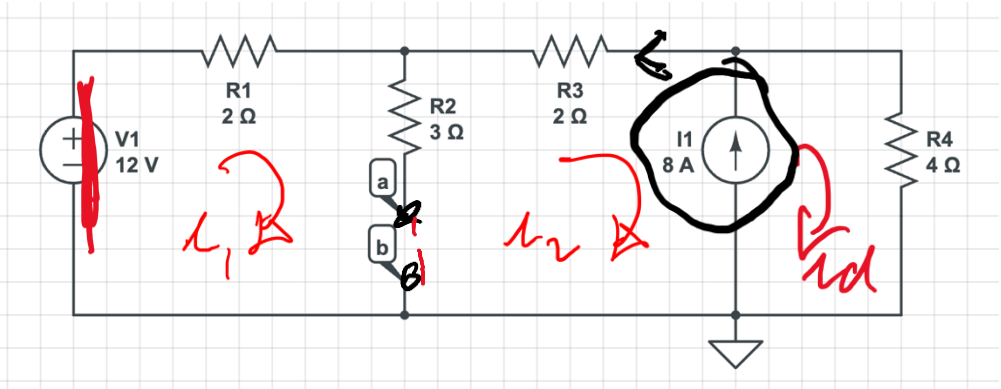
Review questions

Example 1



Norton's

for the voltage source

$5i_1 - 3i_2 = 12$

$-3i_1 + 9i_2 = 0$

Solve for i_1 and i_2

$i_1 = 3$ A $\quad i_2 = 1$ A

$i_{sc} = 2$ A

Thevenin's

2 || 3 + 2 resistance on the left

$\frac{6}{5} + 2 = \frac{16}{5}$

$i = \frac{8}{\frac{1}{4} + \frac{5}{16}} \cdot \frac{5}{16}$

$= \frac{16}{9}$ for the current source

$i_{sc_T} = 2 + \frac{16}{9}$

$= \frac{34}{9}$

$i_{sc_2} = \frac{\frac{40}{9}}{\frac{1}{2}+\frac{1}{3}} \cdot \frac{1}{3}$

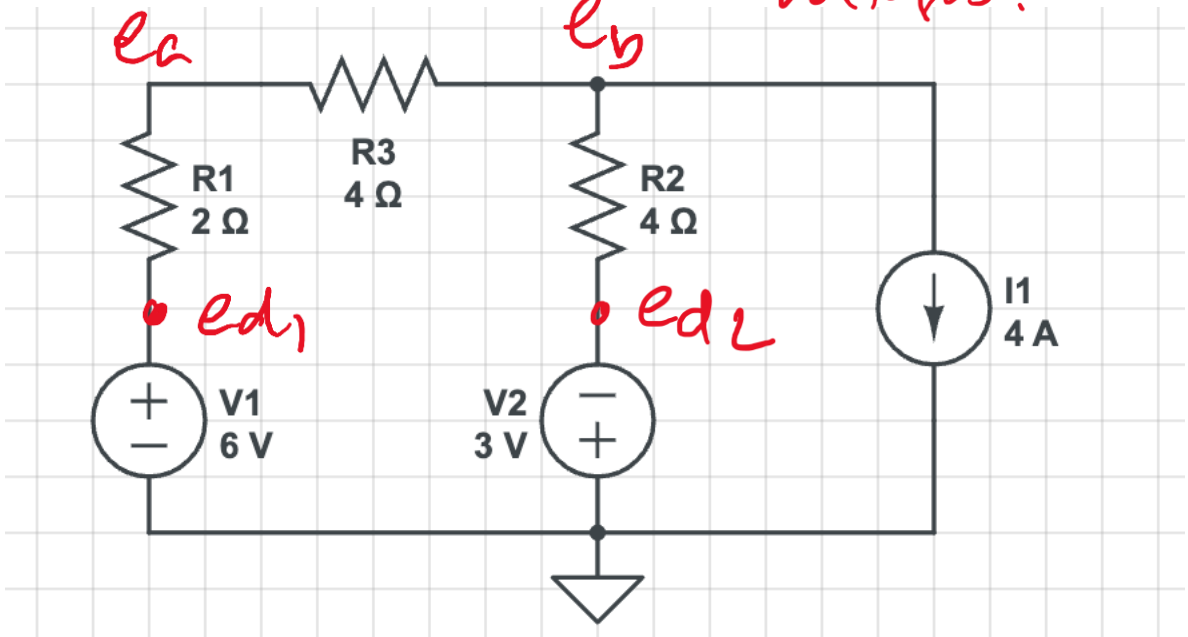
current source

Req

Req = 9/2

Example 2

Find e_a / e_b using node voltages!



