

# ECE 111 - Homework #8

EE 206 Circuits I

$$V = IR, P = VI$$

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

Volts	Amps	Ohms	Watts
32V	2.4A	<b>13.33 Ohms</b>	<b>76.8W</b>
32V	<b>4.00A</b>	8	<b>128W</b>
<b>40.0V</b>	3.0A	<b>13.33 Ohms</b>	120W
32V	<b>3.00A</b>	<b>10.67 Ohms</b>	96W

Sample Calculations

$$V = IR$$

$$32V = 2.4A \cdot R$$

$$R = \left( \frac{32V}{2.4A} \right) = 13.33\Omega$$

$$P = VI$$

$$P = (32V)(2.4A) = 76.8W$$

## Resistor Color Codes

2) Determine the value of the following resistors

a) Brown - Black - Green

1 - 0 - 5

$$R = 10 \cdot 10^5$$

$$R = 1M\Omega$$

b) Orange - Orange - Red

3 - 3 - 2

$$R = 33 \cdot 10^2$$

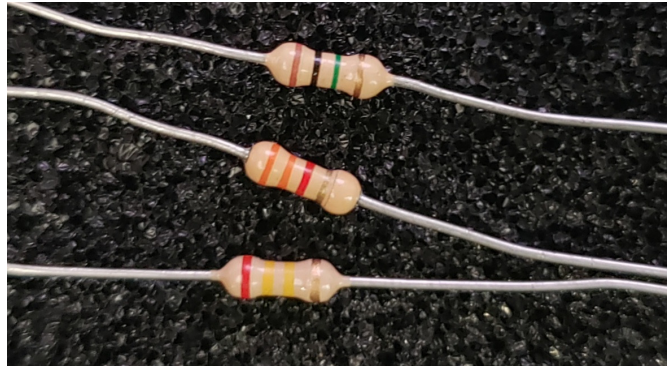
$$R = 3.3k\Omega$$

c) Red - Yellow - Yellow

2 - 4 - 4

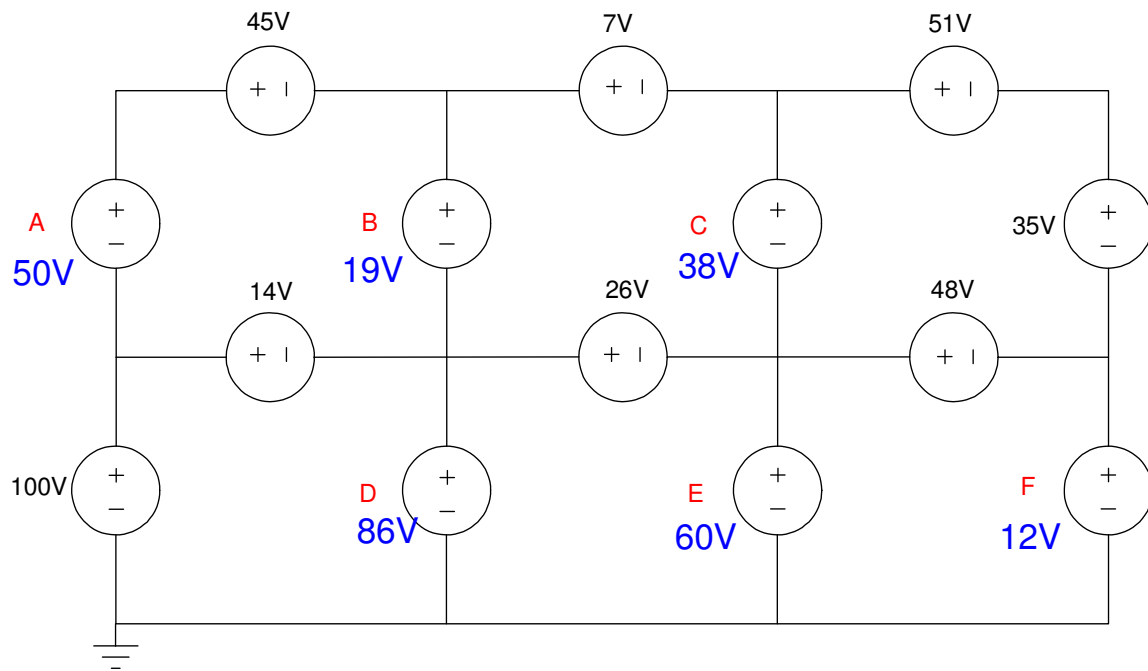
$$R = 24 \cdot 10^4\Omega$$

$$R = 240k\Omega$$



## Kirchoff's Laws:

3) Use conservation of voltage to determine the unknown voltages



Apply conservation of voltage: around any closed path, the voltages have to sum to zero.

Example Window (2, 1)

$$-100V + 14V + D = 0$$

$$D = 86V$$

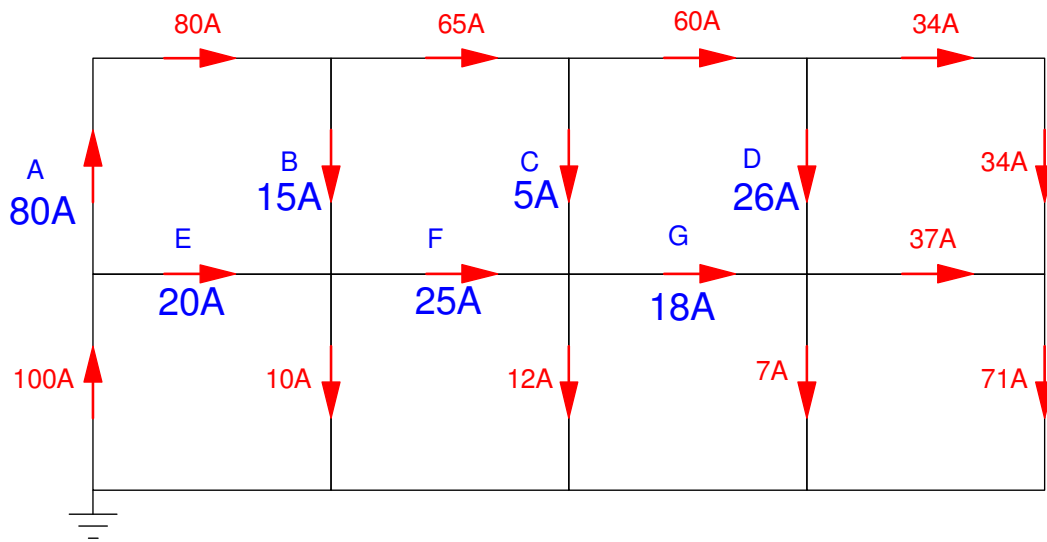
Window (2,2)

$$-86V + 26V + E = 0$$

$$E = 60V$$

etc.

4) Use conservation of current to determine the unknown currents



Apply conservation of current: Current In = Current Out

Top left corner:

