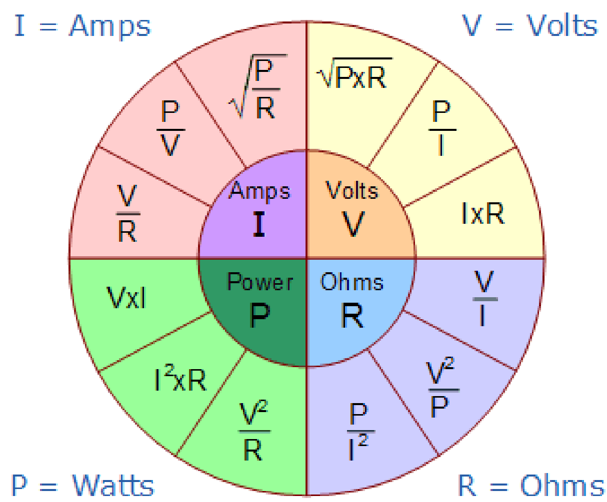
ELG2138 - Lecture 2



https://en.wikipedia.org/wiki/Kirchhoff%27s_circuit_laws

Voltage divider

If you do KvL around the whole loop you have to assign current.

Every element has its own voltage
V_{IN} has voltage of (Vs)
Circuit has total Resistance of I_S

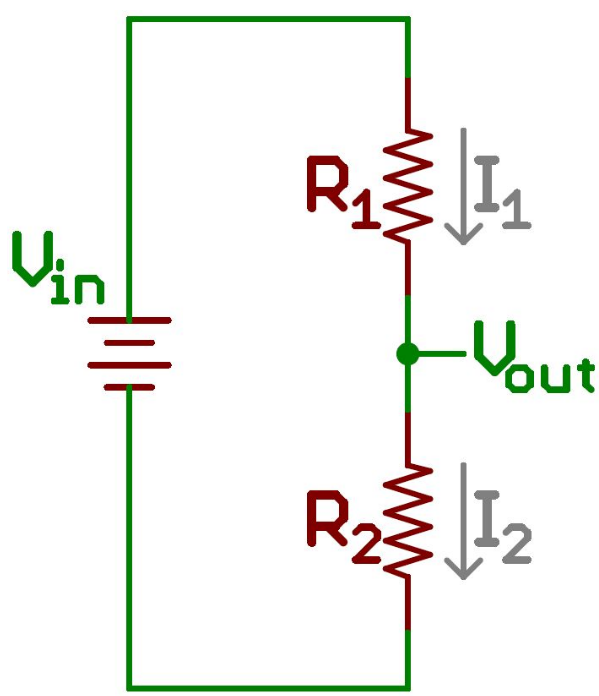
Each resistor (I_1 and I_2) will have voltages (V_1 and V_2)

Therefore KvL states that $-Vs + V_1 + V_2 = 0$ must be true.

$-Vs + I_S(R_1$ and $R_2) = 0$

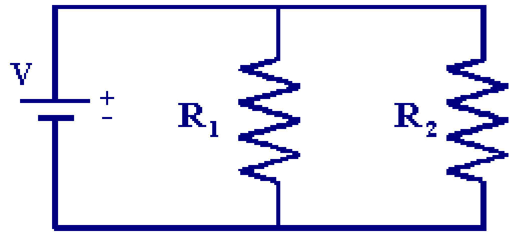
$$V1 = \frac{R1}{R1+R2} * Vs$$
$$V2 = \frac{R2}{R1+R2} * Vs$$

General Theory $Vi = \frac{Ri}{\{R\}} * Vs$



Current divider

Suppose we have a current source. Suppose we want to combine resistances so they divide current between them. All resistors will take an equal amount of current



Each Resistor will have their own current because they are not in series (I_1 and I_2)

V will have its own current I_S

Apply KcL. Imagine a node around the top of the two resistors

$$Ii = \frac{Is}{\sum \frac{i}{Rn}} * \frac{1}{Ri}$$

KcL at Node$_A$
$I_S = i_! + i_2$
$i_1 = V/R_1$ & $i_2 = V/R_2$
$I_S = V/R_1 + V/R_2$

