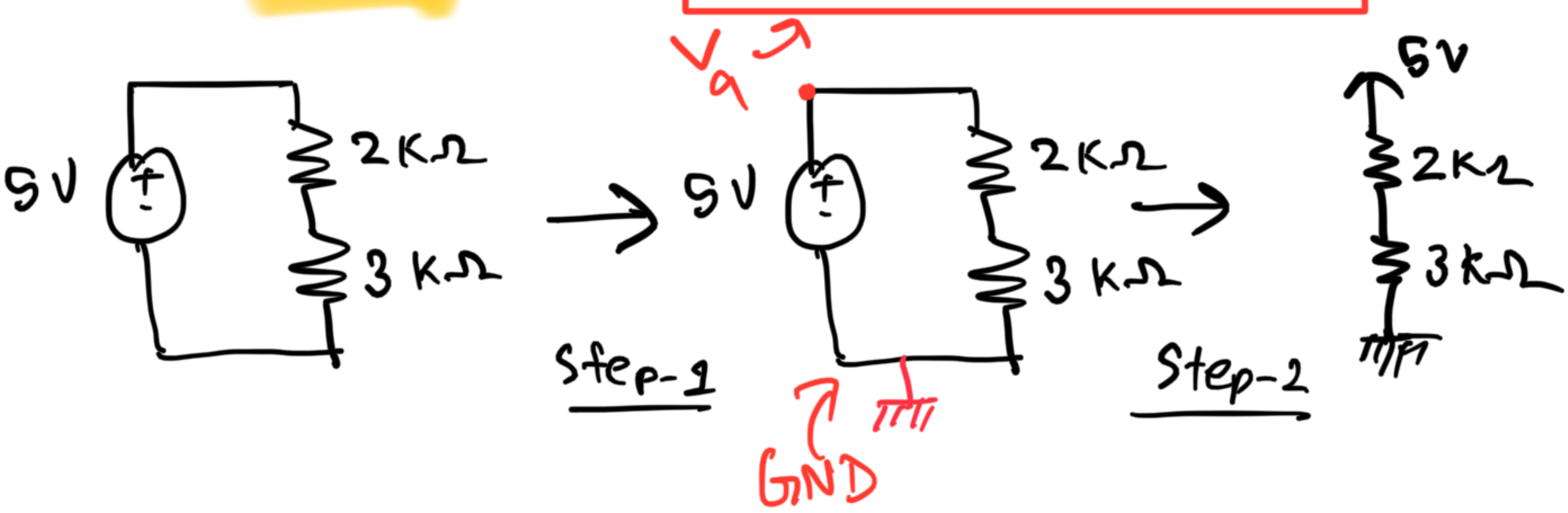
Alternative Circuit Representation

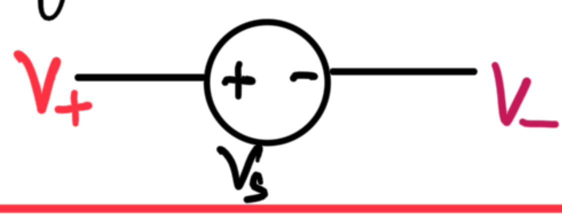
In this course, we will see some circuits being repeated over & over. Hence, a short-hand notation would be useful.

Idea: select one node as ground, then replace nodes with known voltages with an arrow.

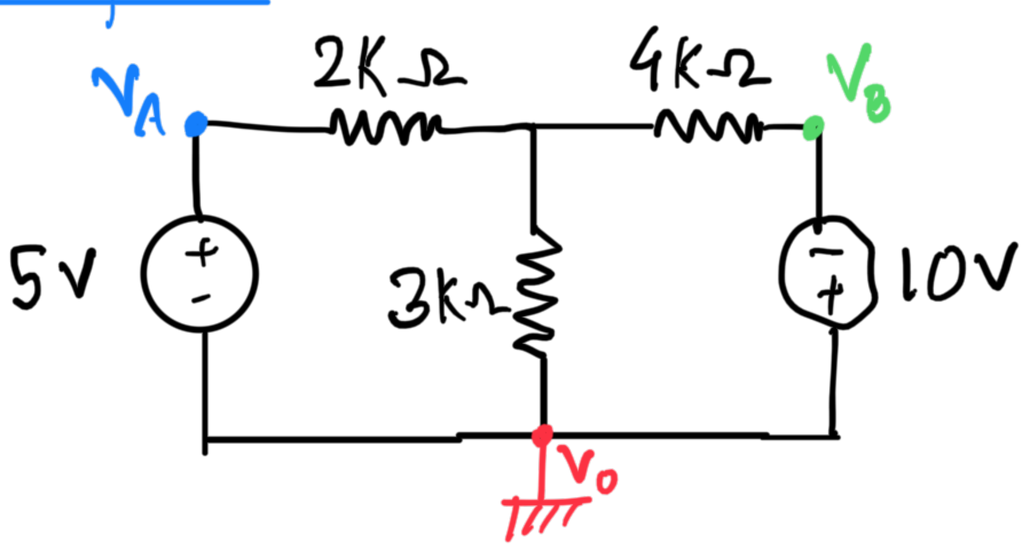
$$\boxed{V_a - 0 = 5 \Rightarrow V_a = 5V}$$



