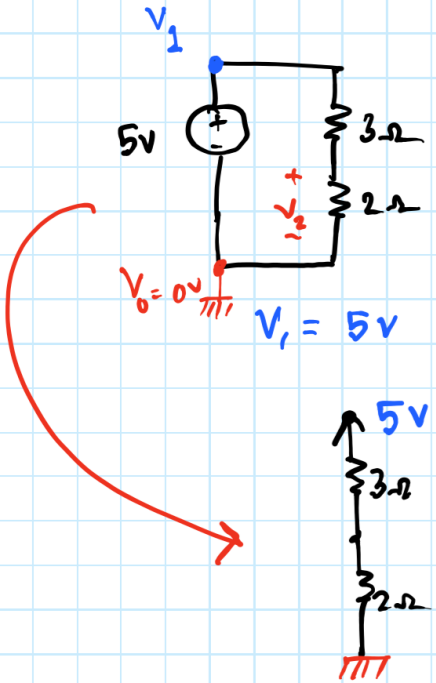
Lecture 2

Wednesday, 2 February, 2022 2:51 AM

Alternative Circuit Representaion



$$V_2 = \frac{2}{2+3} \times 5$$

voltage division

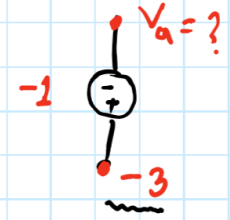
$V_a = V_+ - V_-$ ✓

(1)

$-3 = V_1 - 2$

$\Rightarrow V_1 = 2 - 3 = -1$

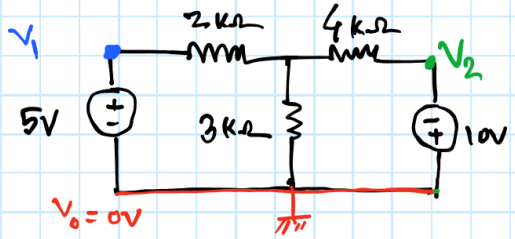
(2)



$-1 = -3 - V_a$

$\Rightarrow V_a = -3 + 1 = -2$

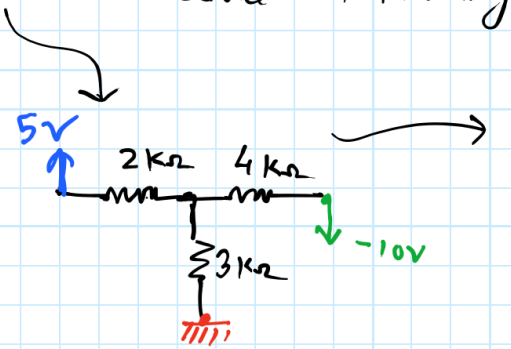
Example-2



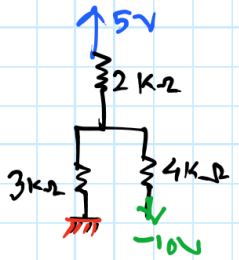
Tips: Try to select GND node to reduce # floating voltage sources

$V_1 - 0 = 5 \Rightarrow V_1 = 5V$

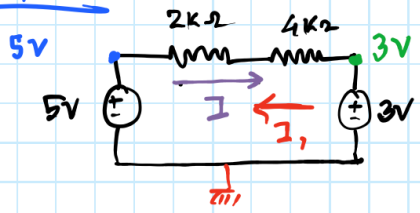
$0 - V_2 = 10 \Rightarrow V_2 = -10V$

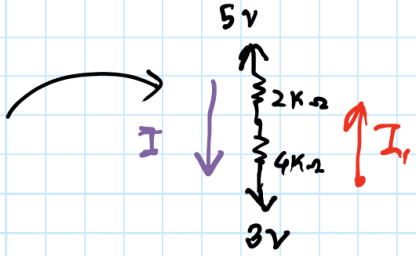


CKT 1 $\Leftrightarrow$ CKT-2



Example-3



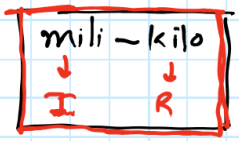


Ohm's law $V = iR$

$i = \frac{V}{R}$ → voltage diff.

