

How Can We Check...node voltages?

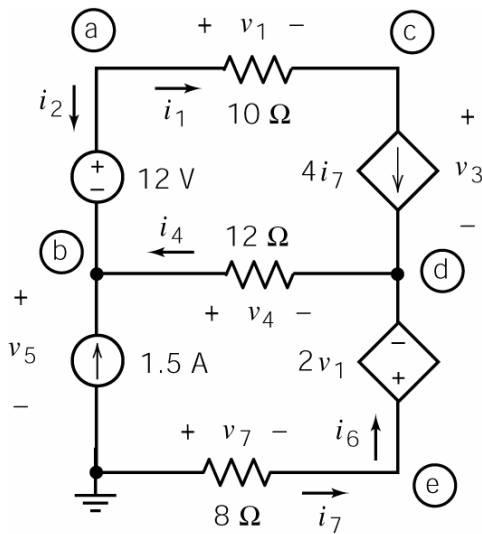
1. The reference directions of the element currents and voltages are labeled on this circuit drawing. The subscripts suggest a numbering of the 7 elements of this circuit. That numbering has been used to tabulate the values of the voltage and current of each circuit element.

Computer analysis of this circuit indicates that the node voltages are

$$v_a = 234 \text{ V}, v_b = 222 \text{ V}, v_c = 294 \text{ V}, v_d = 132 \text{ V} \text{ and } v_e = 12 \text{ V}$$

where, for example, v_a denotes the node voltage at node a.

- a. Check to see if the node voltages satisfy the constitutive equations of the circuit elements.
- b. Check to see if the node voltages satisfy agree with the tabulated values of the element currents and voltages.
- c. Verify that power is conserved.



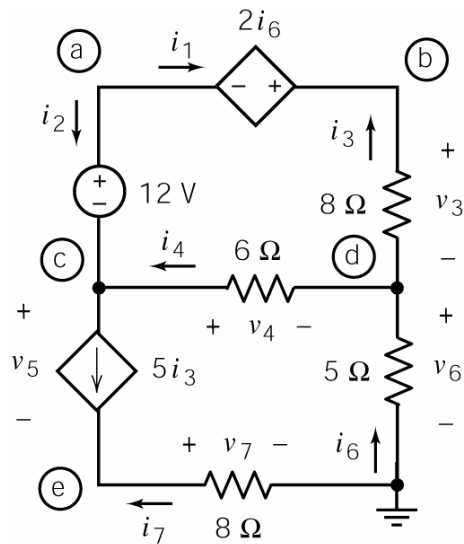
	$v, \text{ V}$	$i, \text{ A}$	$p = iv, \text{ W}$
1	-60.0	-6.0	360
2	12.0	6.0	72
3	162.0	-6.0	-972
4	90.0	-7.50	-675
5	222.0	1.50	333
6	-120.0	-1.50	180
7	-12.0	-1.50	18

2. Computer analysis of this circuit indicates that the node voltages are

$$v_a = -1.555 \text{ V}, v_b = -3.778 \text{ V}, v_c = -13.556 \text{ V}, v_d = -5.559 \text{ V} \text{ and } v_e = 8.889 \text{ V}$$

where, for example, v_a denotes the node voltage at node a.

The reference directions of the element currents and voltages are labeled on this circuit drawing. The subscripts suggest a numbering of the 7 elements of this circuit. That numbering has been used to set up a table for the values of the voltage and current for each circuit element. Complete the table.



	v, V	i, A	$p = iv, \text{W}$
1			
2			
3			
4			
5			
6			
7			

Solutions:

1.

For example we can check:

Ohm's law:
$$i_4 = -\frac{v_4}{12} = -\frac{v_b - v_d}{12} = -\frac{222 - 132}{12} = -7.5 \text{ A}$$

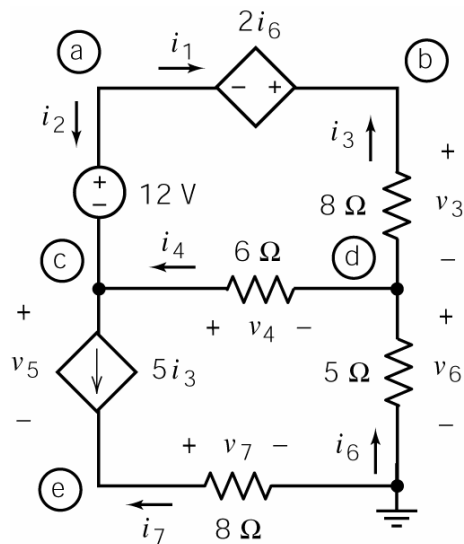
KCL at node d:

$$i_4 = 4i_7 + i_6 = 4i_7 + i_7 = 5i_7 \Rightarrow -\frac{v_b - v_d}{12} = 5\left(\frac{0 - v_e}{8}\right) \Rightarrow -\frac{222 - 132}{12} = 5\left(\frac{-12}{8}\right)$$

The constitutive equation of the VCVS:

$$v_6 = 2v_1 \Rightarrow v_b - v_d = 2(v_a - v_c) \Rightarrow (12 - 132) = 2(243 - 294)$$

2.



	$v, \text{ V}$	$i, \text{ A}$	$p = iv, \text{ W}$
1	-2.222	0.2222	-0.4937
2	12	-0.2222	-2.6664
3	1.778	-0.2222	-0.3951
4	-8.00	1.333	-10.664
5	-22.44	1.111	-24.933
6	-5.559	1.111	6.176
7	8.889	-1.111	9.8757