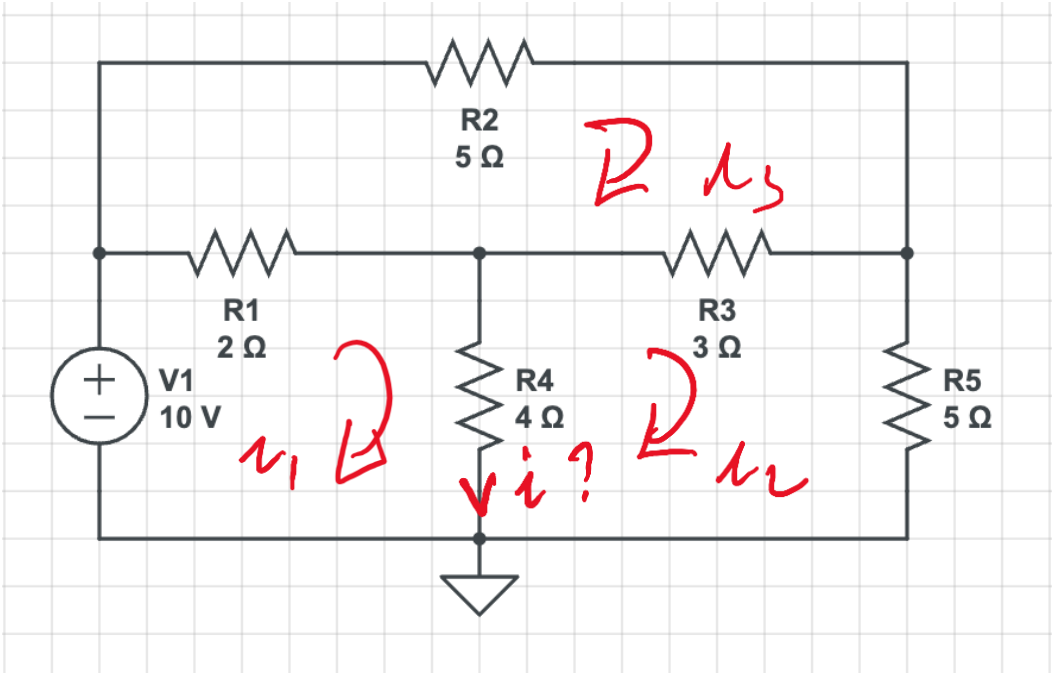
$$e_a\left(\frac{1}{2}+\frac{1}{4}\right)-\frac{e_b}{4}-\frac{e_{d_1}}{2}=0$$

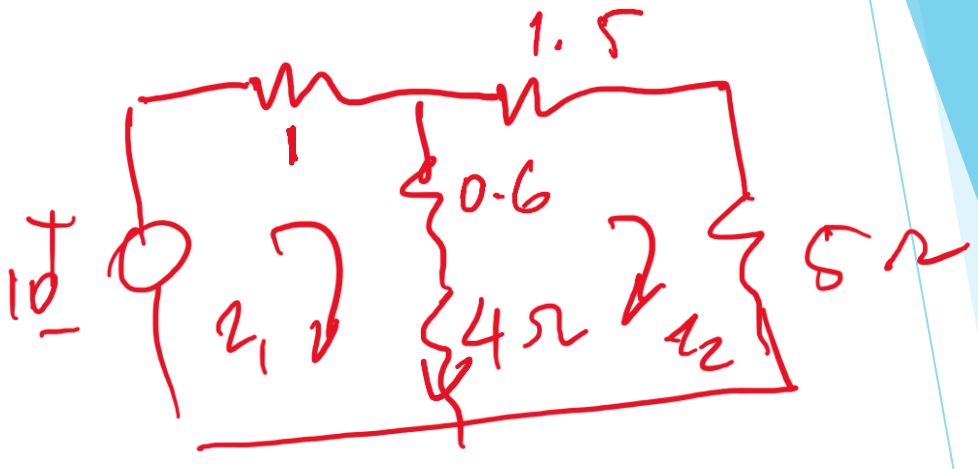
$$-\frac{e_a}{4}+e_b\left(\frac{1}{4}+\frac{1}{4}\right)-\frac{e_{d_2}}{4}=-4$$

