

ECE 111 - Homework #8

ECE 211 Circuits I

$V = IR$, $P = VI$

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

Volts	Amps	Ohms	Watts
15V	3.0A	5.00	45.00
15V	1.875	8	28.125
20.00	6.0A	3.333	120W
15V	4.00	3.75	60W

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) Grey - Red - Yellow

8 2 4

$$R = 82 \cdot 10^4 = 820k\Omega$$

b) Orange - White - Red

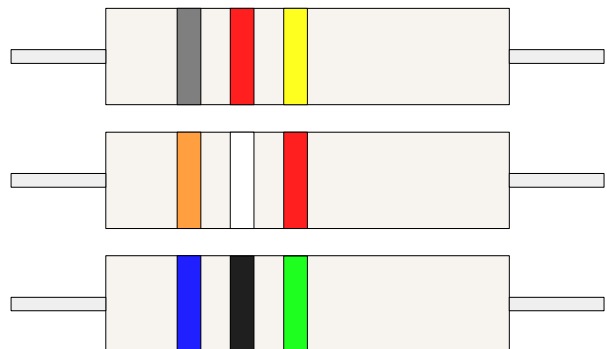
3 9 2

$$R = 39 \cdot 10^2 = 3.9k\Omega$$

c) Blue- Black - Green

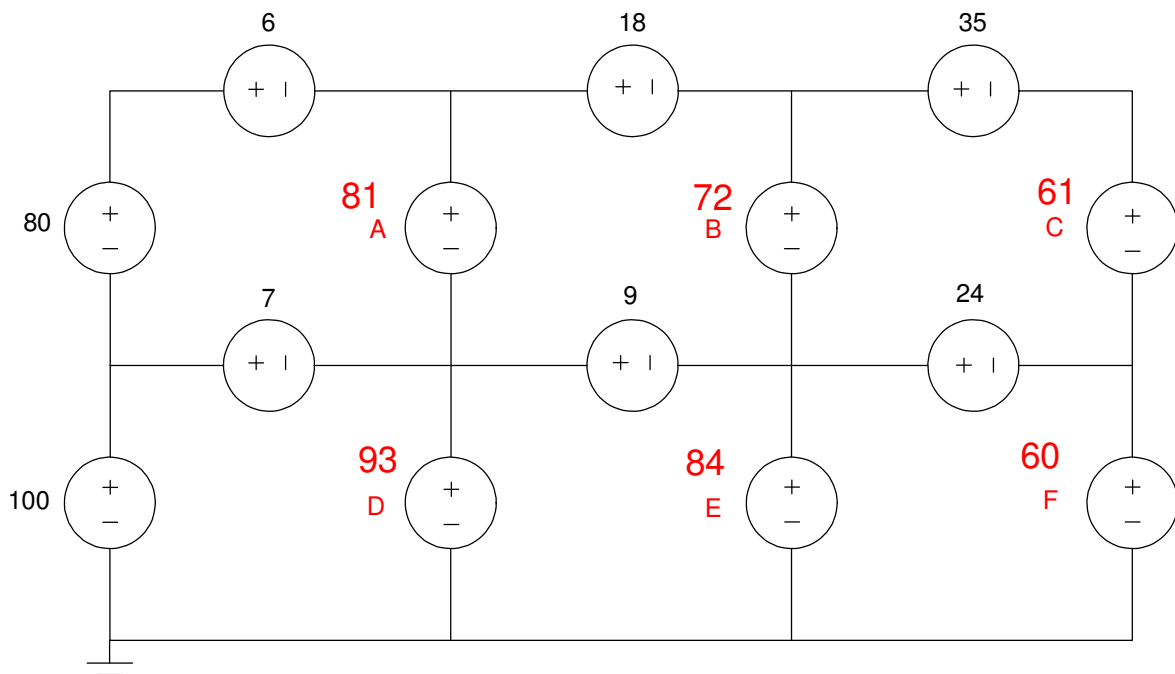
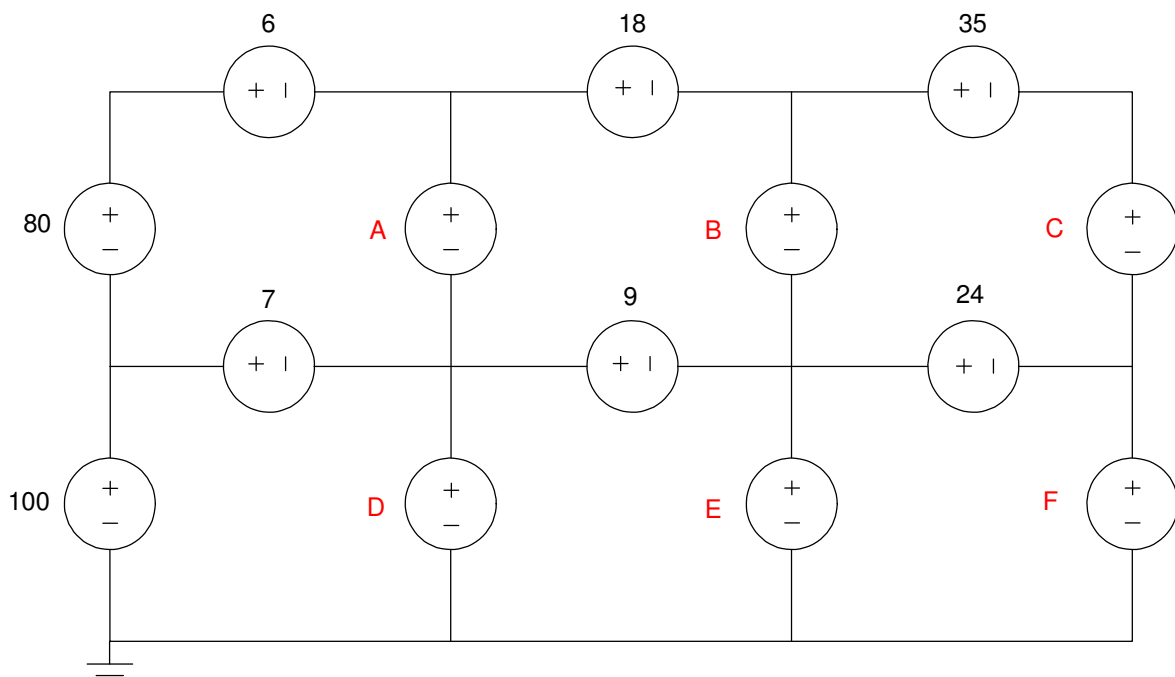
6 0 5