REMINDER: For voltage source, $\boxed{V_+ - V_- = V_s}$



Example - 1

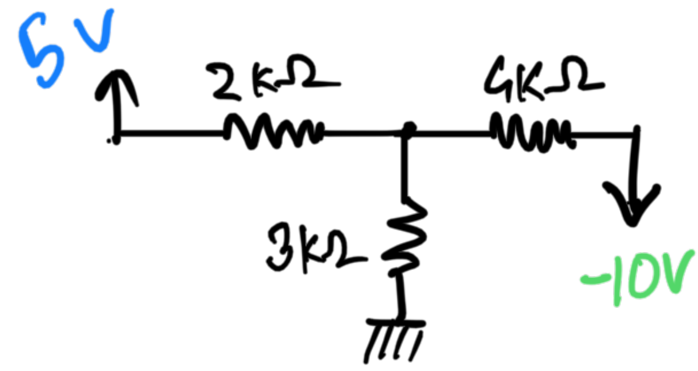


$V_0 = 0V$

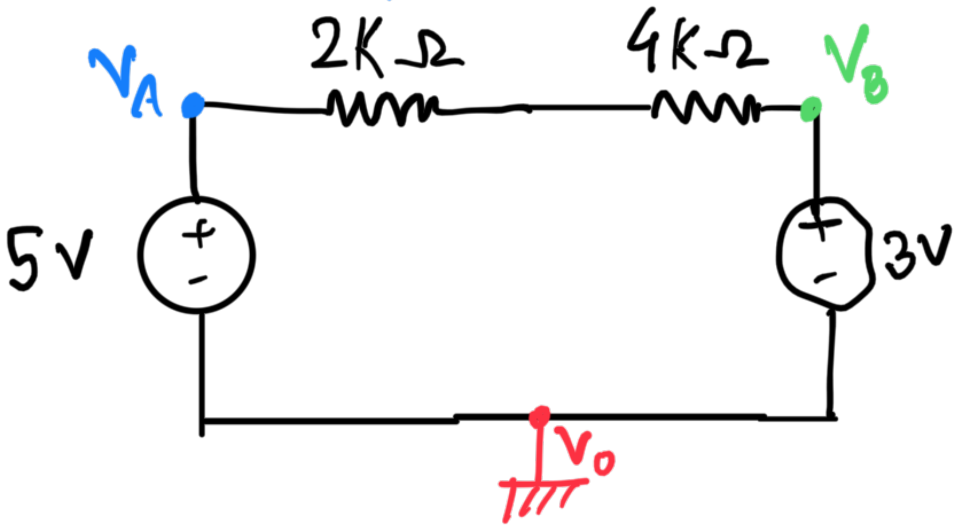
for 5V $\rightarrow V_A - V_0 = 5V \Rightarrow V_A = 5V$

