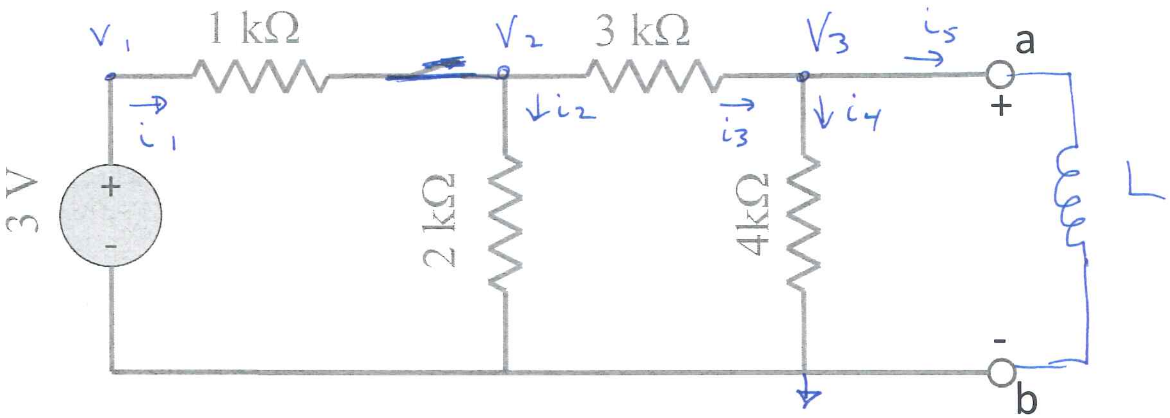
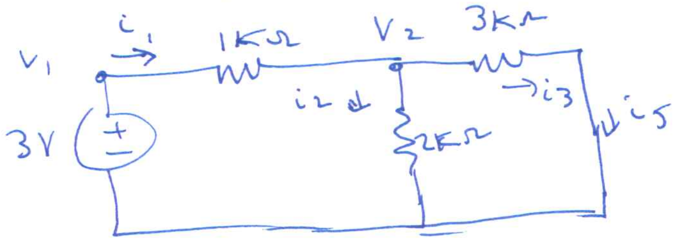
Comprehensive Example



A) At DC, inductor is a short circuit. So we need to solve:



Note $V_3 = 0$

$i_4 = 0$

$i_3 = i_5$

$$i_1 = \frac{3\,V}{1k\Omega + (2k\Omega \| 3k\Omega)} = \frac{3}{1 + \frac{2\cdot 3}{2+3}}\,mA = \frac{3}{1+\frac{6}{5}}\,mA = \frac{3}{11/5}\,mA = \frac{15}{11}\,mA$$

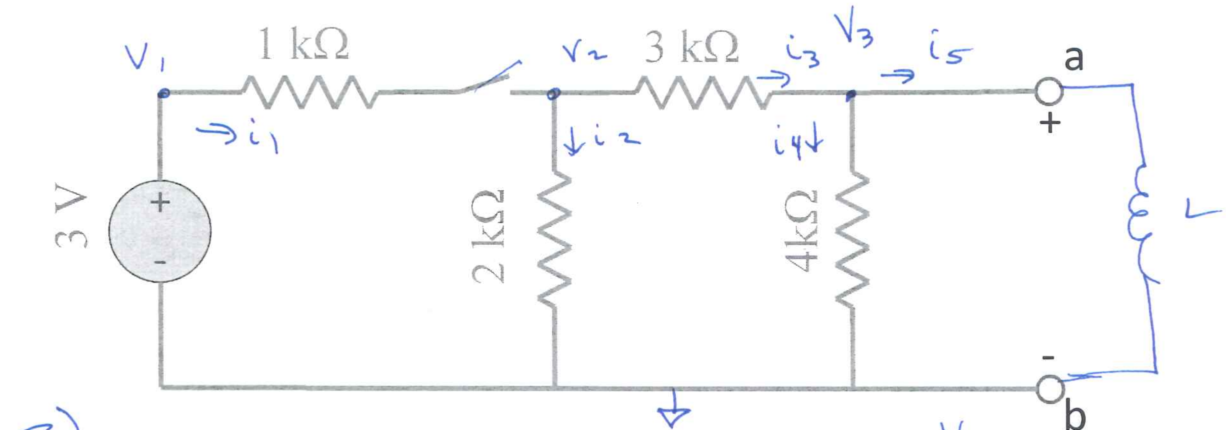
$$i_2 = i_1 \frac{3}{2+3} = \frac{15}{11}\,\frac{3}{5}\,mA = \frac{9}{11}\,mA$$

$$i_3 = i_1 \frac{2}{2+3} = \frac{15}{11}\,\frac{2}{5}\,mA = \frac{6}{11}\,mA$$

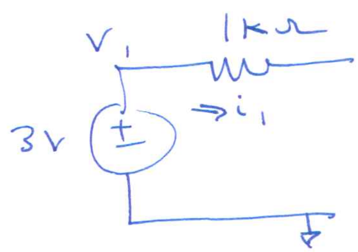
$V_1 = 3V$

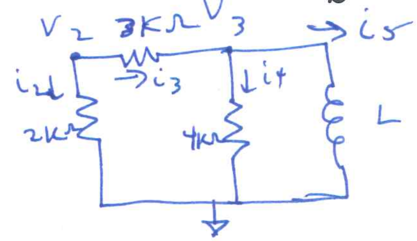
$$V_2 = 3V - i_1\,1k\Omega = 3V - \frac{15}{11}\,V = \frac{33-15}{11}\,V = \frac{18}{11}\,V$$

Comprehensive Example



B)





$=$

$V_1 = 3V \quad i_1 = 0$

$\tau = \frac{L}{R_{eq}} = \frac{L}{4 \| (2+3)\, k\Omega} = \frac{L}{\frac{4 \cdot 5}{4+5} k\Omega} = \frac{9L}{20\, k\Omega}$

$i_5 = i_L(t) = i_L(t=0)\, e^{-t/\tau}$

$i_L(t=0) = \frac{6}{11}$ mA from last slide. $\Rightarrow i_5(t) = \frac{6}{11}\, mA\, e^{-t/\tau}$

$+i_3 = i_5 \frac{4}{4+(2+3)} \Rightarrow i_3(t) = \frac{4 \times 6}{9 \times 11} e^{-t/\tau}\, mA = \frac{24}{99} e^{-t/\tau}\, mA$

$i_2(t) = -i_3(t)$

$i_4(t) = -i_5(t) \frac{2+3}{4+2+3} = -\frac{5}{7} \times \frac{6}{11} e^{-t/\tau}\, mA = -\frac{30}{77} e^{-t/\tau}\, mA$

$V_2(t) = i_2(t)\, 2k\Omega = -\frac{24}{99} \times 2\, e^{-t/\tau}\, V = -\frac{48}{99} e^{-t/\tau}\, V$

$V_3(t) = 4k\Omega\, i_4(t) = -\frac{120}{77} e^{-t/\tau}\, V$