→ total resistance

20301164
20101320
20101439
20104453

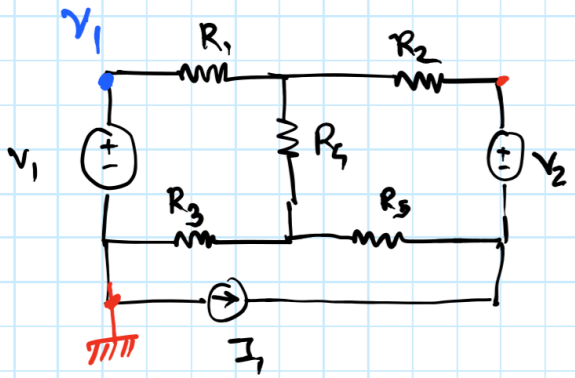


mA x kΩ = V

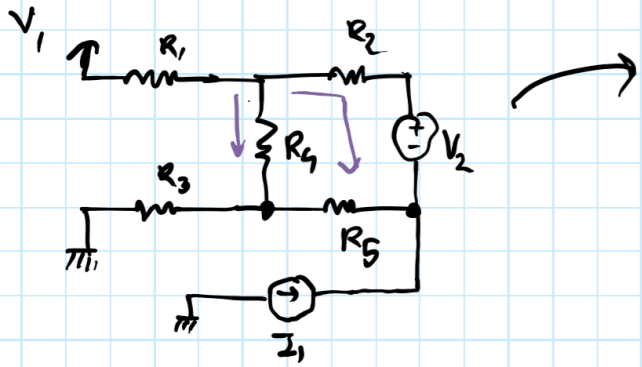
$I = \frac{5-3}{2+4} = \frac{2}{6} = \frac{1}{3} = 0.33\ mA$

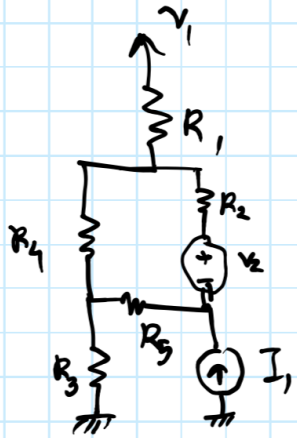
$I_1 = \frac{3-5}{2+4} = \frac{-2}{6} = -\frac{1}{3} = -0.33\ mA$

Example-4

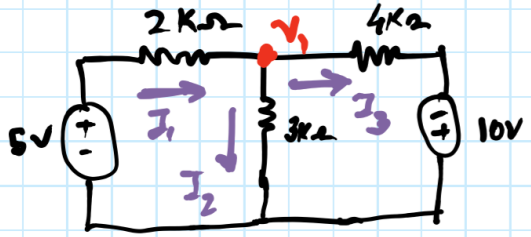


← floating voltage source [no terminals connected to ground]





KCL in A.R.



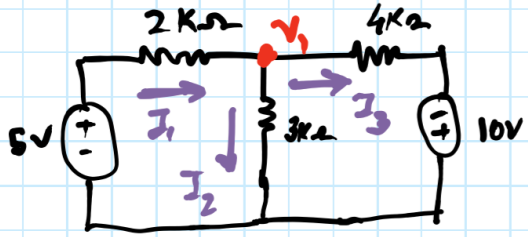
for V_1 node

$I_1 \rightarrow$ in

$I_2, I_3 \rightarrow$ out

$$-I_1 + I_2 + I_3 = 0$$

KCL in A.R.