$$R = 60 \cdot 10^5 = 6.0M\Omega$$

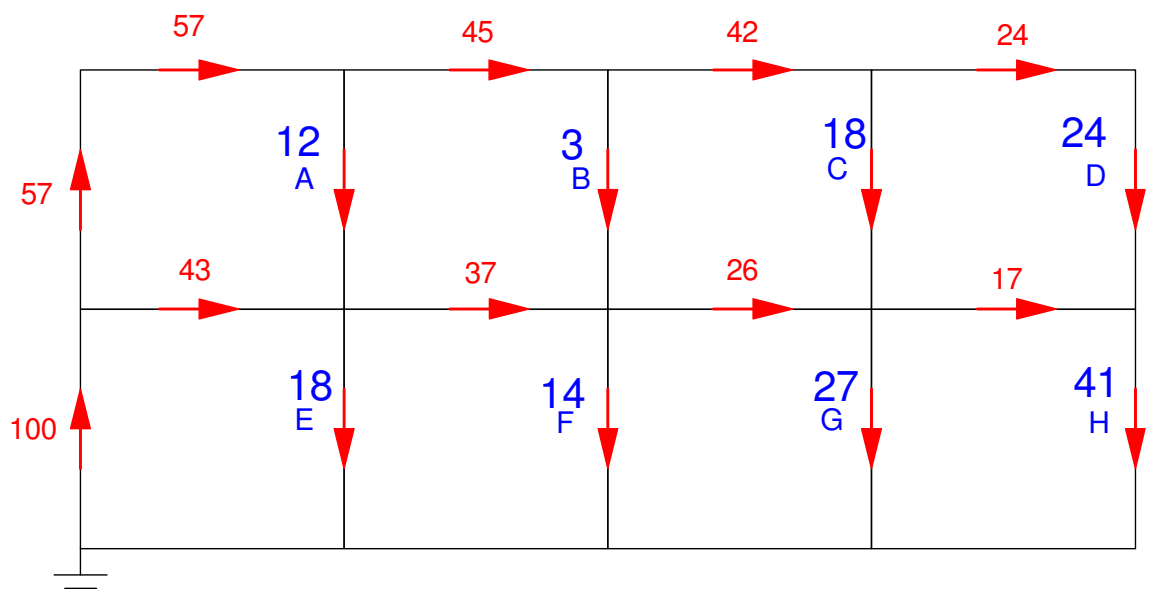
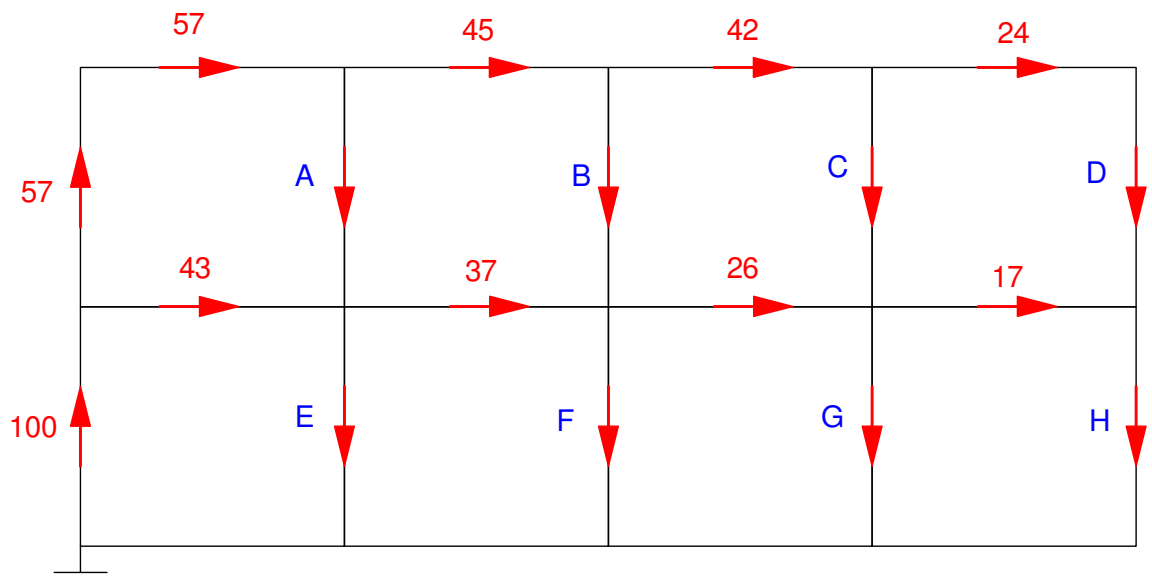


Kirchoff's Laws:

3) Use conservation of voltage to determine the unknown voltages

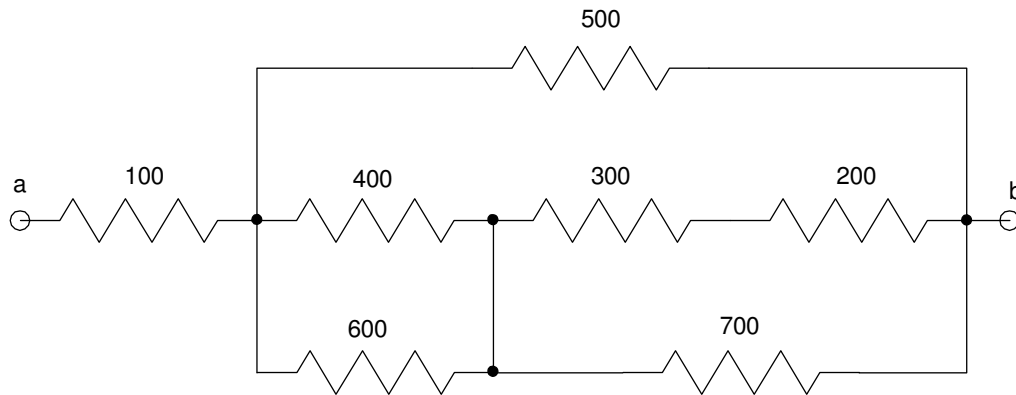


4) Use conservation of current to determine the unknown currents



Resistors in Series and Parallel

5) Compute the total resistance R_{ab} by hand (i.e. using Matlab or a calculator)



In Matlab

```
>> R1 = 200 + 300
R1 = 500

>> R2 = 1 / (1/R1 + 1/700)
R2 = 291.6667

>> R3 = 1 / (1/400 + 1/600)
R3 = 240

>> R4 = R2 + R3
R4 = 531.6667

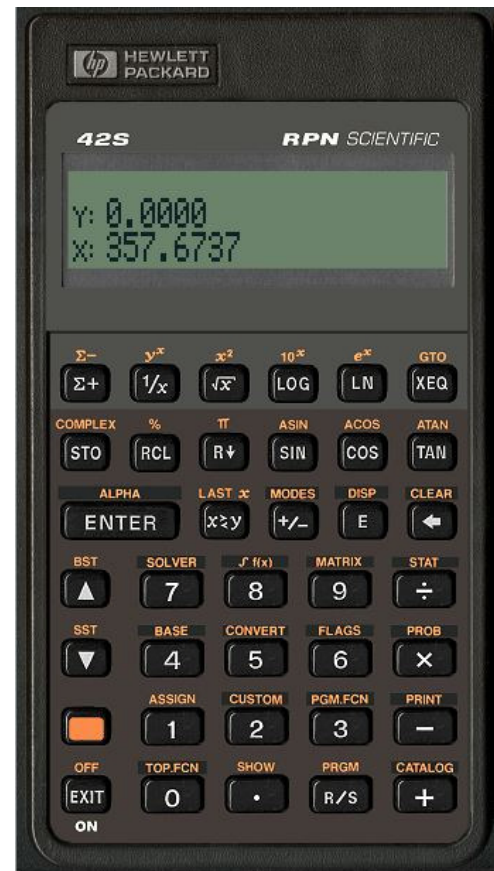
>> R5 = 1 / (1/R4 + 1/500)
R5 = 257.6737

>> Rab = 100 + R5
Rab = 357.6737
```

HP42:

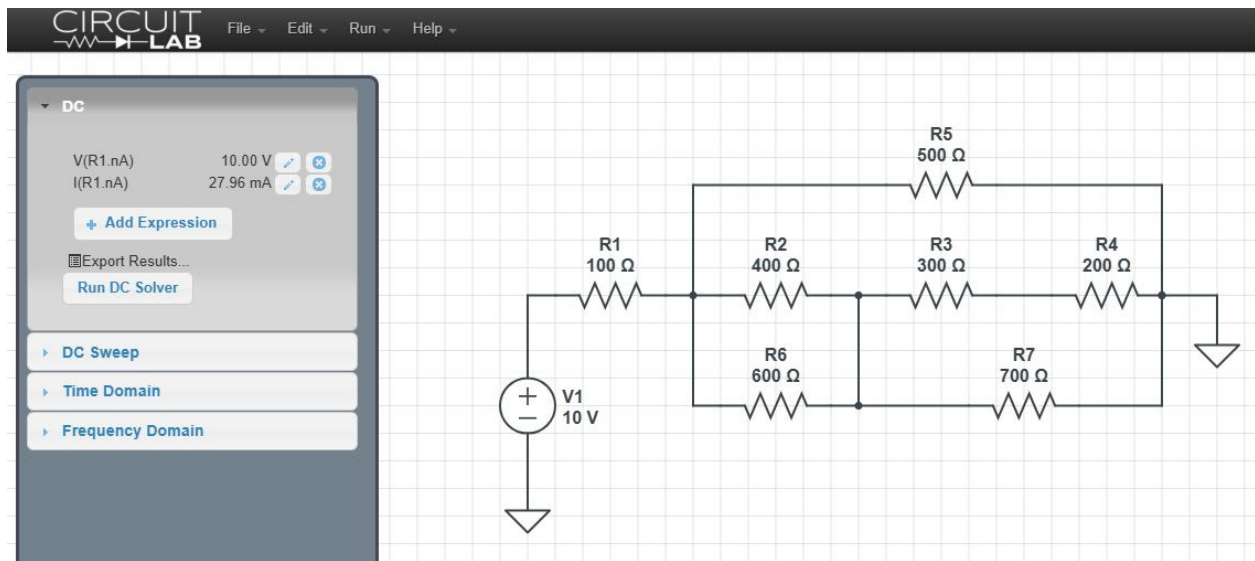
```
200          +
enter
300          1/x
+            500
            1/x
1/x          +
700          1/x
1/x
+            100
1/x          +

400
1/x
600
1/x
+
1/x
```



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 $V = IR$



From $V = IR$, the effective resistance is

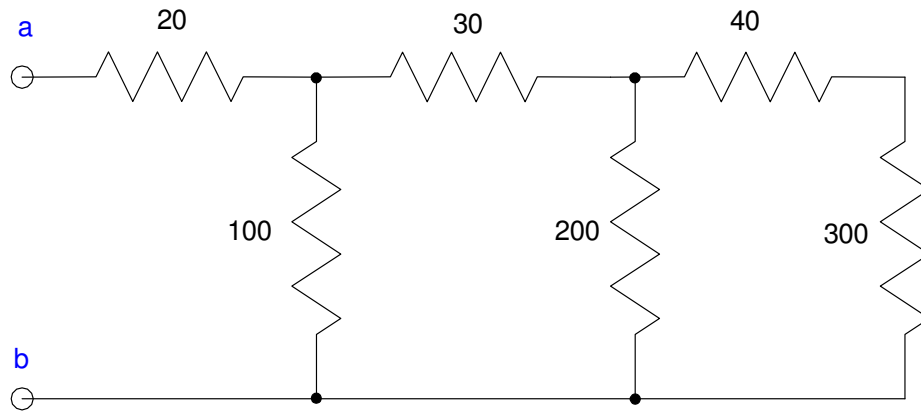
$$R = \frac{V}{I}$$

$$R = \frac{10V}{27.96mA} = 356.6539\Omega$$

This matches calculations (a little off due to rounding errors)

$$R_{ab} = 357.6737$$

7) Compute the total resistance R_{ab} by hand (i.e. using Matlab or a calculator)