$$A = 80A$$

Middle Left

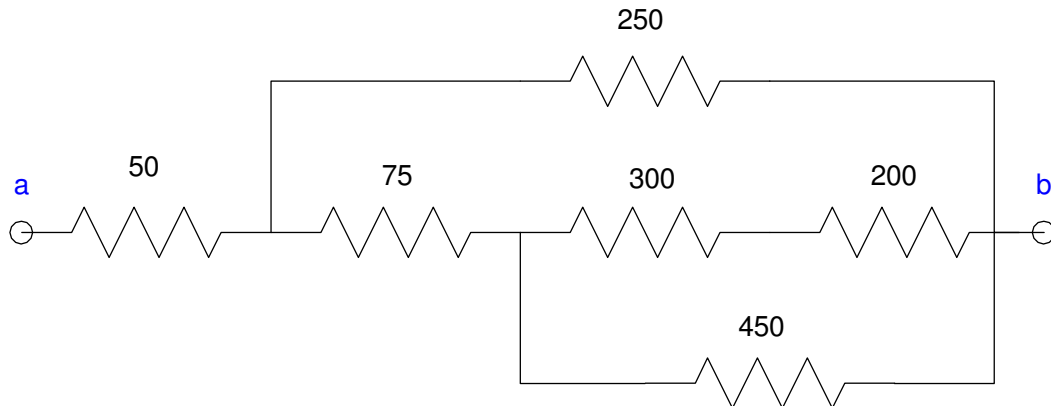
$$100A = A + E$$

$$E = 20A$$

etc

## Resistors in Series and Parallel

5) Find the total resistance  $R_{ab}$  by hand



Problem #4 & 5

Combine resistors in series and parallel

In series

$$R_{net} = R_1 + R_2$$

In parallel

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

$$\begin{aligned} 300 + 200 &= 500 \\ 500 \parallel 450 &= 236.84 \\ 236.84 + 75 &= 311.84 \\ 311.84 \parallel 250 &= 138.76 \\ 138.76 + 50 &= 188.76 \end{aligned}$$

On an HP42 or HP Prime

HP Prime: to get to RPN mode, Settings - Entry - RPN

```

200
enter
300
+
1/x
450
1/x
+
1/x
75
+
1/x
250
1/x
+
1/x
50
+

```



6) Find the total resistance  $R_{ab}$  using CircuitLab

- Apply a 10V source to a and b.
- Determine the current draw from the 10V source
- Calculate the net resistance from  $V = IR$

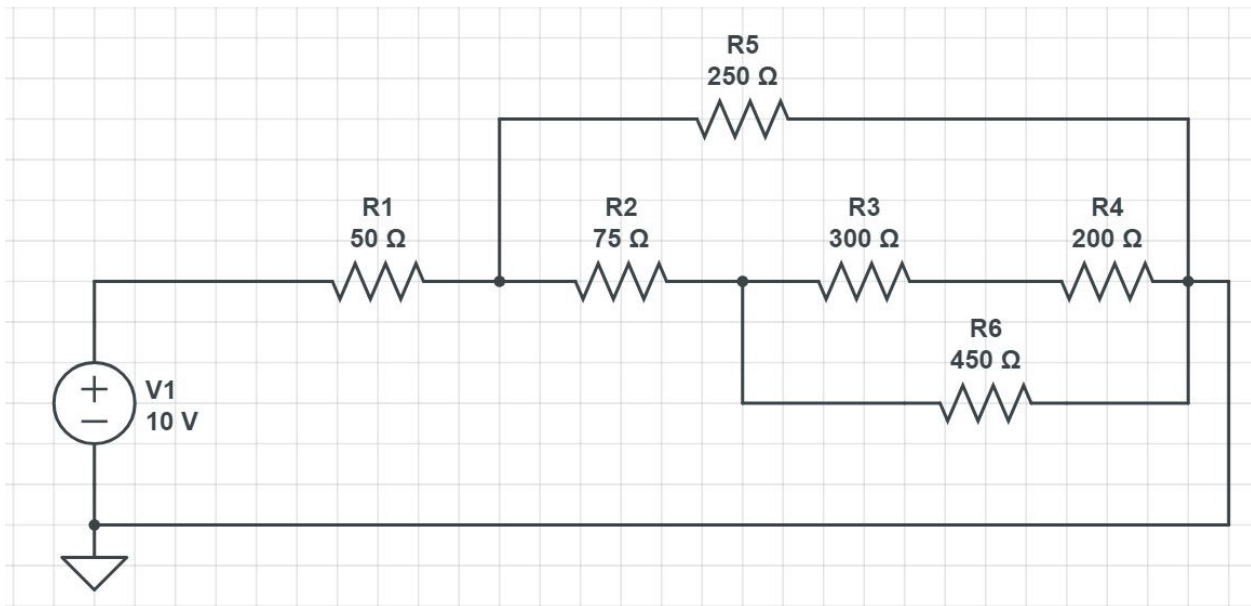
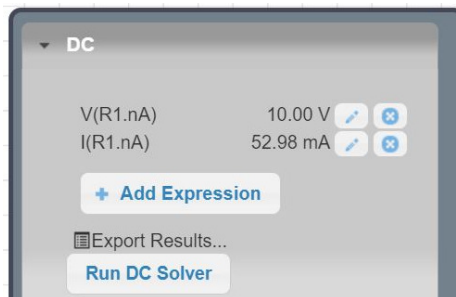
Calculations

