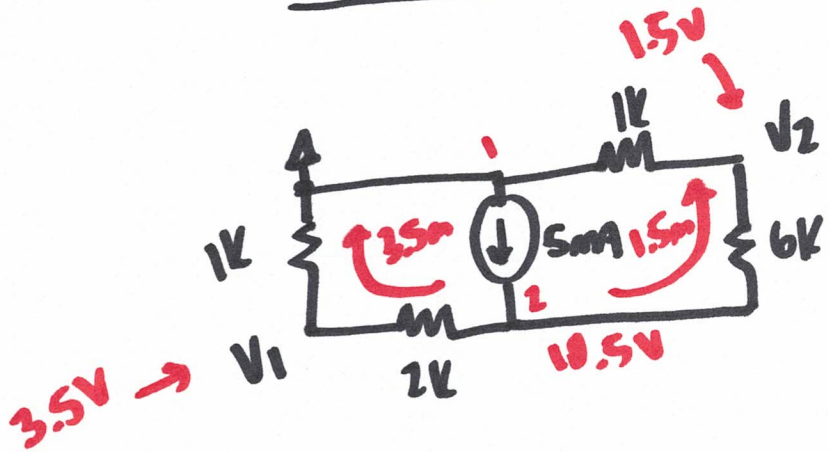
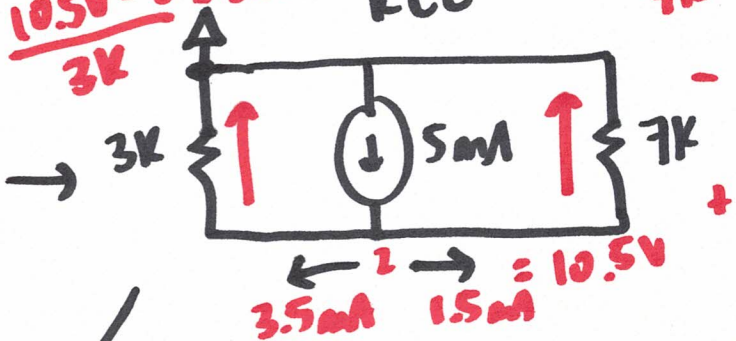
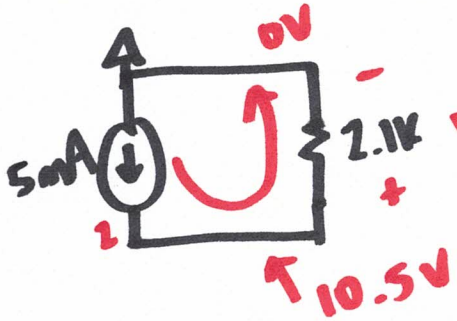
EE 220: Circuits I

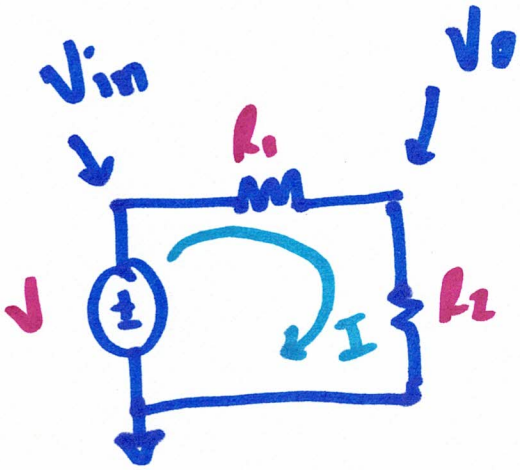




parallel: share 2 nodes

$$R_{eq} = \frac{7K \cdot 3K}{7K + 3K} = 2.1K$$





→ voltage divider

$$I = \frac{V_{in} - V_{out}}{R_1} \qquad I = \frac{V_{out} - 0}{R_2} = \frac{V_{out}}{R_2}$$

