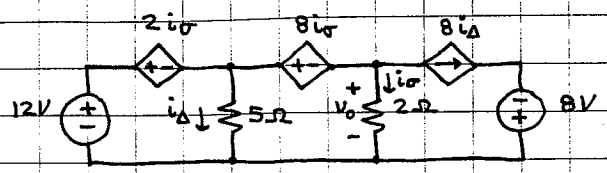
ex:



a) Calculate i_Δ and v_o. Use Ohm's law, Kirchoff's laws.

Left-side V loop (& Ohm's law): $12V - 2i_\sigma - i_\Delta 5\Omega = 0V$

Center V loop (& Ohm's law, as always): $v_o + 8i_\sigma - i_\Delta 5\Omega = 0V$

but $v_o = i_\sigma 2\Omega$ so center loop eqn is: $i_\sigma 2\Omega + 8i_\sigma - i_\Delta 5\Omega = 0V$

Now we have 2 eqns in two unknowns. Eliminate i_σ.

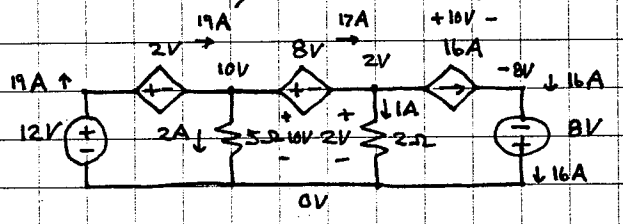
$10 i_\sigma - i_\Delta 5\Omega = 0$ (2nd eqn) $\therefore i_\sigma = i_\Delta \frac{5}{10} = \frac{i_\Delta}{2}$

Substitute into 1st eqn $12V - 2\frac{i_\Delta}{2} - i_\Delta 5\Omega = 0V$

$$i_\Delta = \frac{12V}{6\Omega} = 2A \qquad (i_\sigma = 1A)$$

and $v_o = i_\sigma \cdot 2\Omega = \frac{i_\Delta}{2} \cdot 2\Omega = i_\Delta \cdot 1\Omega = 2V$

Consistency check: put all i's and v's on circuit diagram and verify that it obeys Kirchoff's laws and Ohm's law.



Left loop V = 0 and 10V across 5Ω gives 2A ✓

Center loop V = 0 and 2V across 2Ω gives 1A ✓

b) Show power delivered = power absorbed for sol'n to (a).

Consistency check diagram for (a) shows v's and i's we get from solution plus what we deduce from Kirchoff's laws and Ohm's law. (We make sure total current into nodes = 0 and V drops around loops sum to 0V.)

An element develops power if positive current flows out of terminal labeled + for voltage. An element absorbs power if positive current flows into terminal labeled + for voltage. These definitions are for V drop > 0. Reverse them if V drop < 0 from terminal labeled + to terminal labeled −.

element	pwr developed = −i·v	pwr absorbed = i·v
12V src	19A · 12V = 228 W	
$2i_\sigma$ src		19A · 2V = 38 W
5Ω		2A · 10V = 20W
$8i_\sigma$ src		17A · 8V = 136W
2Ω		1A · 2V = 2W
$8i_\Delta$ src		16A · 10V = 160W
8V src	16A · 8V = 128 W	
tot	356W	tot 356W ✓