

ECE 111 - Homework #5

Week #5: EE 206 Circuits I. - Due 11am Tuesday, September 27th

1) A resistor has the following volts / amps / resistance / power. Determine the missing parameters:

	Volts	Amps	Ohms	Watts
a)	40V	1.5A	26.67	60W
b)	40V	10A	4	400W
c)	24V	5A	4.8	120
d)	40V	2.5A	16	100

Sample Calculations

$$V = IR$$

$$P = VI$$

a)

$$R = \left(\frac{V}{I}\right) = \left(\frac{40V}{1.5A}\right) = 26.67\Omega$$

$$P = VI = (40V)(1.5A) = 60W$$

b)

$$I = \left(\frac{V}{R}\right) = \left(\frac{40V}{4\Omega}\right) = 10A$$

$$P = VI = (40V)(10A) = 400W$$

c)

$$V = \left(\frac{P}{I}\right) = \left(\frac{120W}{5A}\right) = 24V$$

$$R = \left(\frac{V}{I}\right) = \left(\frac{24V}{5A}\right) = 4.8\Omega$$

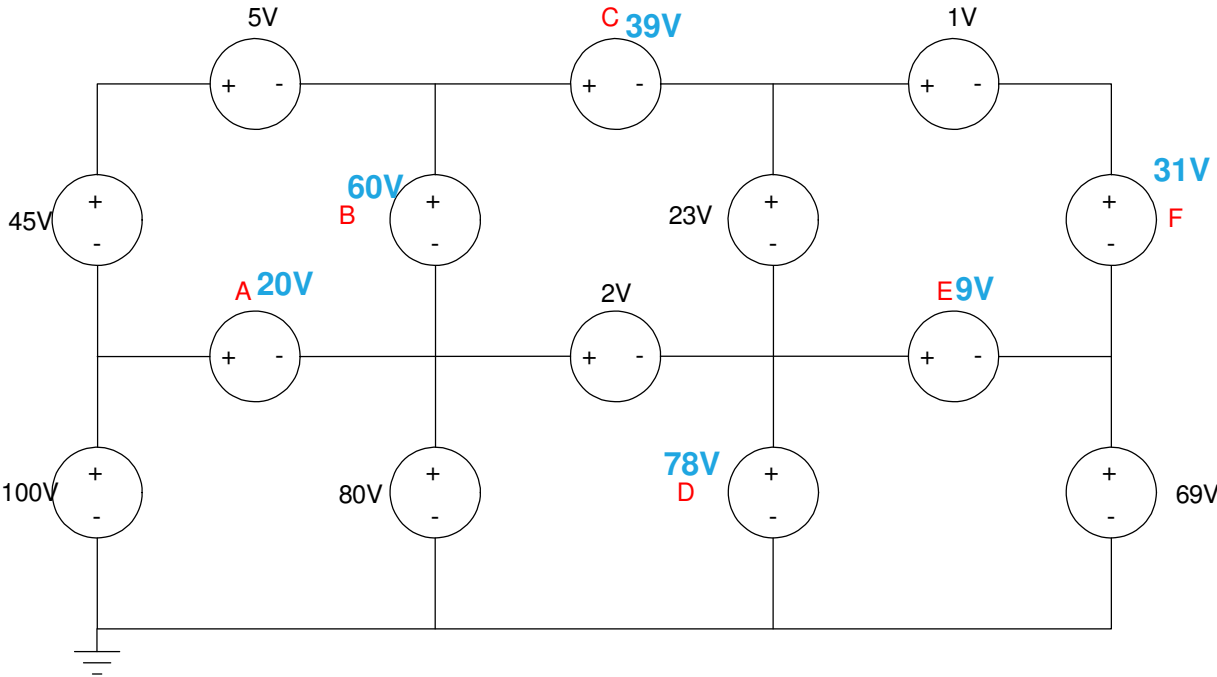
d)