Problem 7 & 8

In Matlab

```
>> R1 = 300 + 40
R1 = 340

>> R2 = 1 / (1/R1 + 1/200)
R2 = 125.9259

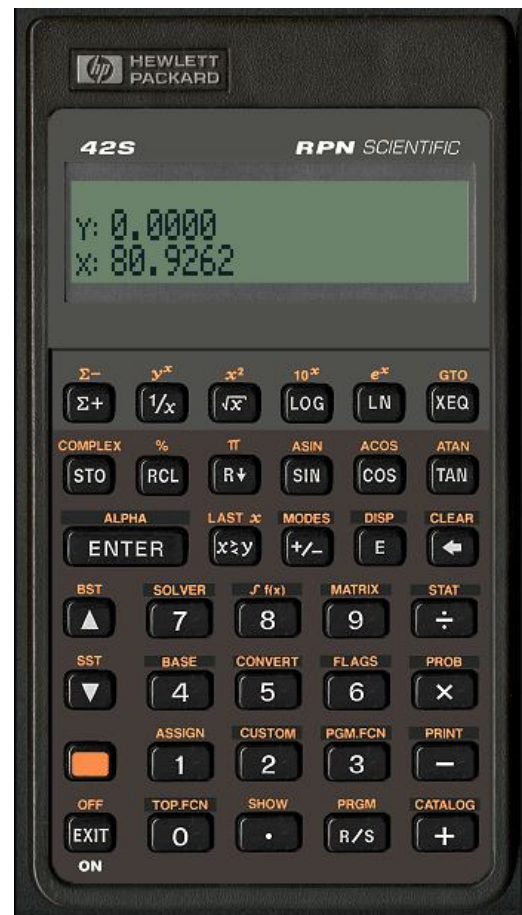
>> R3 = R2 + 30
R3 = 155.9259

>> R4 = 1 / (1/100 + 1/R3)
R4 = 60.9262

>> Rab = R4 + 20
Rab = 80.9262
```