$e_{d_1}=6 \quad e_{d_2}=3$

$e_a=1\,V \quad e_b=-9\,V$

Example 3





$5.6 i_1 - 4.6 i_2 = 10$

$-4.6 i_1 + 11.1 i_2 = 0$

$i_1 = 2.7$

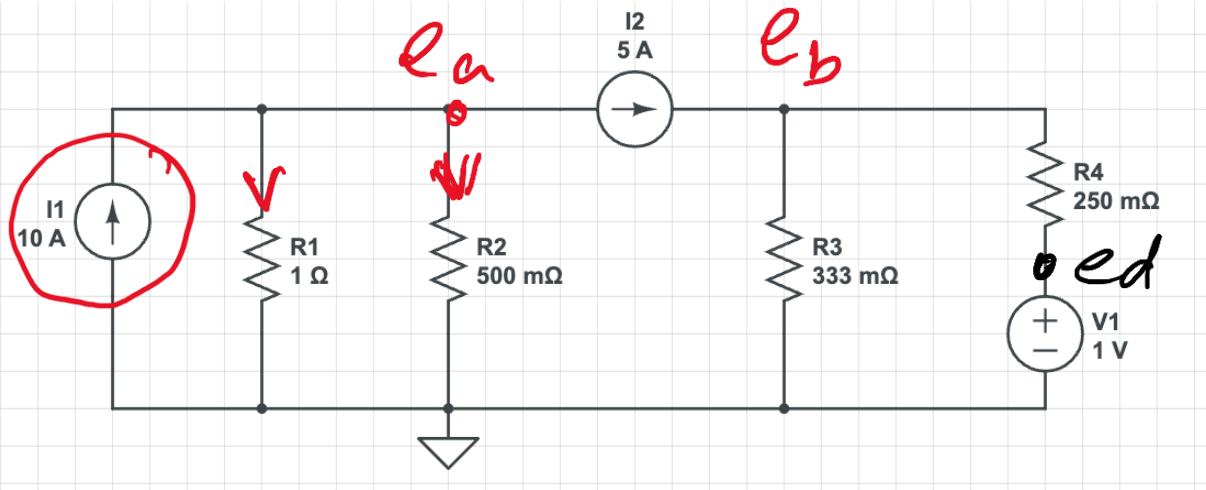
$i_2 = 1.12$

$i_3 = 0.87$

$i = i_1 - i_2$

$= 1.58\ A$

Example 4



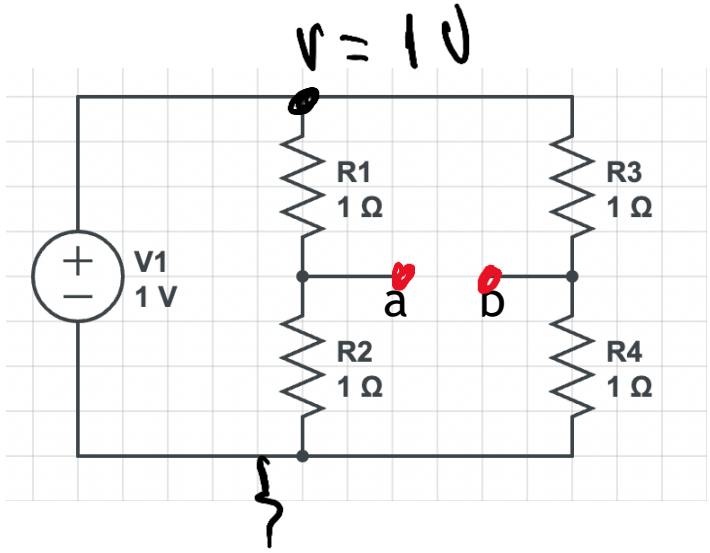
$$e_a\left(\frac{1}{1}+\frac{1}{0.5}\right)+5-10=0$$

$$e_b\left(\frac{1}{.333}+\frac{1}{.25}\right)-\frac{1}{.25}=5$$

$$e_a = 1.67\ V$$

$$e_b = 1.285 = \frac{9}{7}$$

Example 5



Find Thévenin's and Norton's at a - b.

