

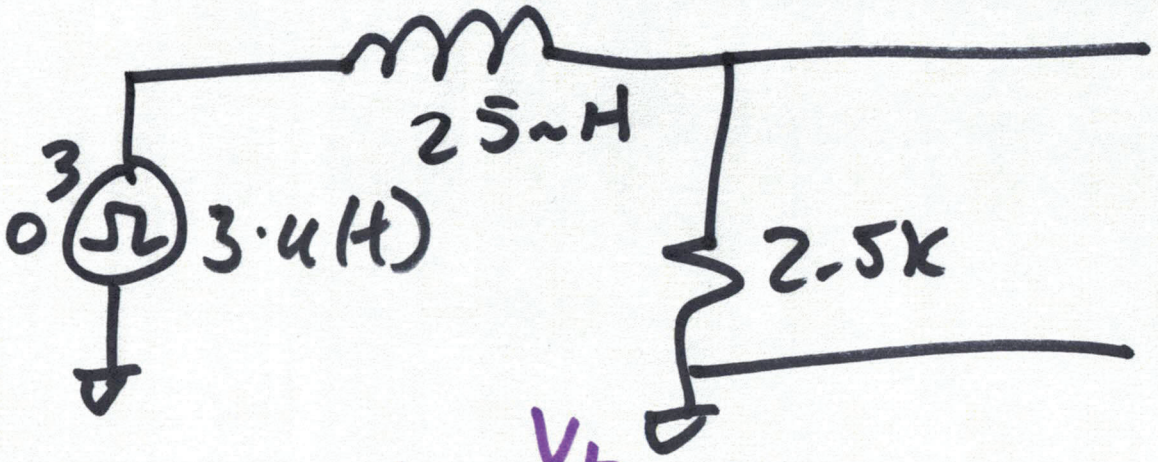
$$= \frac{A(s+3)}{s} + \frac{B(s+3)}{s+4} + C + \frac{D}{s+3}$$

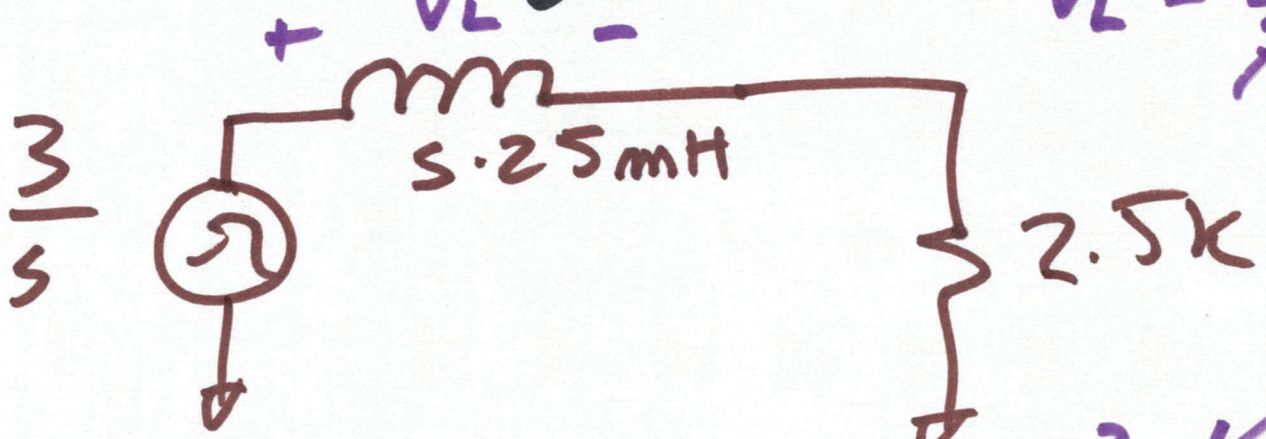
$s = 1$

$$\frac{3 + 36 + 131 + 144}{1 \cdot (5)(1+6+9)} =$$

$$A \cdot \frac{4}{1} + B \cdot \frac{4}{5} + C + \frac{D}{4}$$

4)