$$I = \left(\frac{P}{V}\right) = \left(\frac{100W}{40V}\right) = 2.5A$$

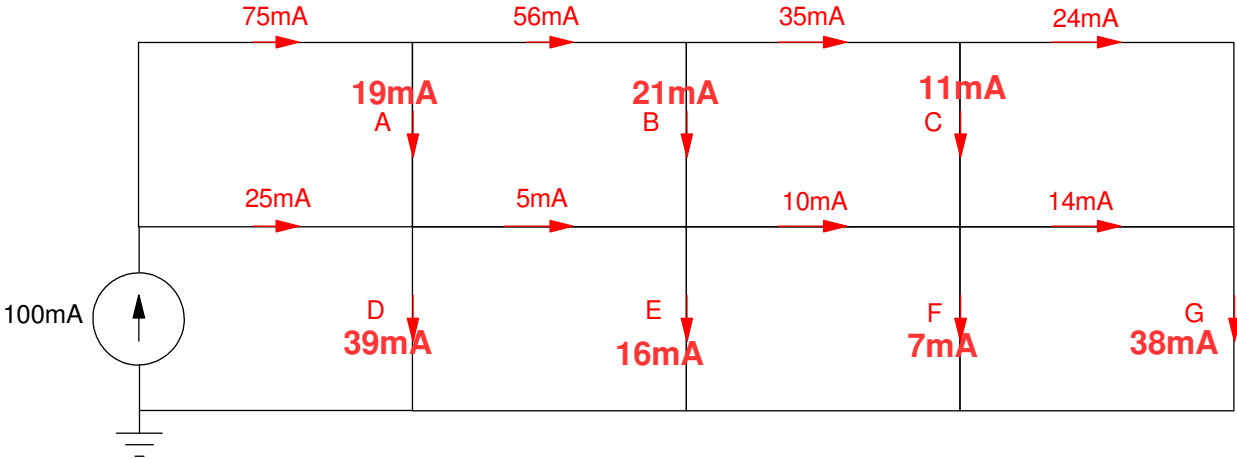
$$R = \left(\frac{V}{I}\right) = \left(\frac{40V}{2.5A}\right) = 16\Omega$$

Kirchoff's Laws:

2) Use conservation of voltage to determine the unknown voltages

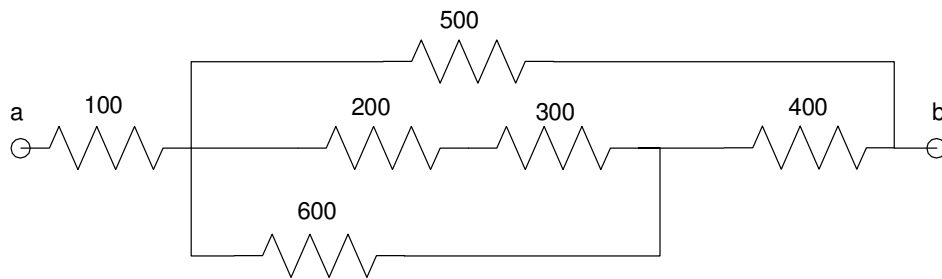


3) Use conservation of current to determine the unknown currents



Resistors in Series and Parallel

4) Find the total resistance R_{ab}



$$300 + 200 = 500 \quad \text{series}$$

$$500 \parallel 600 = 272.72 \quad \text{parallel}$$

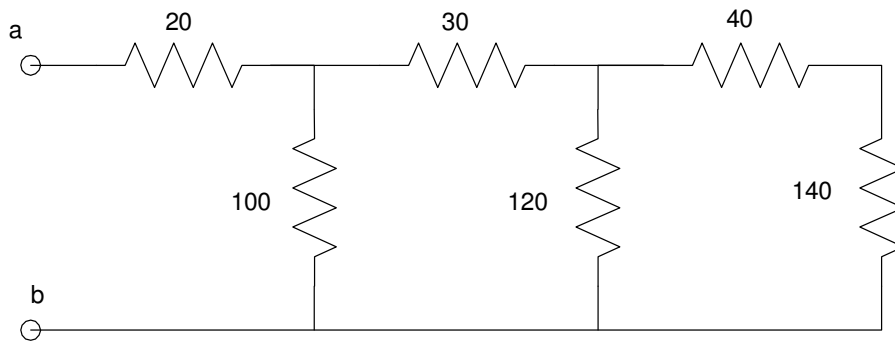
$$272.72 + 400 = 672.72 \quad \text{series}$$

$$672.72 \parallel 500 = 286.82 \quad \text{parallel}$$

$$286.82 + 100 = 386.82 \quad \text{series}$$

$$\mathbf{R_{ab} = 386.82 \text{ Ohms}}$$

5) Find the total resistance Rab



$$140 + 40 = 180$$

$$180 \parallel 120 = 72$$

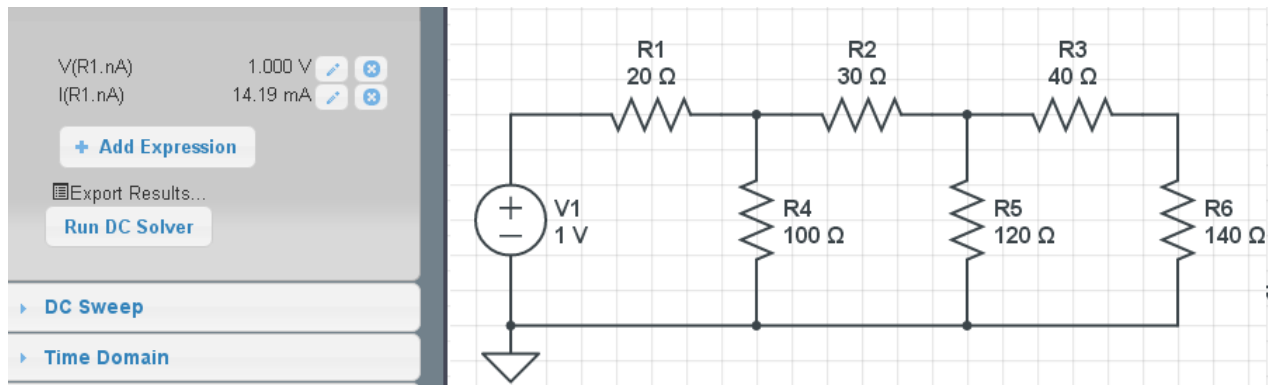
$$72 + 30 = 102$$

$$102 \parallel 100 = 50.49$$

$$50.49 + 20 = 70.49$$

$$\mathbf{R_{ab} = 70.49 \text{ Ohms}}$$

6) Use CircuitLab to find the resistance Rab (apply a 1V source and determine the current draw)



