ECE 111 - Homework #8

EE 206 Circuits I

Due Monday, March 27th. Please submit via email or on BlackBoard

V = IR, P = VI

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

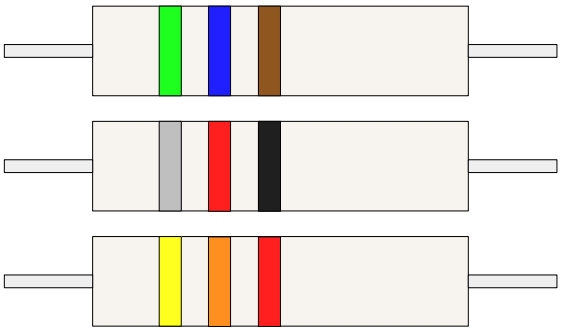
Volts (V)	Amps (I)	Ohms (R)	Watts (W)
12V	1.7A	**7.059**	**20.4 W**
12V	**2.00A**	24	**24.00W**
29.412V	1.7A	**17.30 Ohms**	50W
12V	**0.333 A**	**36.0 Ohms**	4W

Resistor Color Codes

black	brown	red	orange	yellow	green	blue	violet	grey	white
0	1	2	3	4	5	6	7	8	9

2) Determine the value of the following resistors

a) Green - Blue - Brown



5 6 1

$R = 56 \cdot 10^{1}\Omega$

$R = 560\Omega$

b) Grey - Red - Black

8 2 0

$R = 82 \cdot 10^{0}\Omega$

$R = 82\Omega$

c) Yellow - Orange - Red

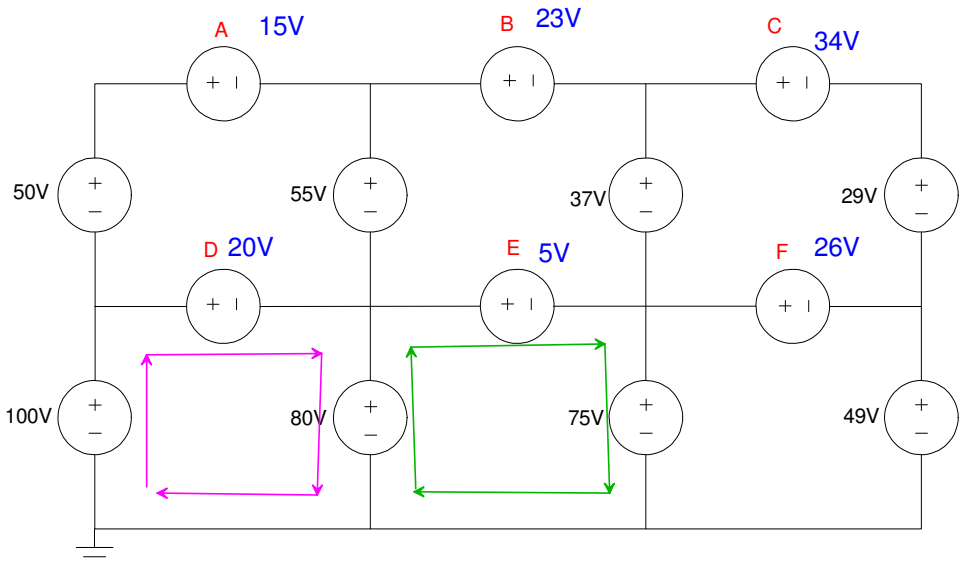
4 3 2

$R = 43 \cdot 10^{2}\Omega$

$R = 4.3k\Omega$

Kirchoff's Laws:

3) Use conservation of voltage to determine the unknown voltages



The voltages around any closed loop much sum to zero

Pink:

-100 + D + 80 = 0

D = 20

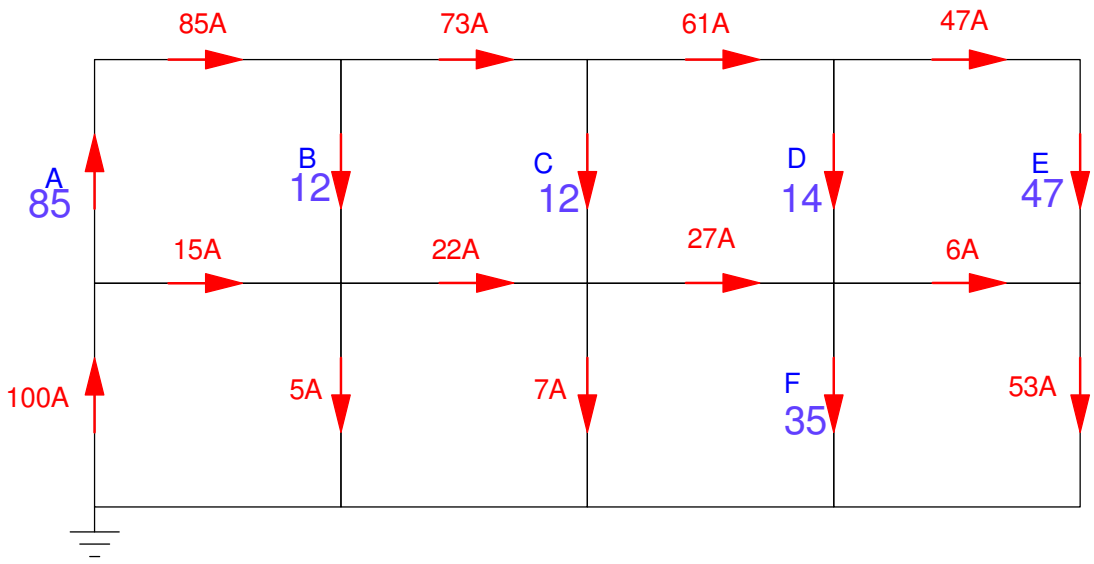
Green:

-80 + E + 75 = 0

E = 5

4) Use conservation of current to determine the unknown currents

Current In = Current Out



A = 85

85 = B + 73

73 = C + 61

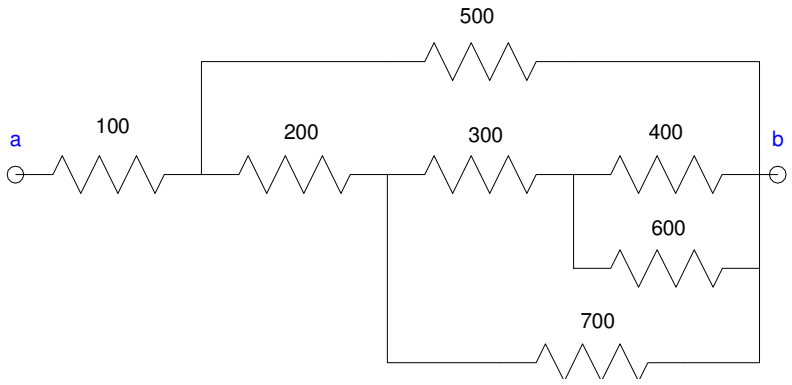
51 = D + 47

47 = E

27 + D = F + 6

Resistors in Series and Parallel

5) Compute the total resistance Rab by hand (i.e. using Matlab or a calculator)



Using Matlab

```
>> Ra = 1 / (1/400 + 1/600)
Ra =   240

>> Rb = Ra + 300
Rb =   540

>> Rc = 1 / (1/Rb + 1/700)
Rc =  304.8387

>> Rd = Rc + 200
Rd =  504.8387

>> Re = 1 / (1/Rd + 1/500)
Re =  251.2039

>> Rab = Re + 100
Rab =  351.2039
```

Using an HP Prime or HP42 (Free42)

```
400
1/x
600
1/x
+
1/x
300
+
1/x
700
1/x
+
1/x
200
+
1/x
500
1/x
+
1/x
100
+
```

6) Find the total resistance Rab 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