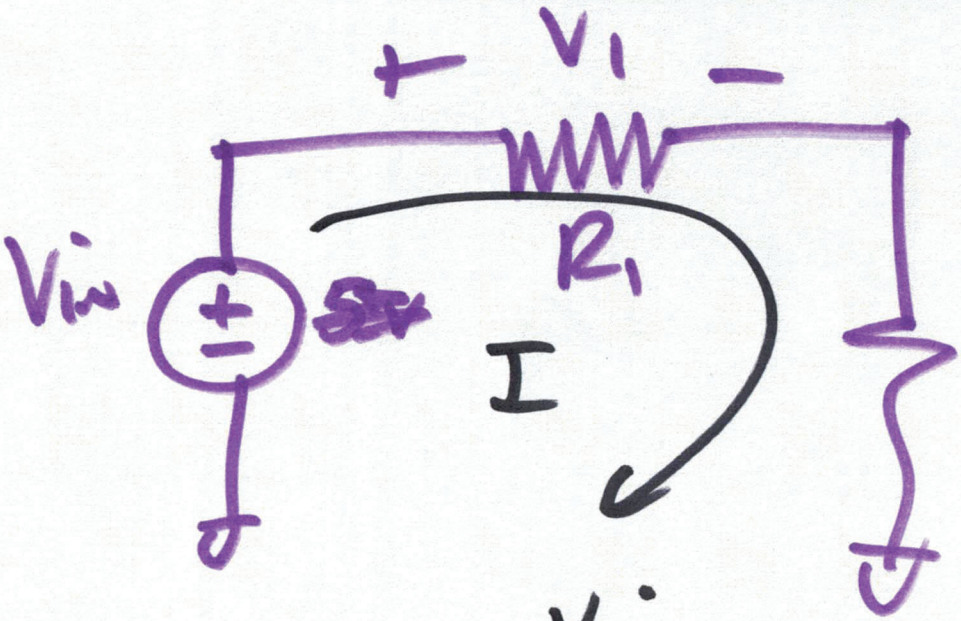


$$V_L = \frac{3}{s} \cdot \frac{5.25\times10^{-3}}{5.25\times10^{-3} + 2.5}$$

$$V_L = \frac{3.25\times10^{-3}}{5.25\times10^{3} + 2.5\times10^{3}}$$

$$= \frac{3}{s + \left(\frac{2.5\times10^{3}}{25\times10^{-3}}\right)} \Rightarrow 3e^{-t/\tau} = \frac{1}{7}$$

5)



