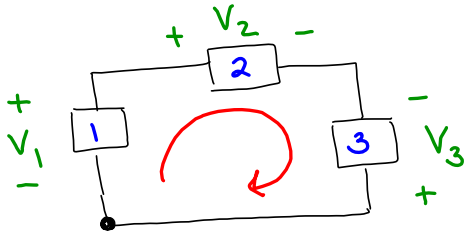
KVL : sum the voltages around a loop

sum must equal = 0



PSC : $-V_1 + V_2 - V_3 = 0$

ASC : $+V_1 - V_2 + V_3 = 0$

KVL process

① Pick a loop direction
CW or CCW

② Sign Convention
relative to the polarities

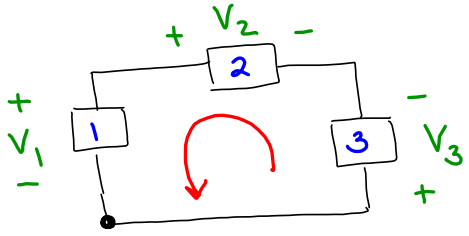
Active sign convention

Passive sign convention.

Passive Sign Convention : whatever sign (from the polarity) is encountered is the arithmetic operation performed for that voltage.

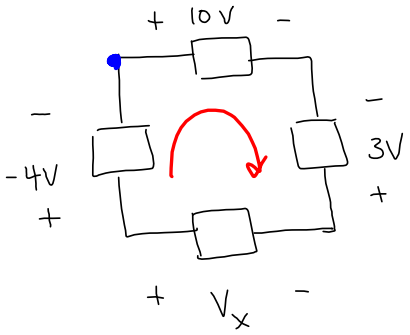
Active Sign Convention : moving from (-) to (+) => ADD

moving from (+) to (-) => Subtract



PSC : $+V_3 - V_2 + V_1 = 0$

ASC : $-V_3 + V_2 - V_1 = 0$



PSC: $+10 - 3 - V_x + (-4) = 0$

$V_x = 3V$

ASC: $-10 + 3 + V_x - (-4) = 0$

$V_x = 3V$

Ohm's Law : the current that flows through a conducting medium is proportional to the voltage across that medium.

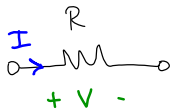
proportionality constant ≡ resistance

R ≡ resistance

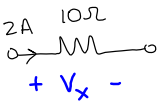
$R = \frac{V}{I}$ or $\frac{v(t)}{i(t)} = \frac{V}{A}$ => ohm [Ω]

ohm's law => $V = IR$ => passive elements
resistor *
capacitor
inductor

for a resistor, if V and I have the same sign => current flows from (+) to (-) for the voltage.



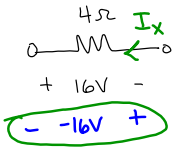
$R \geq 0$



$V_x = IR = 2(10) = 20V$

$P = VI$
$P = (20)(2)$
$= 40W$, Abs

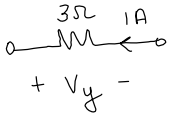
$V = IR \Rightarrow I = \frac{V}{R}$



$I_x = \frac{-16}{4}$ $\quad -I_x = \frac{16}{4}$

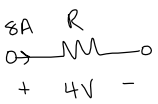
$I_x = -4A$

$P = VI$
$P = (16)(-4)$
$= -64W$, Del
$+64W$, Abs

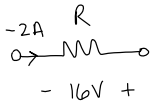


$V_y = 3(-1) = -3V$

$P = (V_y)(1) = -3(1) = -3W$, Del
or $+3W$, Abs



$R = \frac{V}{I} = \frac{4}{8} = 0.5\Omega$



$R = \frac{V}{I} = \frac{16}{-(-2)} = 8\Omega$

$V = IR$

$P = VI$

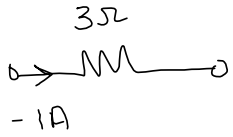
$P = (IR)I$

$= I^2R$

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

$P = VI$

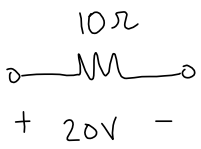
$P = V\left(\frac{V}{R}\right) = \frac{V^2}{R}$



