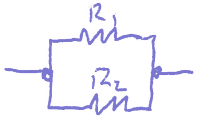
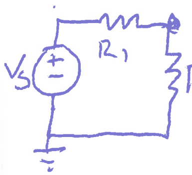
Resistors

$R_T = R_1 + R_2$



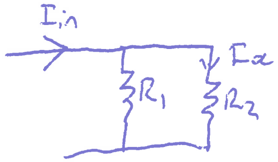
$R_T = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$

Voltage Divider



$V_A = \frac{R_2}{R_1 + R_2} V_S$

Current Divider



$I_x = \frac{R_1}{R_1 + R_2} I_{in}$

Circuit Equations

Ohm's Law $\quad V = IR$

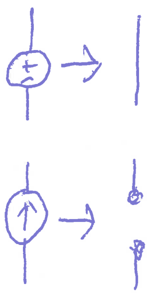
Power Across Resistor $P = VI = I^2R = \frac{V^2}{R}$

Inst. Power Inductor $P_L = \frac{1}{2}LI^2$

Inst. Power Capacitor $P_C = \frac{1}{2}CV^2$

INSTANTANEOUS

Zeroing Sources



Nodal Analysis

1. Form KCL equations
   e.g. $I_1 = I_2 - I_3$
2. Express currents in terms of node voltages

e.g.

$I_1 = \frac{V_A - V_B}{R_1}$

3. Sub ~~values~~ equations from ② into ①
4. Solve for node voltages
5. Use nodal voltages to find branch currents
6. Check $\Sigma P = 0$

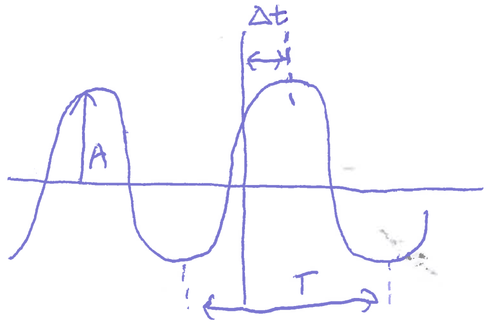
Mesh Analysis

1. Draw current loops
2. Form Mesh equation
   Hint: look for direction across Voltage sources

@ I_x: $V_S = R_1 I_x + (I_x - I_y)R_2 + R_3 I_x$

3. Solve for mesh currents
4. Relate mesh currents to branch currents
5. From ground, calculate node Voltages
6. check $\Sigma P = 0$

Sinusoids



$V(t) = A\cos(\omega t + \phi)$

$f = \frac{1}{T}$, $\omega = 2\pi f$

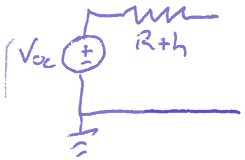
$\phi = \frac{\Delta t}{T} \times 2\pi$

Positive phase if wave is left shifted

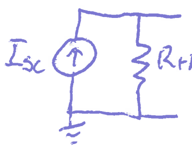
Negative otherwise

Equivalent Circuits

Thevenin



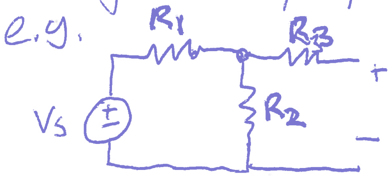
Norton



To find V_{oc}:

Leave circuit as-is and find voltage across open ports

e.g.



$V_{oc} = \frac{R_2}{R_1 + R_2} V_S$

To find I_{sc}:

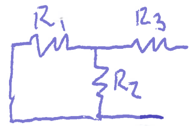
Short the output only and find current

$I_{sc} = \frac{R_2}{R_2 + R_3}\left(\frac{V_S}{R_1 + R_2 \| R_3}\right)$

Input current

To find R_{th}:

Zero all sources and minimize



$R_{th} = R_3 + \frac{R_1 R_2}{R_1 + R_2}$

Load Line