for 10V $\rightarrow V_0 - V_B = 10V \Rightarrow V_B = -10V$

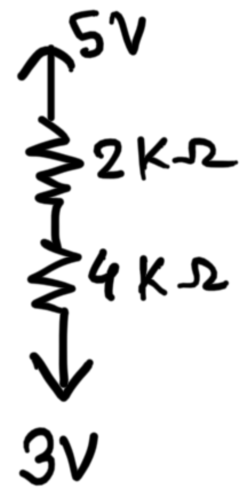
Therefore $\Rightarrow$



Example-2



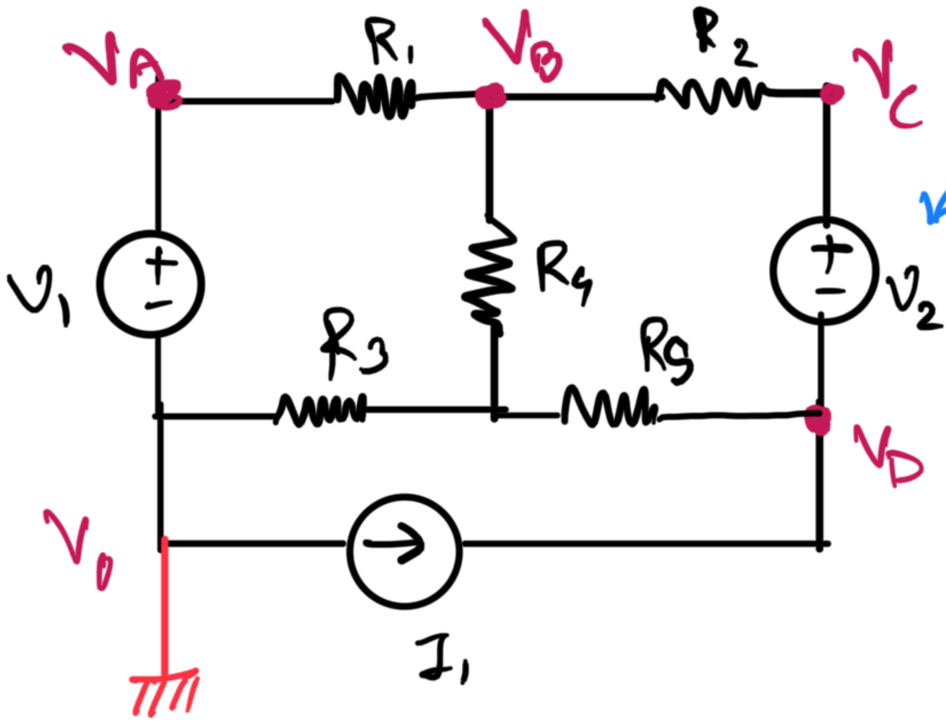
$\Rightarrow$



$V_A - 0 = 5 \Rightarrow \boxed{V_A = 5V}$

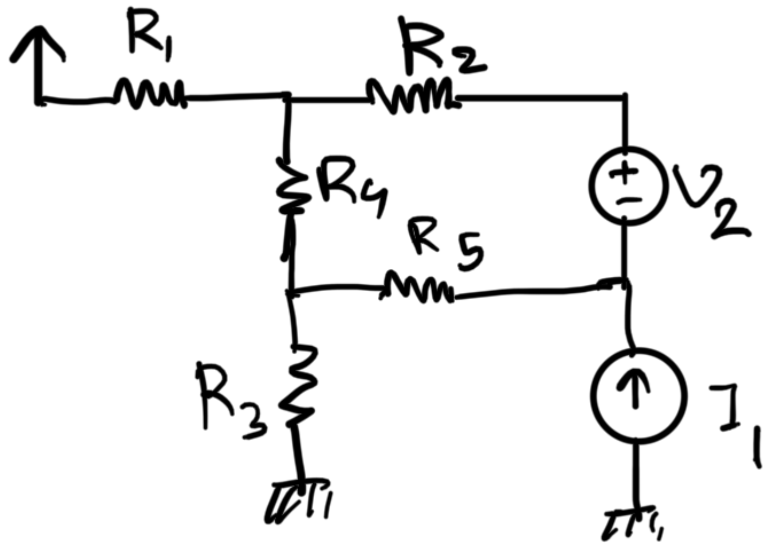
$V_B - 0 = 3 \Rightarrow \boxed{V_B = 3V}$