$$V_2 = V_{IN} \cdot \frac{R_2}{R_1 + R_2}$$

$$V_1 = V_{IN} \cdot \frac{R_1}{R_1 + R_2}$$

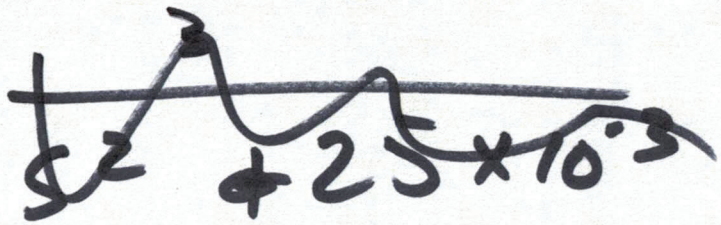
$$I = \frac{V_{IN}}{R_1 + R_2}$$

$$V_1 = I \cdot R_1$$

$$V_2 = I \cdot R_2$$

$$I(s) = \frac{\frac{3}{s}}{5.25\times10^{-3} + 2.5\times10^{3}}$$

$$A = -B = \frac{3}{2.5k} =$$

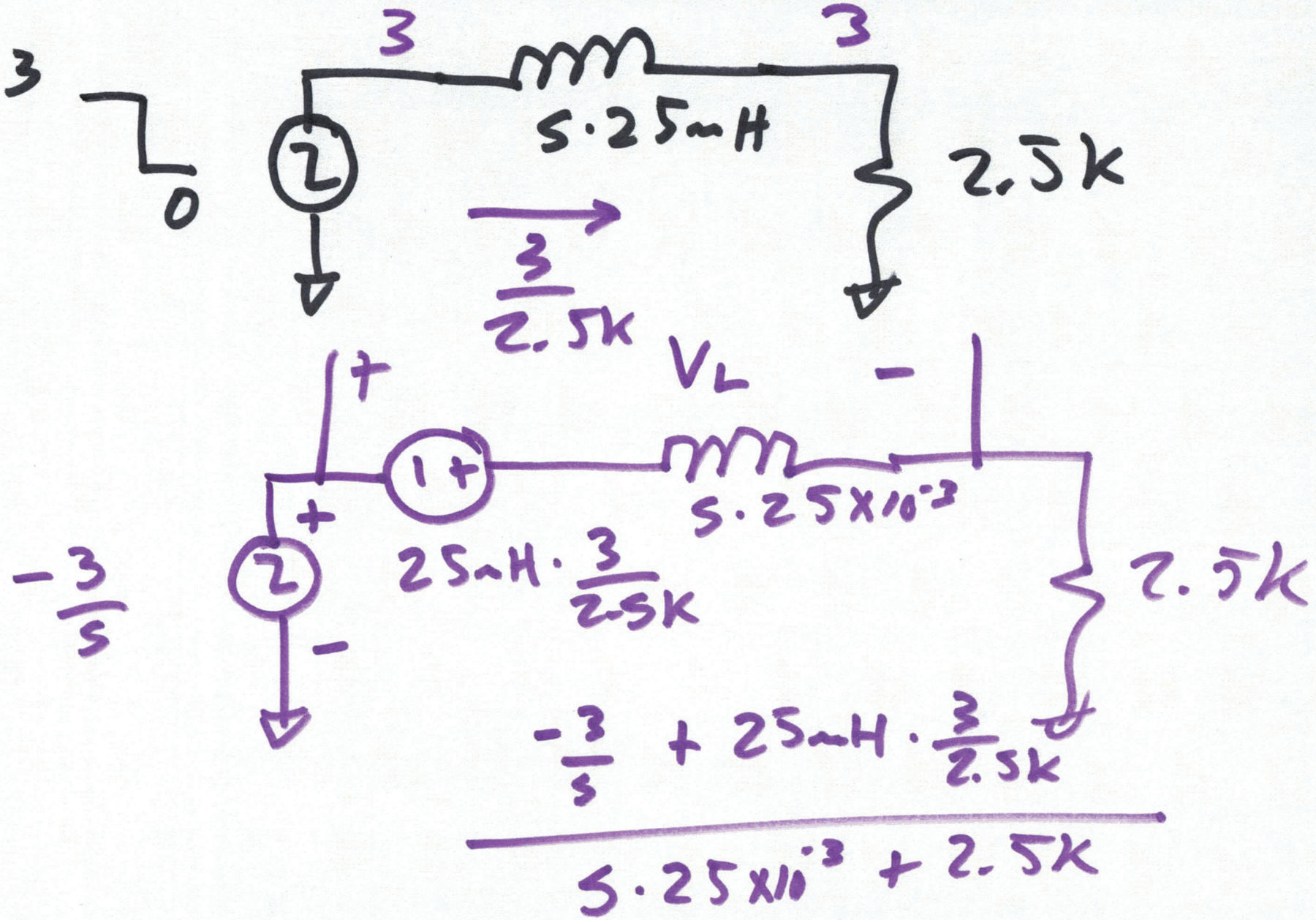


$$= \frac{3}{s} \cdot \frac{\frac{1}{25\times10^{-3}}}{\left(s + \frac{2.5\times10^{3}}{25\times10^{-3}}\right)}$$

$$B = -3 \cdot \frac{1}{2.5\times10^{3}}$$

$$i(t) = \frac{3}{2.5k}\left(1 - e^{-t/\tau}\right) = \frac{A}{s} + \frac{B}{s + \frac{1}{\tau}}$$

$$A = \frac{3}{25\times10^{3}}$$


3
3
3
5.25mH
2.5k
0
2
3/2.5k
+
VL
-
1+
5.25x10^-3
+
2
25mH · 3/2.5k
-3/s
-
2.5k
-3/s + 25mH · 3/2.5k
5.25x10^-3 + 2.5k

8)

$$I = \frac{-3}{s} \cdot \frac{1}{5.25\times10^{3} + 2.5k} + \frac{25mH \cdot \frac{3}{2.5k}}{5.25\times10^{-3} + 2.5k}$$

$$\frac{3}{2.5k}\left(1 - e^{-t/\tau}\right) \qquad \frac{3/2.5k}{s + \frac{2.5k}{25mH}}$$

$$\frac{3}{2.5k} e^{-t/\tau/R}$$