Circuit Lab gives

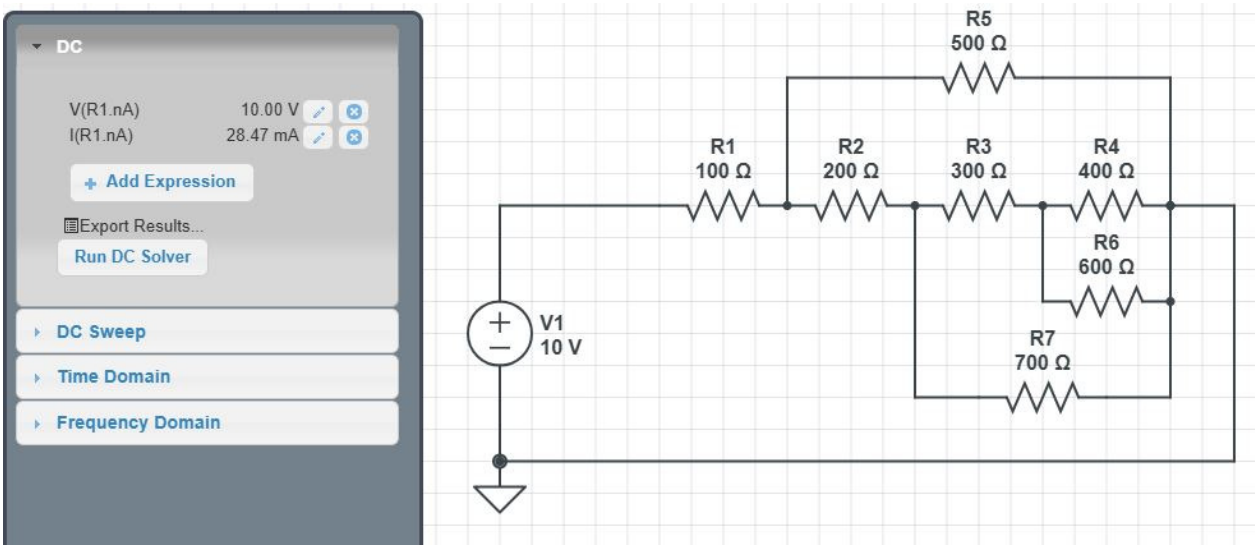
- 10.00V
- 28.47mA

From V = I R

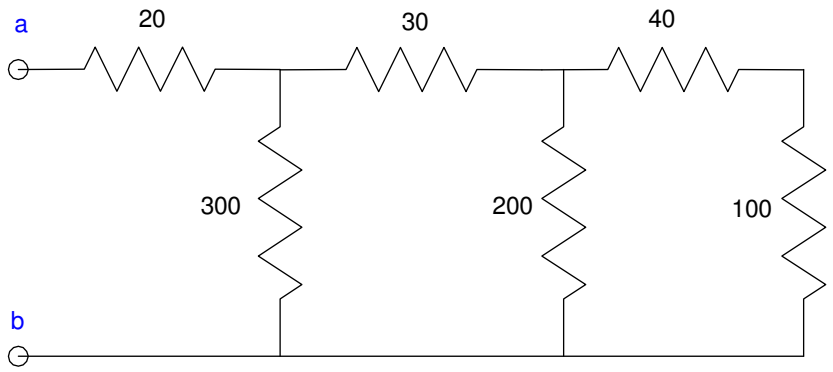
$$R = \left(\frac{10V}{28.47mA}\right) = 351.247\Omega$$

Which matches calculations (with some rounding errrors)

```
Rab =  351.2039
```



7) Compute the total resistance Rab by hand (i.e. using Matlab or a calculator)




```
>> Ra = 100 + 40

Ra =   140

>> Rb = 1 / (1/Ra + 1/200)

Rb =   82.3529

>> Rc = Rb + 30

Rc =  112.3529

>> Rd = 1 / (1/300 + 1/Rc)

Rd =   81.7404

>> Rab = Rd + 20
```

Rab = 101.7404

On an HP Prime (or HP42)

```
100
enter
40
+
1/x
200
1/x
+
1/x
30
+
1/x
300
1/x
+
1/x
20
+
```