$P = I^2(R)$

$= (-1)^2(3)$

$= 3W$, Abs



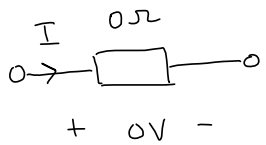
$P = \frac{V^2}{R} = \frac{(20)^2}{10} = 40W$, Abs

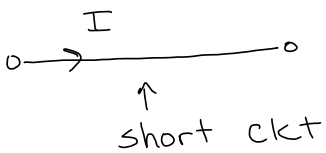
Special Cases:

$R = 0$

$V = IR$

$V = 0$ if $R = 0$

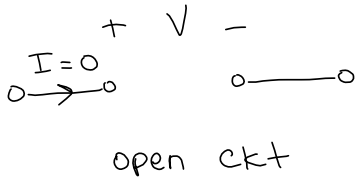




$R \to \infty$

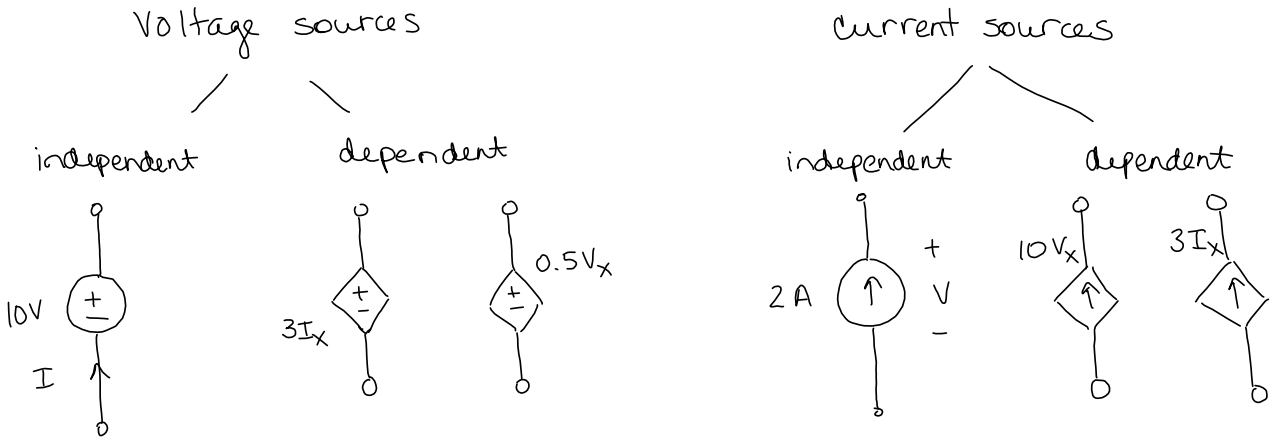
$I = \frac{V}{R}$

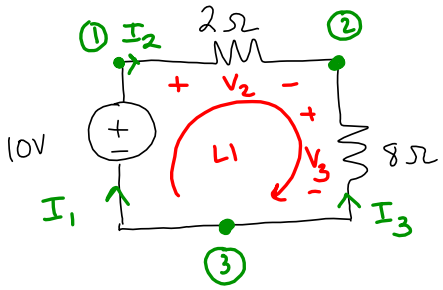
$I = 0$ if $R \to \infty$



Conductance $\equiv$ $G = \frac{1}{R} = \frac{I}{V}$ mhos $\mho$

Active Elements => Deliver or Absorb power





KCL

① $I_1 = I_2$

② $I_2 + I_3 = 0$

③ $0 = I_1 + I_3$

Brute Force

① Identify all nodes and loops in a ckt.

② Label all voltages and currents as appropriate.

③ Write KCL, KVL, & Ohm's law equations

④ Solve