V_a and V_b

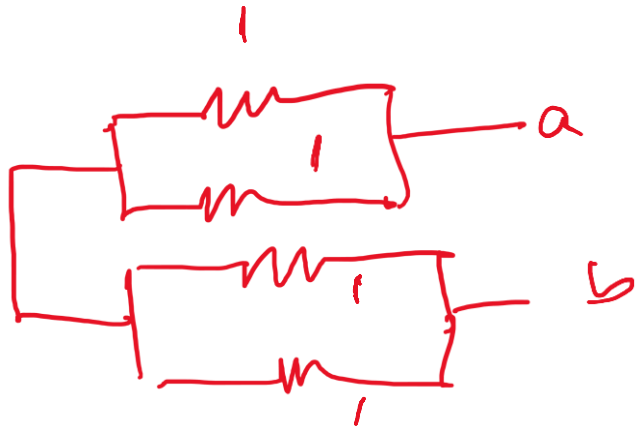
$V_a = \frac{1}{2} \cdot 1 = 0.5\,V$

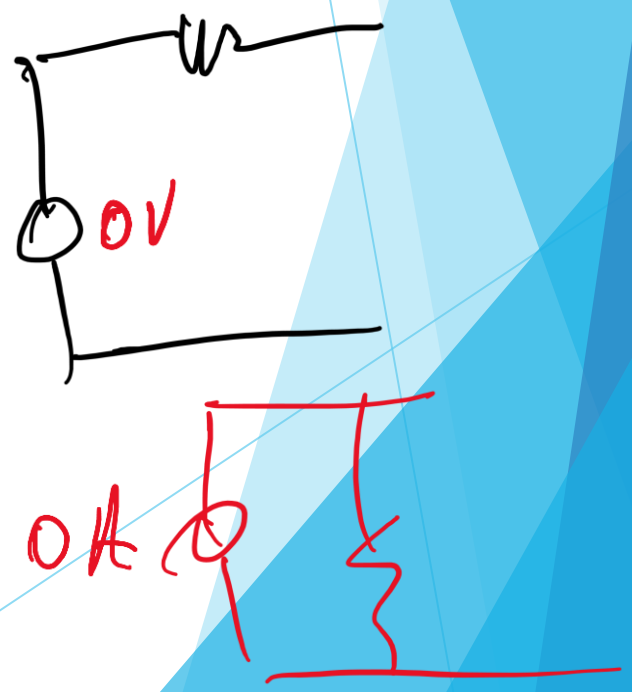
$V_b = 0.5\,V$

$V_{ab} = 0$

$V_{ab} = V_a - V_b$

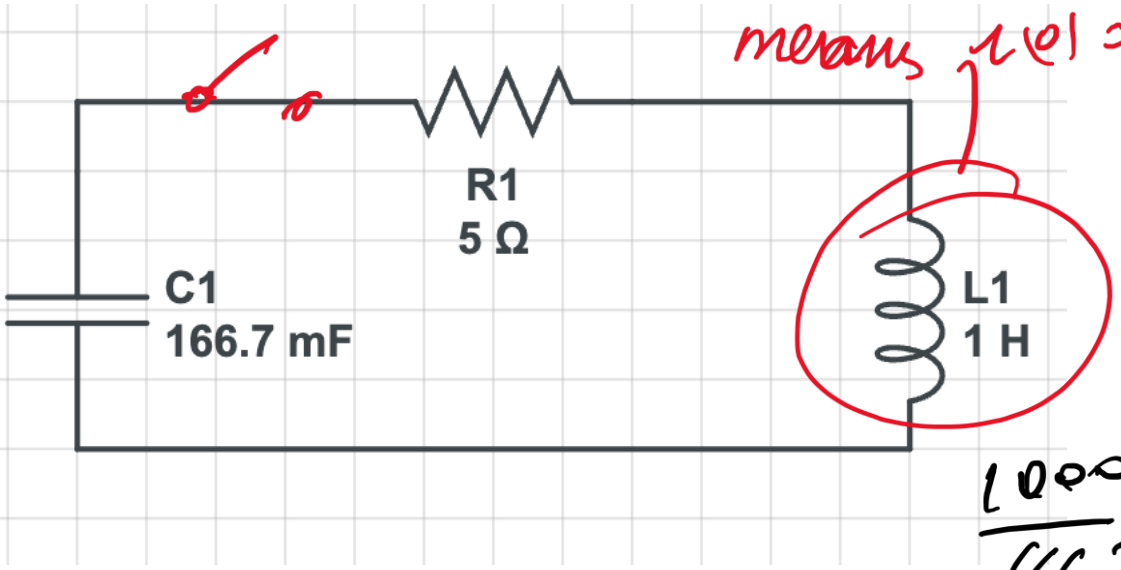
$V_a = \frac{1}{2} \cdot \frac{R_2}{R_1 + R_2} = 0.5\,V$