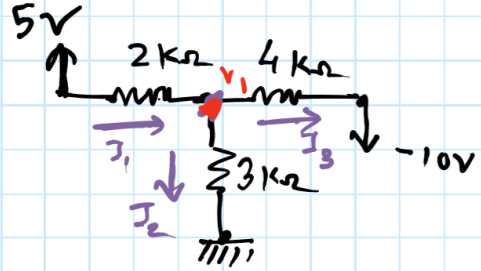
for V_1 node

$I_1 \rightarrow$ in
$I_2, I_3 \rightarrow$ out
$\Big\} -I_1 + I_2 + I_3 = 0$

KCL: $\sum I = 0$
any node

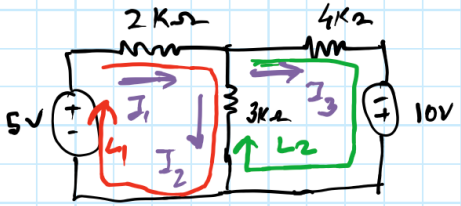
one convention
out = +ve
in = -ve

Exactly the same

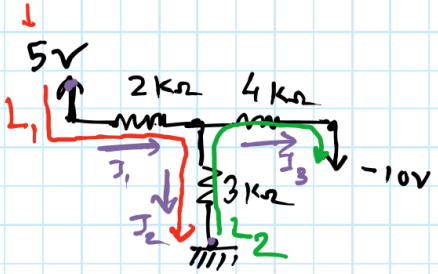


$I_1 \rightarrow$ in
$I_2, I_3 \rightarrow$ out
$\Big\} -I_1 + I_2 + I_3 = 0$

KVL in A.R



Loop ⟺ Line



KVL: Loop → $\sum v = 0$ (along loop)

Line → $\sum v = V_{start} - V_{end}$ (along line)

I → mA

mA x KΩ = volt

L_1: $2I_1 + 3I_2 - 5V = 0$

L_2: $4I_3 - 10 - 3I_2 = 0$

we apply KVL along a line.

L_1: $2I_1 + 3I_2 = 5 - 0$

$2I_1 + 3I_2$: sum of vs along line

5: V of start node

0: V of end node

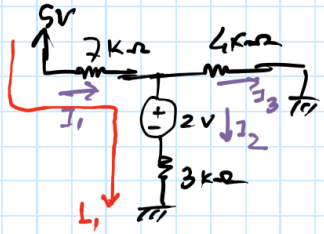
$\Rightarrow 2I_1 + 3I_2 - 5 = 0$

L_2: $-3I_2 + 4I_3 = 0 - (-10) = 10$

$-3I_2 + 4I_3$: sum of vs along line

$\Rightarrow -3I_2 + 4I_3 - 10 = 0$

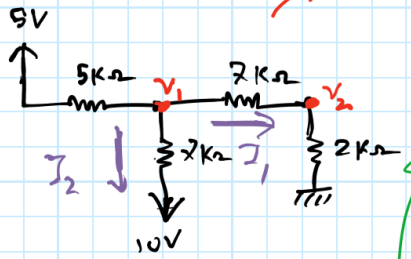
Example-2



L_1: $\underbrace{7I_1 + 2 + 3I_2}_{\text{Sum of } v_i\text{s}} = \underbrace{5 - 0}_{\text{start}}$ ← end

if Current source along line, we cannot use KVL.

Nodal analysis:



↗ loop representation

↗ did not convert KΩ → Ω

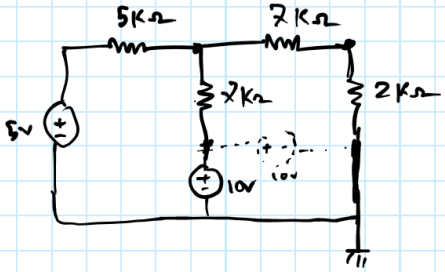
V_1:

$$\Rightarrow V_1\left(\frac{1}{5}+\frac{1}{2}+\frac{1}{7}\right) - \frac{5}{5} - \frac{V_2}{2} - \frac{10}{2} = 0$$

V_2:

$$V_2\left(\frac{1}{7}+\frac{1}{2}\right) - \frac{0}{2} - \frac{V_1}{2} = 0$$

Solve ⇒ V_1 and V_2



Exactly same

$$I_1 = \frac{V_1 - V_2}{2}$$

$$I_2 = \frac{V_1 - 10}{2}$$