8) Find the total resistance, Rab, using CircuitLab

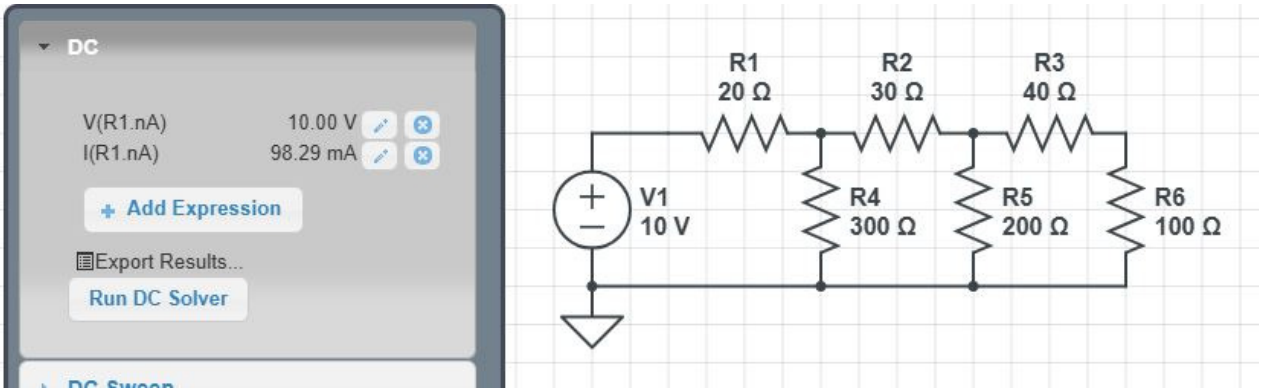
From CircuitLab

- V = 10.00V300
- I = 98.29mA

$$R = \frac{V}{I} = \frac{10.00V}{98.29mA} = 101.740\Omega$$

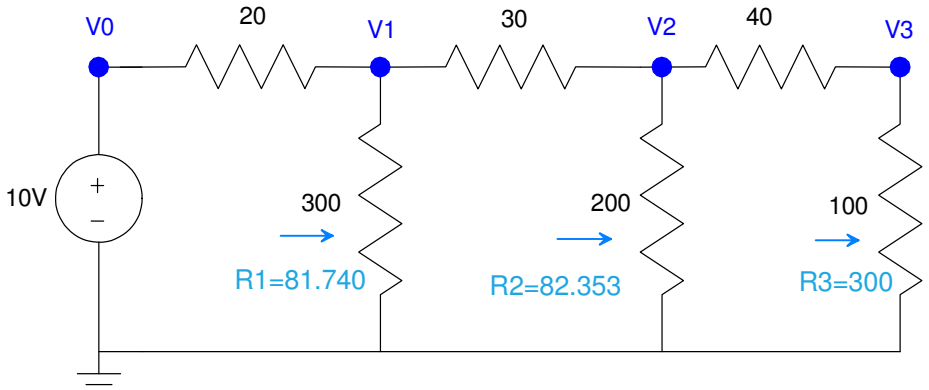
Matches calculations

```
Rab =  101.7404
```



Voltage Division

9) Use voltage division to find V1, V2, and V3.



Find the resistances looking right

```
>> R3 = 100
R3 =   100

>> R2 = 1 / (1/200 + 1/(R3+40))
R2 =   82.3529

>> R1 = 1 / (1/300 + 1/(R2+30))
R1 =   81.7404
```

Now use voltage division

```
>> V0 = 10
V0 = 10

>> V1 = ( R1 / (R1 + 20) ) * V0
V1 =    8.0342

>> V2 = ( R2 / (R2 + 30) ) * V1
V2 =    5.8890

>> V3 = ( R3 / (R3 + 40) ) * V2
V3 =    4.2064
```

10) Use CircuitLab to find V1, V2, V3.

- same answers as what was calculated

```
V0 = 10
V1 =    8.0342
V2 =    5.8890
V3 =    4.2064
```