$$\frac{V_{in} - V_{out}}{R_1} = \frac{V_{out}}{R_2}$$

$$\frac{V_{in}}{R_1} - \frac{V_{out}}{R_1} = \frac{V_{out}}{R_2}$$

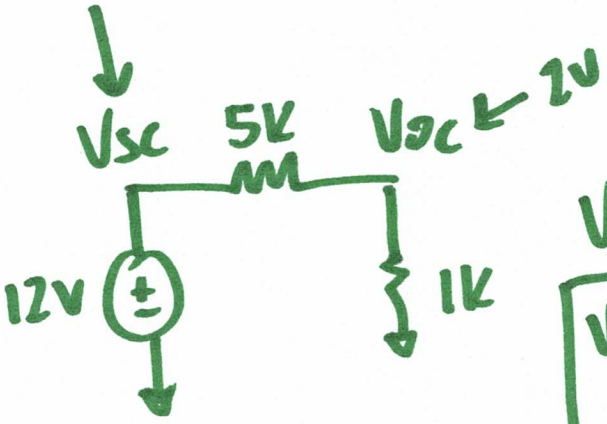
$$\frac{V_{in}}{R_1} = \frac{V_{out}}{R_1} + \frac{V_{out}}{R_2} \rightarrow \frac{\frac{V_{in}}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2}} = V_{out}\frac{\left[\left(\frac{1}{R_1} + \frac{1}{R_2}\right)\right]}{\frac{1}{R_1} + \frac{1}{R_2}}$$

$$V_{out} = \frac{(v_{in}/R_1)}{\left(\frac{1}{R_1}+\frac{1}{R_2}\right)} \frac{R_1 \cdot R_2}{R_1 \cdot R_2}$$

$$V_{out} = \frac{v_{in} \cdot R_2}{R_2 + R_1} \rightarrow$$

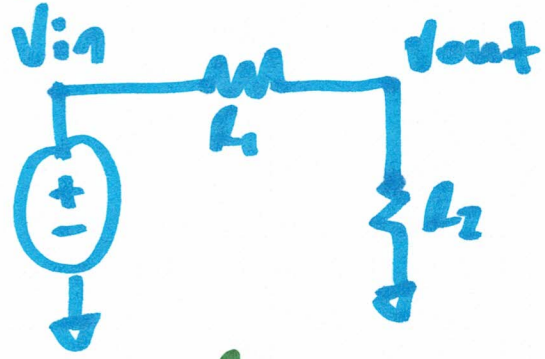
Voltage divider equation

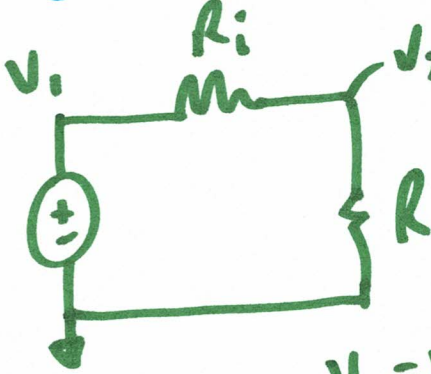
$$\boxed{V_{out} = v_{in}\left(\frac{R_2}{R_1+R_2}\right)}$$