$m^2 + m + \text{constant} = 0$

Example 6



series inductor means $i(0) = 0$

$$L\frac{di}{dt} + Ri + \frac{1}{C}\int i\,dt = 0$$

$$L\frac{d^2i}{dt^2} + R\frac{di}{dt} + \frac{i}{C} = 0$$

$$\frac{1}{C} = \frac{1}{166.7\times10^{-3}} = 6$$

$$\frac{1000}{166.7} = 6$$

$$\frac{1}{C} = \frac{1}{166.7\times10^{-3}}$$

$$m^2 + 5m + 6 = 0$$

$$(m+2)(m+3) = 0$$

$$m = -2 \;;\; m = -3$$

$$i(t) = A_1 e^{-2t} + A_2 e^{-3t}$$

The initial current in the inductor is 0 amp. The initial voltage on the capacitor is 10V. Find i(t) in the circuit below.

$i(0) = ? = 0$ $\quad A_1 + A_2 = 0$

$$L\frac{di(0)}{dt} = -\frac{1}{C}\int i\,dt$$

V_0 Voltage

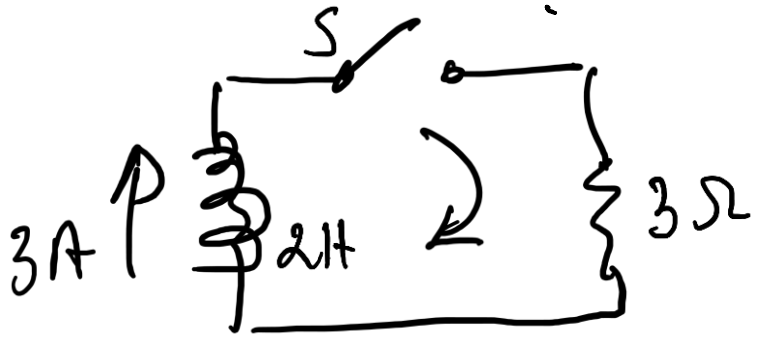
$$\frac{di}{dt}(0) = -\frac{V_0}{L} = -10$$

on C

$$A_1 + A_2 = 0$$

$$-2A_1 - 3A_2 = 10$$

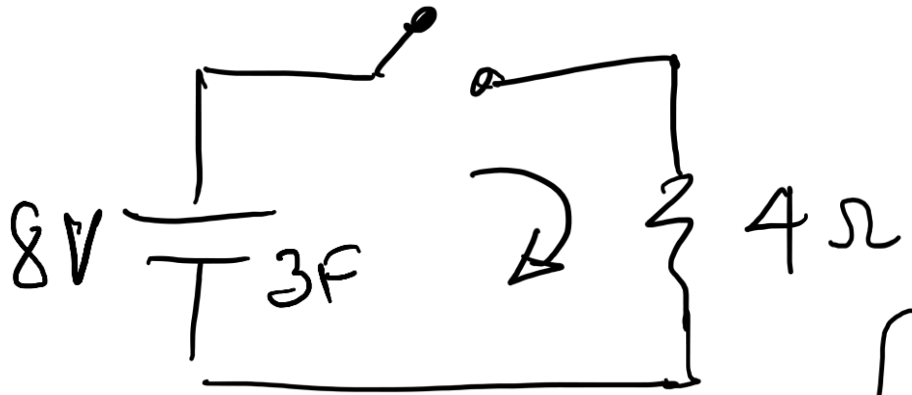
Example 7



S closed $t=0$

$$i(t) = 3e^{-3/2\,t}$$

$$L\frac{di}{dt} + Ri = 0$$



S closed at $t=0$

$$Ri + \frac{1}{C}\int i\,dt = 0$$

$$i(t) = 2e^{-4/12\,t}$$

$$Ae^{-\frac{1}{RC}t}$$

$$\frac{1}{RC} = \frac{1}{3.4} = \frac{1}{12}$$

$$\frac{V}{R} = I_0$$

$$L\frac{di}{dt} + Ri + \frac{1}{C}\int i\,dt = 0$$

$$m^2 + 4m + 4 = 0$$

$$(m+2)(m+2) = 0$$

$m = -2$ twice

$$i(t) = A_1 e^{-2t} + A_2 t e^{-2t}$$

rule for diff. eqn.