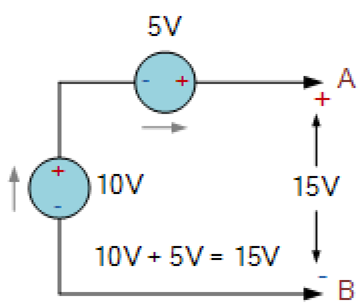
$V = I_S * 1/ (1/R_1) + (1/R_2)$

Independent Voltage Sources

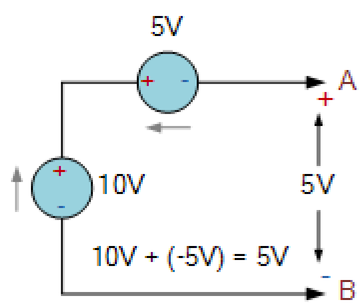
Rules to replace multiple sources with a single source

If poles are in the same direction, you can add them.

If poles are opposing, subtract them in a way where there is a "winning" source.



Series Aiding Voltages
(Voltage Addition)



Series Opposing Voltages
(Voltage Subtraction)

Independant current series is not allowed
Independent voltage series is not allowed

In Class Problem

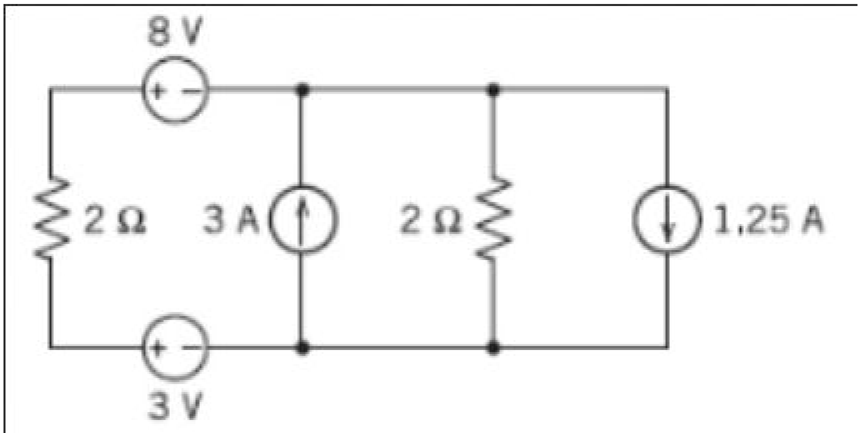
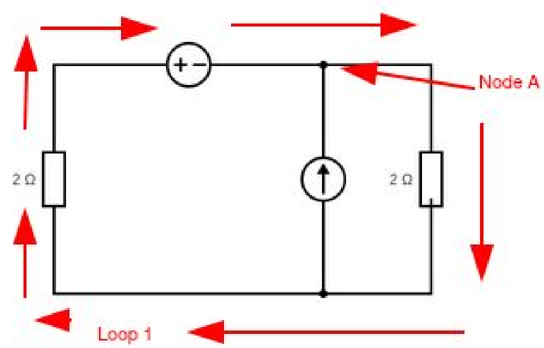


Figure P 3.5-1

Combine 8V and 3V (V = 8V - 3V = 5V)
Combine 3A and 1.25A (3A - 1.25A = 1.75A)



<u>KvL at Node A</u>

$I.75 = i_1 + i_2$

<u>KvL at Loop 1, whole circuit</u>

$-2\Omega * i_2 + 5V + 2\Omega * i_1 = 0$

<u>Substitute</u>

$I.75 = i_1 + i_2$
$-2\Omega * i_2 + 5V + 2\, i_1 = 0$

We got $i_1 = 0.375$ & $i_2 = - 2.125$

Since $1.75 \neq 0.375 + (- 2.125)$ we have to reverse the signs.

$i_1 = - 0.375$ A
$i_2 = 2.125$ A