$$V_{oc} = 12V\left(\frac{1K}{1K+5K}\right)$$

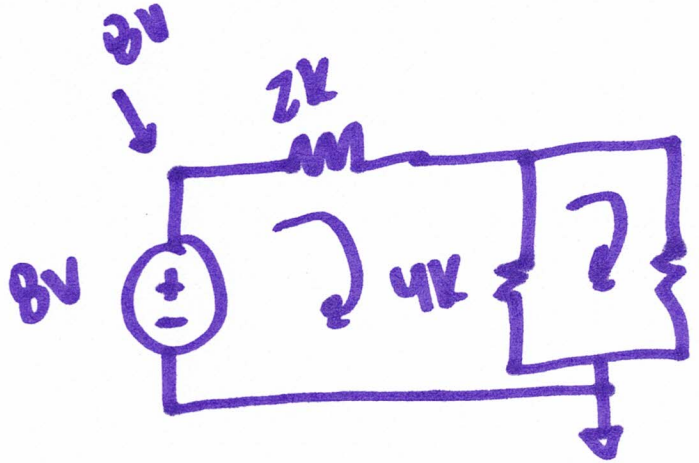
$$\boxed{V_{oc} = \frac{12}{6} = 2V}$$



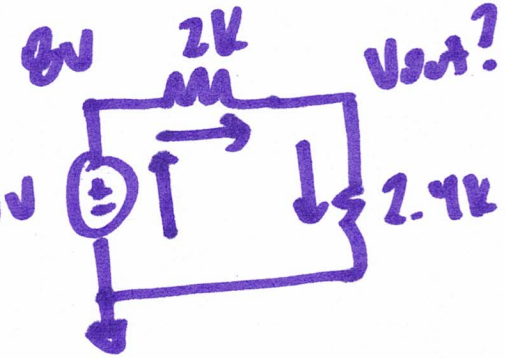


$$V_2 = V_1 \cdot \left(\frac{R_f}{R_i+R_f}\right)$$

Voltage Divider



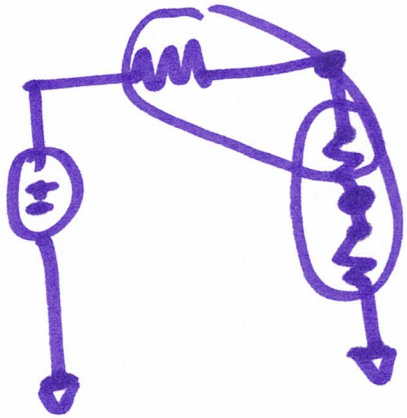
$$R_{eq} = \frac{4K \cdot 6K}{4K + 6K} = 2.4K$$



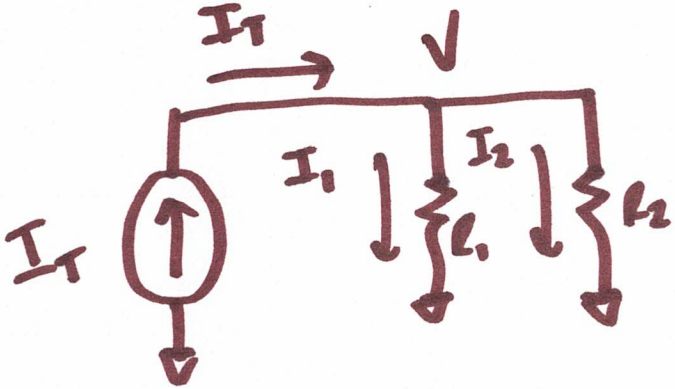
$0 = 8V - I \cdot 2K - I \cdot 2.4K$

$$V_{out} = 8V\left(\frac{2.4K}{2K + 2.4K}\right)$$

$V_{out} = ?$



Current Divider



$$I_T = I_1 + I_2$$

$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_{eq} = \left(\frac{R_1 \cdot R_2}{R_1 + R_2}\right)$$

$$I_1 = \frac{V}{R_1} \qquad I_2 = \frac{V}{R_2}$$

$$I_T = \frac{V}{R_{eq}}$$

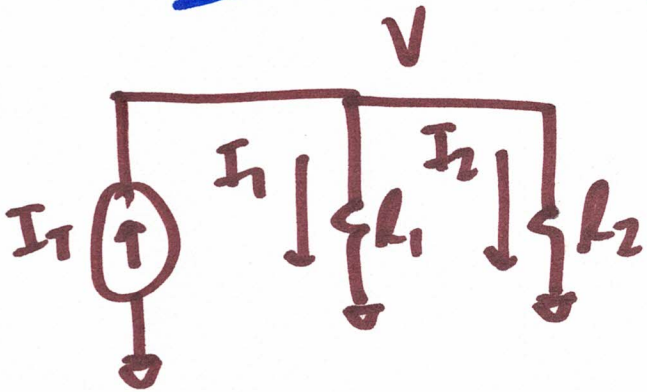
$$I_1 = I_T \cdot \frac{R_1 \cdot R_2}{(R_1 + R_2) R_1}$$