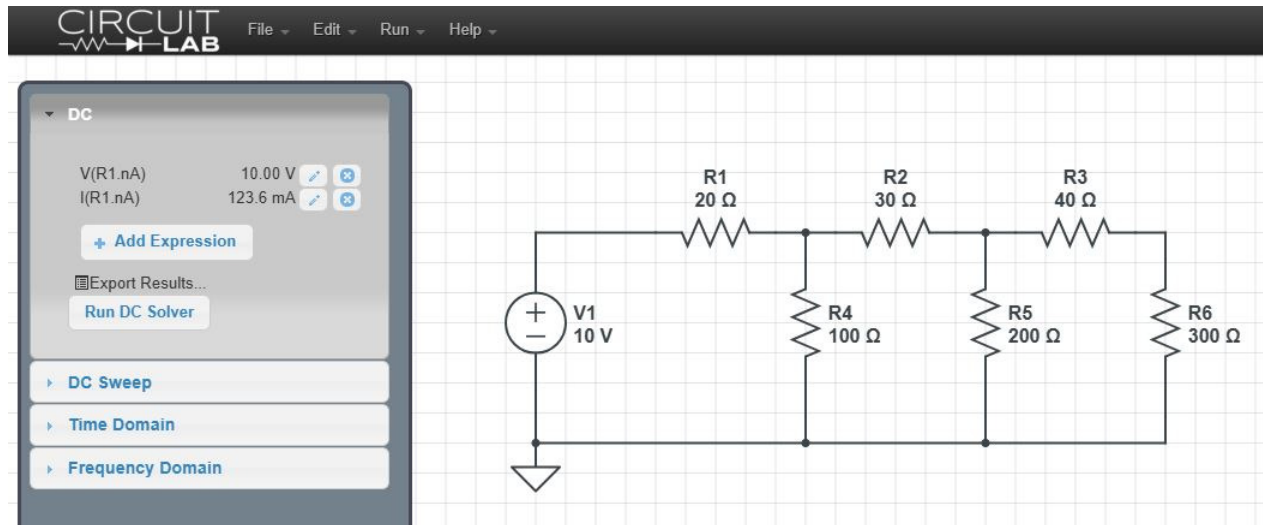
HP42

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



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 $V = IR$



The effective resistance is

$$R = \frac{V}{I}$$

$$R = \frac{10V}{123.6mA}$$

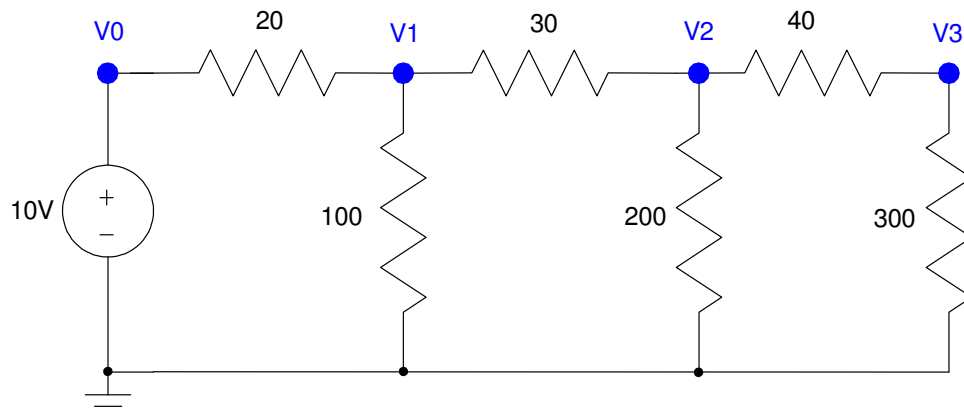
$$R = 80.9061\Omega$$

This matches calculations (with some rounding errors)

$$R_{ab} = 80.9262$$

Voltage Division

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

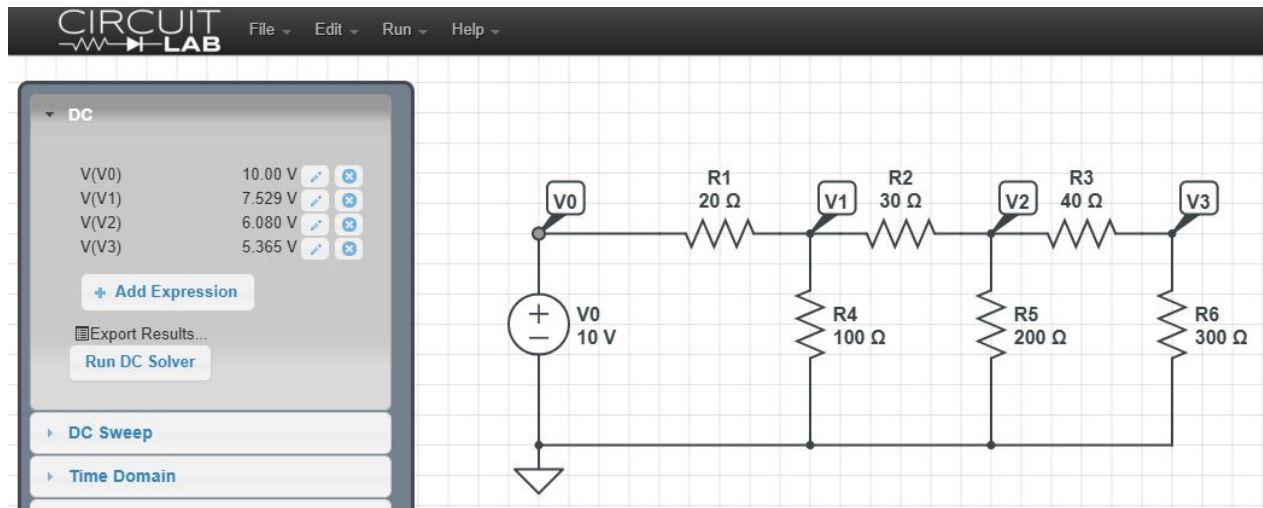


Problem 9 & 10

In Matlab

```
>> R3 = 300;  
>> Ra = 340;  
>> R2 = 1 / (1/Ra + 1/200)  
R2 = 125.9259  
  
>> Rb = R2 + 30  
Rb = 155.9259  
  
>> R1 = 1 / (1/100 + 1/Rb)  
R1 = 60.9262  
  
>> V1 = R1 / (R1 + 20) * 10  
V1 = 7.5286  
  
>> V2 = R2 / (R2 + 30) * V1  
V2 = 6.0801  
  
>> V3 = R3 / (R3 + 40) * V2  
V3 = 5.3648
```

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



This matches Matlab calculations

```
>> V1 = R1 / (R1 + 20) * 10  
V1 = 7.5286
```

```
>> V2 = R2 / (R2 + 30) * V1  
V2 = 6.0801
```

```
>> V3 = R3 / (R3 + 40) * V2  
V3 = 5.3648
```