Example-3



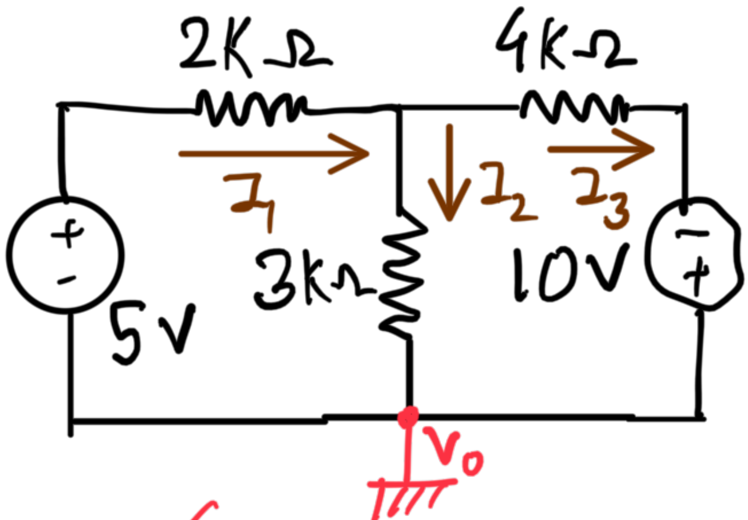
floating voltage source

⇒

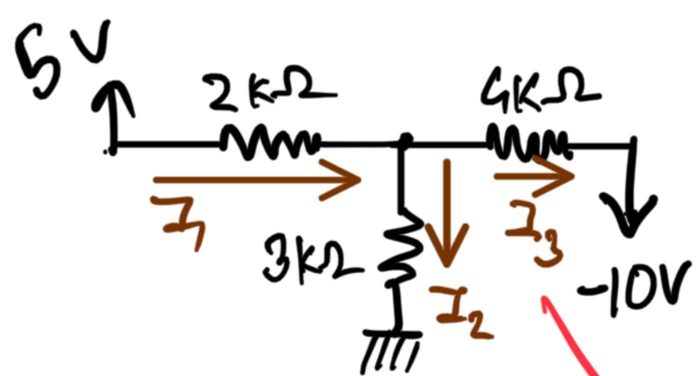


KCL in Alternative Representation

Same as in loop representation.



⇔



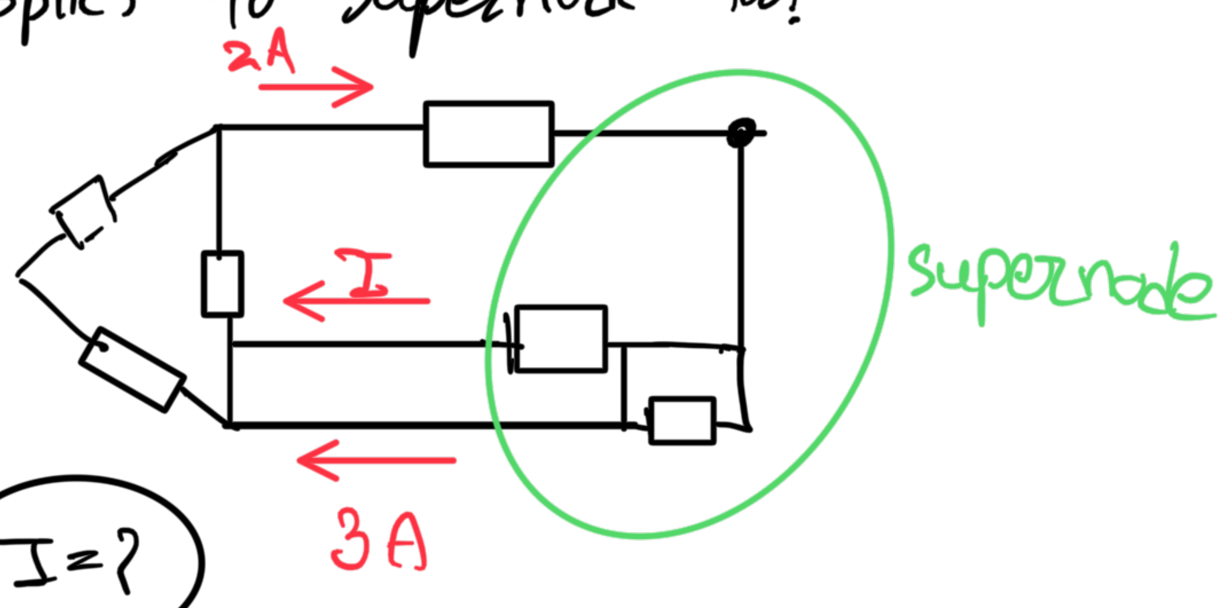
$$\sum_{node} I = 0$$

one convention ⇒
out = +ve
in = -ve

$-I_1 + I_2 + I_3 = 0$

$-I_1 + I_2 + I_3 = 0$

KCL applies to supernode too!



I = ?