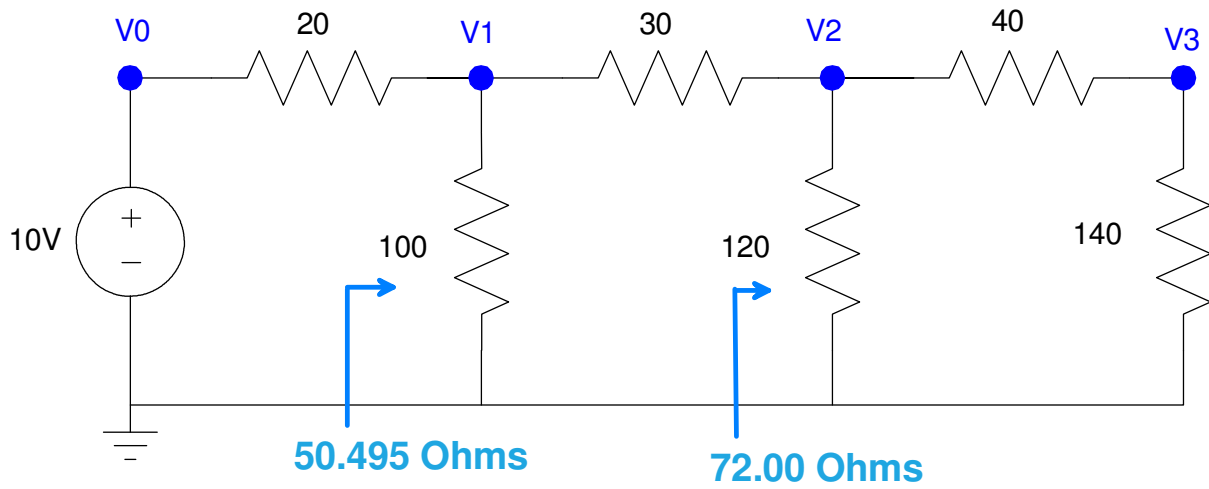
The circuit draws 14.19mA with a 1V source

$$R = \left(\frac{V}{I} \right) = \left(\frac{1V}{14.19mA} \right) = 70.47\Omega$$

This matches calculations from problem #5 (with some rounding errors)

Voltage Division

7) Use voltage division to find V_1 , V_2 , and V_3 .

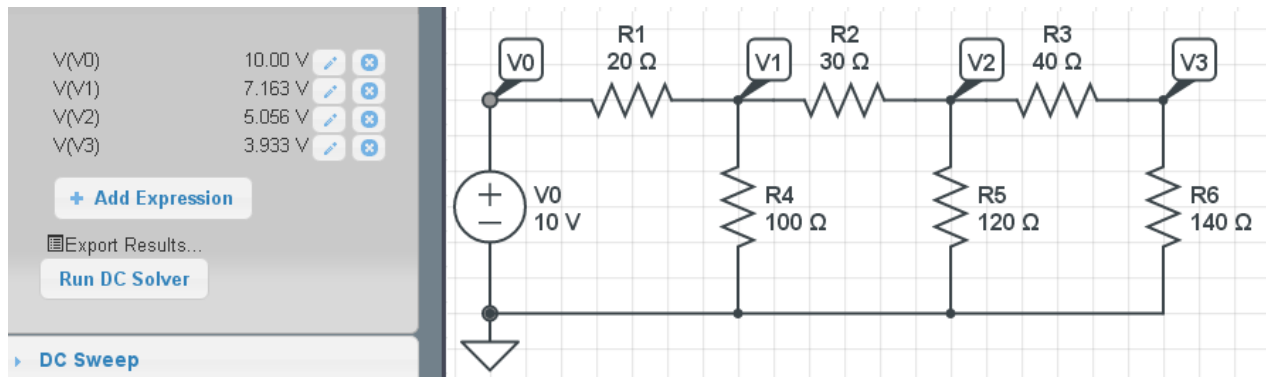


$$V_1 = \left(\frac{50.495}{50.495+20} \right) V_0 = 7.1629V$$

$$V_2 = \left(\frac{72}{72+30} \right) V_1 = 5.0562V$$

$$V_3 = \left(\frac{140}{140+40} \right) V_2 = 3.9326V$$

8) Use CircuitLab to find V_1 , V_2 , V_3 .



CircuitLab results match calculations