$$I_1 = I_T \cdot \frac{R_1 \cdot R_2}{R}$$

$$I_T = \frac{V}{\left(\frac{R_1 \cdot R_2}{R_1 + R_2}\right)} \rightarrow V = \left(I_T \cdot \frac{R_1 \cdot R_2}{R_1 + R_2}\right)$$

$$I_T = V \cdot \left(\frac{R_1 + R_2}{R_1 \cdot R_2}\right)$$

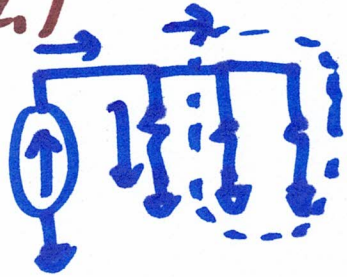
Current Divider



$$I_1 = \frac{V}{R_1} \qquad I_2 = \frac{V}{R_2}$$

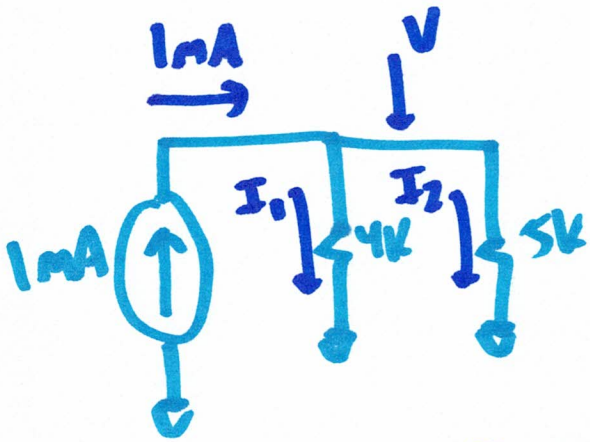
$$V = I_T \cdot \left(\frac{R_2 \cdot R_1}{R_2 + R_1}\right)$$

$$I_1 = \frac{I_T \cdot \frac{R_1 \cdot R_2}{R_1 + R_2}}{R_1}$$



$$\underline{I_1} = I_T \cdot \frac{R_2}{R_1 + R_2}$$

$$\underline{I_2} = I_T \cdot \frac{R_1}{R_1 + R_2}$$



$$I_1 = 1\text{mA} \cdot \left[\frac{5\text{k}}{9\text{k}}\right]$$

$$I_1 = 0.555\text{mA}$$

$$I_2 = 1\text{mA}\left[\frac{4\text{k}}{9\text{k}}\right] = 0.444\text{mA}$$

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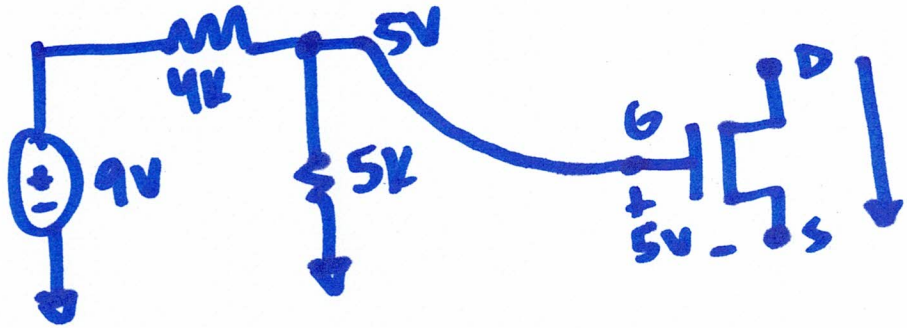
4k
5V
9V
5k
G
D
+
5V
-
S