for the supernode,

2A incoming

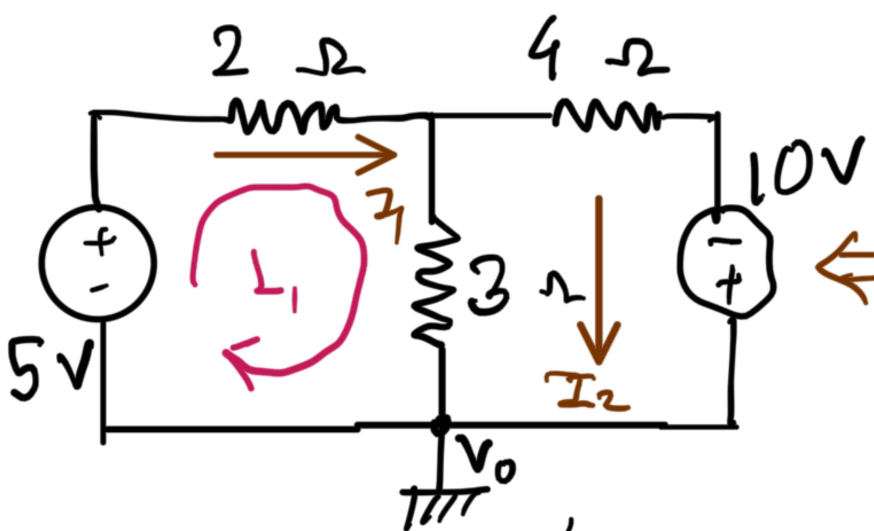
I outgoing

3A outgoing

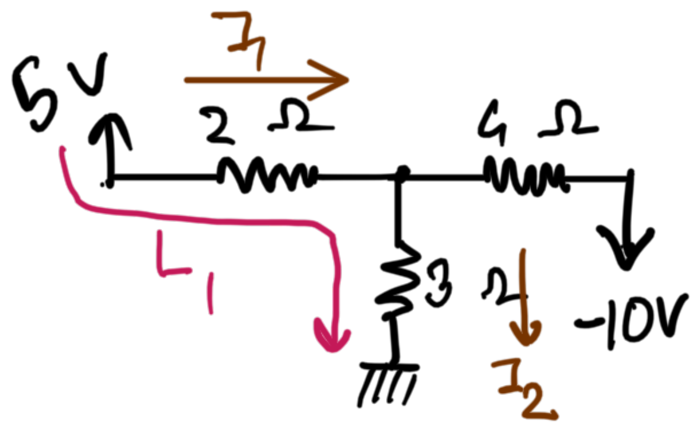
Hence, $-2 + I + 3 = 0$

$$\Rightarrow \boxed{I = -3 + 2 = -1\,A}$$

KVL in Alternative Representation



⇔



"Loop" ⇔ "Line"

$$\sum_{\text{along loop}} V = 0 \quad \Leftrightarrow \quad \sum_{\text{along line}} = V_{start} - V_{end}$$

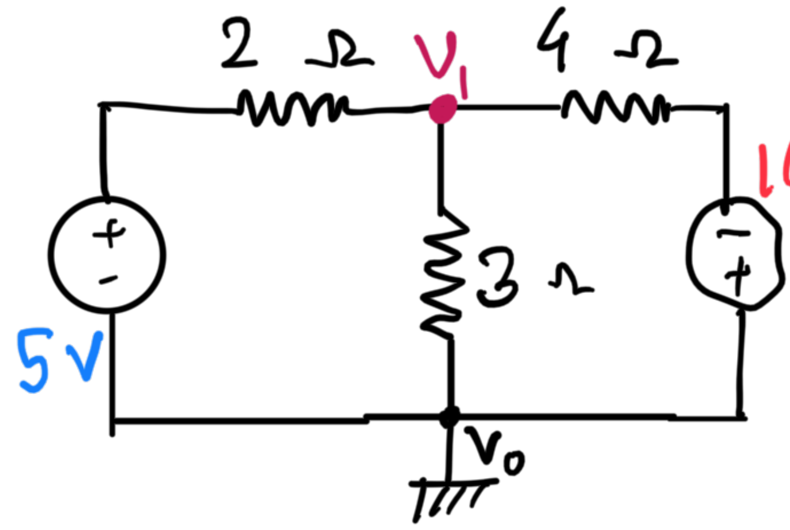
V of end node

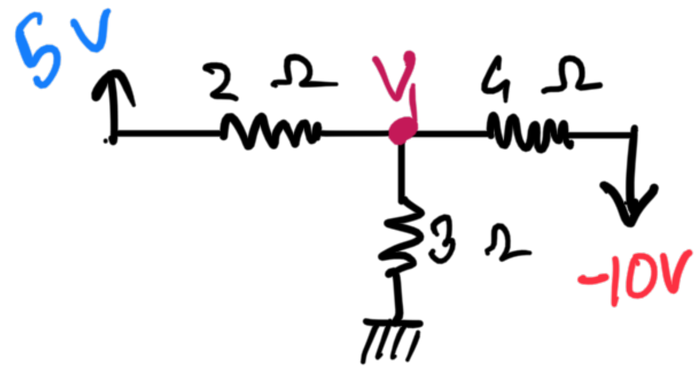
$$2I_1 + 3I_2 - 5 = 0 \quad \Leftrightarrow \quad \overbrace{2I_1 + 3I_2}^{\text{sum of Vs}} = 5 - 0$$

V of start node

Nodal analysis in Alternative Representation

Same as in loop representation





$$V_1\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\right)-\frac{5}{2}-\frac{-10}{4}=0$$