$$V = IR$$

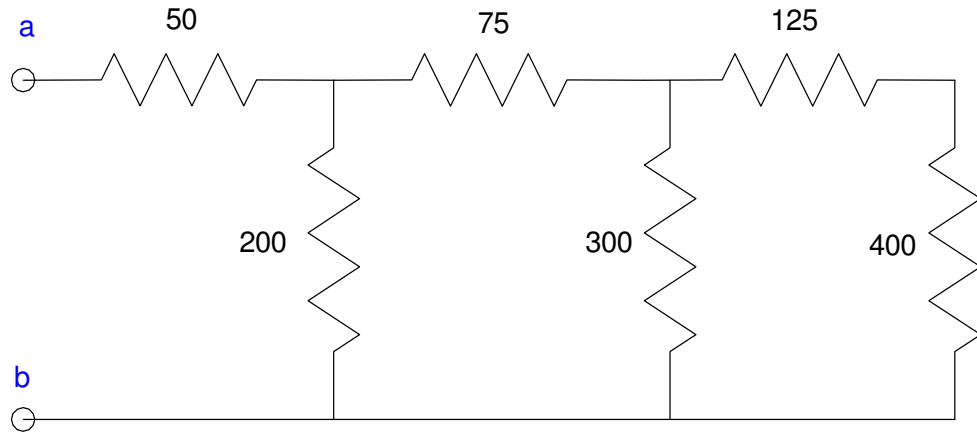
$$10V = 52.98mA \cdot R$$

$$R = 188.75\Omega$$

(calculations were 188.76 Ohms)



7) Find the total resistance  $R_{ab}$  by hand



Problem 7 & 8

Again, add resistors in series and parallel

$$\begin{aligned}
 125 + 400 &= 525 \\
 525 \parallel 300 &= 130.909 \\
 130.909 + 75 &= 265.909 \\
 265.909 \parallel 200 &= 114.14 \\
 114.14 + 50 &= 164.14
 \end{aligned}$$

On an HP42 or HP Prime:

HP Prime: to get to RPN mode, Settings - Entry - RPN

```

125
enter
400
+
1/x
300
1/x
+
1/x
75
+
1/x
200
1/x
+
1/x
50
+

```



8) Find the total resistance,  $R_{ab}$ , using CircuitLab

- Apply a 10V source to a and b.
- Determine the current draw from the 10V source
- Calculate the net resistance from  $V = IR$

