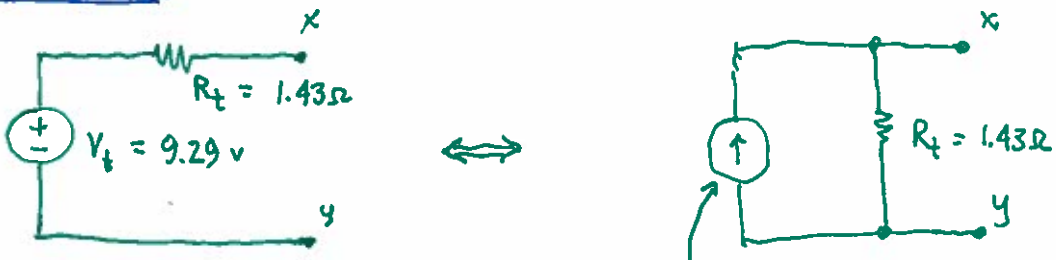
Thursday, February 25, 2016

Thevenin and Norton equivalents related by a source transformation.

Voltage source, V
series resistance, R

Current source, V/R
parallel resistance, R.

Example 2, revisited



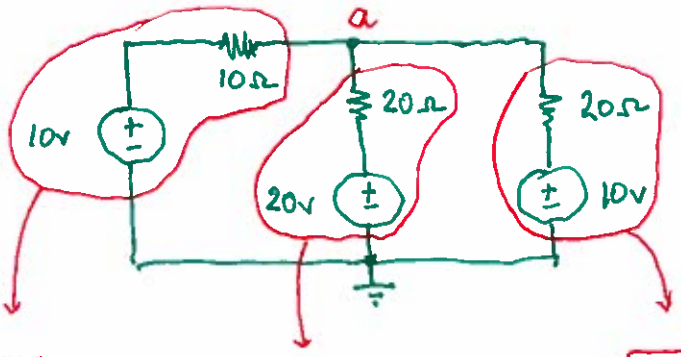
THEVENIN

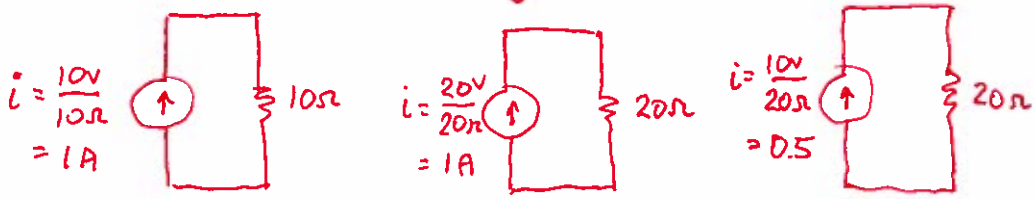
$i_n = V_t/R_t$
$= 6.5$ A

The source transformation as a handy simplification

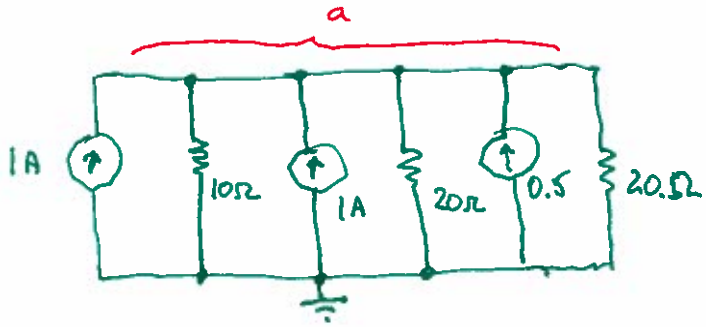
Circuits can often be simplified by source transformations.

Example:

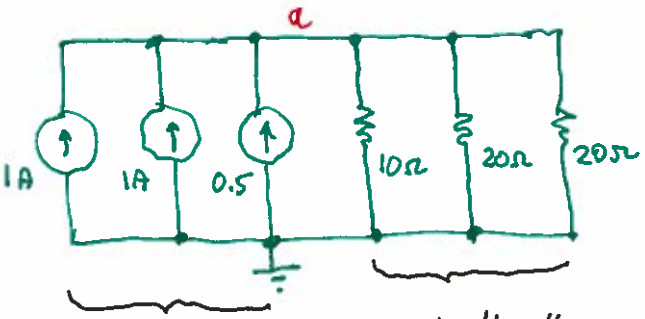




We now have

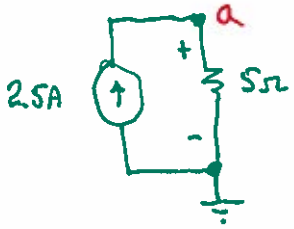


Rearranged:



$1+1+0.5 = 2.5\ A$

$10 // 20 // 20 = 5\Omega$



$V_a = 2.5 \times 5 = 12.5\ V$

Principle of superposition

A fundamentally important concept, and often a required method in AC circuit analysis. We first present for DC circuits.

Method:

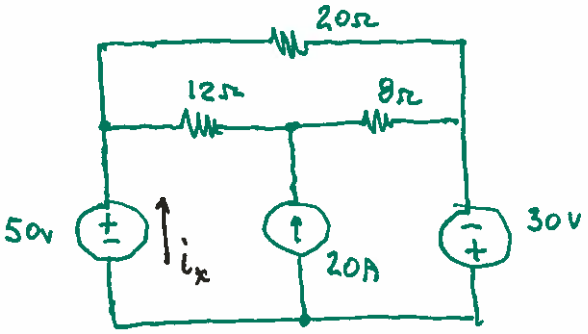
1. Let only one independent source be active.
2. Zero all other independent sources.
3. Determine the response (voltage or current) r' at desired location in the circuit.

Repeat one at a time for all other independent sources in circuit; find r'', r''', etc.

Superposition:

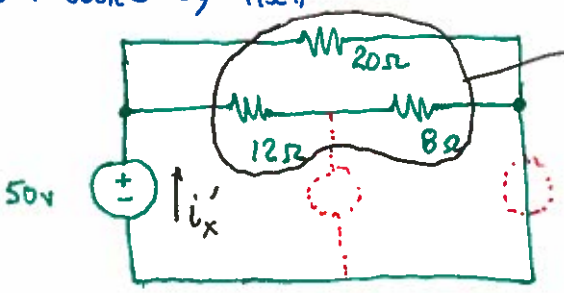
> The total response (voltage or current) r is the sum of the individual responses
> $r = r' + r'' + r''' + \dots$

Example 1: Find i_x by superposition



We have three independent sources. Activate <u>one source at a time</u>, zero the other two.

(a) 50 v source by itself

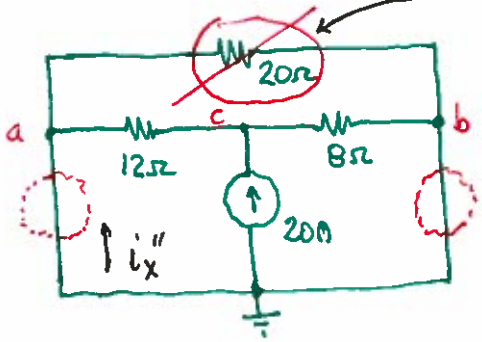


$(8+12)//20 = 20//20$

$= 10\Omega$

so $i_x' = \frac{50}{10} = 5A$

(b) 20 A source by itself



note endpoints connected together! ($V_a = V_b$), so 0 volts, 0 amps - ignore 20Ω resistor!)