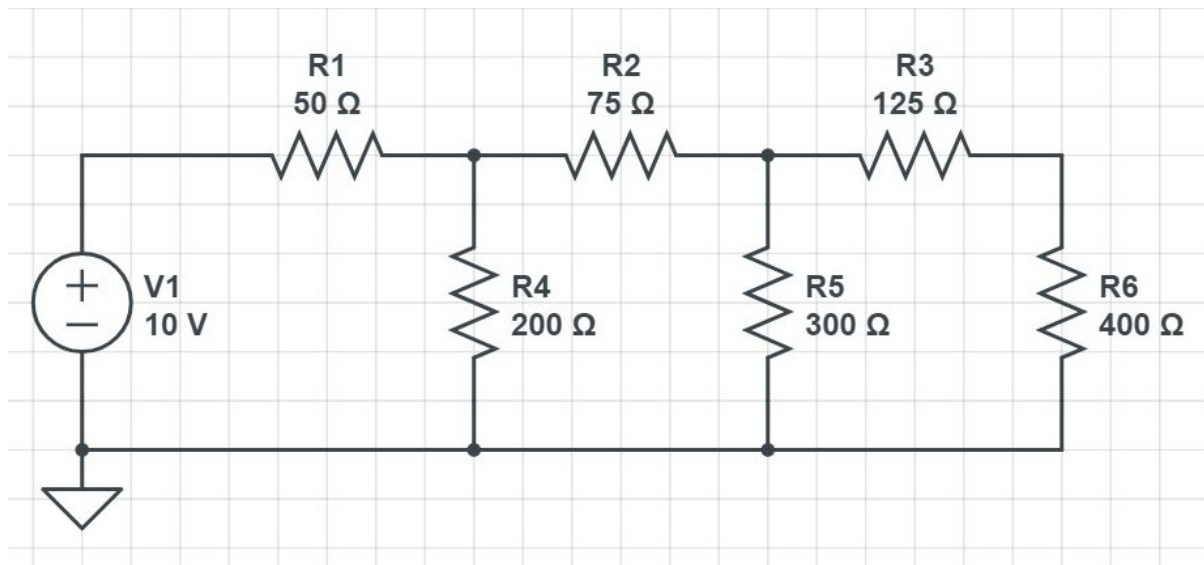
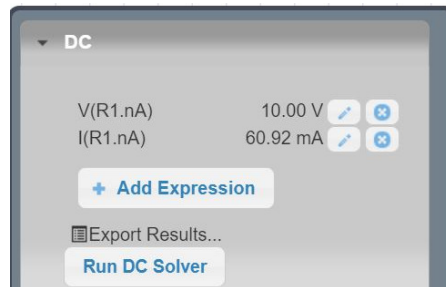
Calculations

$$V = IR$$

$$10V = 60.92mA \cdot R$$

$$R = 164.1497\Omega$$

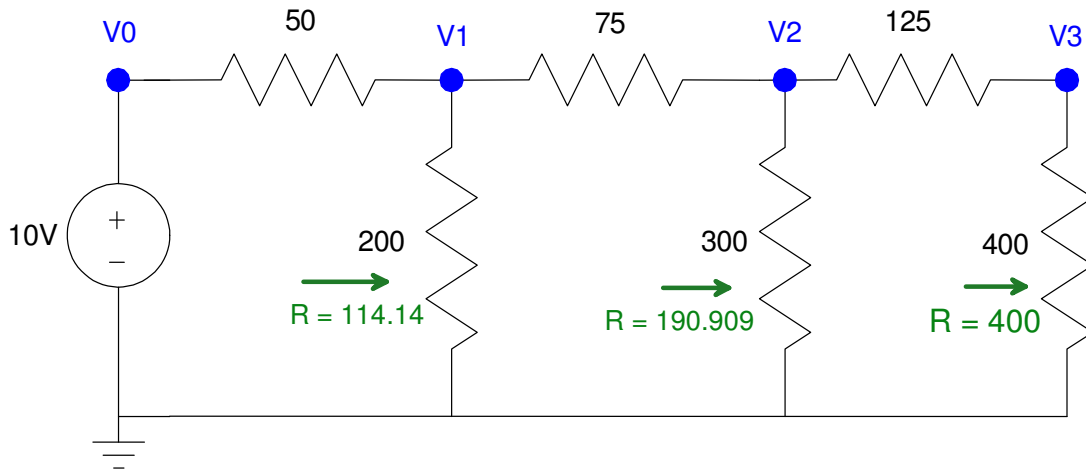
Calculated resistance was 164.1463 Ohms





## Voltage Division

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



Problem 9 & 10

Trick:

- Find the net resistance at  $V_1$  looking right
- $R = 114.14$  Ohms (series and parallel combinations)
- Use voltage division to find  $V_1$

$$V_1 = \left( \frac{114.14}{114.14 + 50} \right) V_0$$

$$V_1 = 6.9539V$$

Find the net resistance at  $V_2$  looking right

$$R = 190.909$$

$$V_2 = \left( \frac{190.909}{190.909 + 75} \right) V_1$$

$$V_2 = 4.9926V$$

Find the net resistance at  $V_3$  looking right

$$R = 400$$

$$V_3 = \left( \frac{400}{400 + 125} \right) V_2$$

$$V_3 = 3.8039V$$

- 10) Use CircuitLab to find V1, V2, V3.
- The results are the same as problem #9

