

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 (V)	Amps (I)	Ohms (R)	Watts (W)
12V	3A	4 Ohms	36W
6V	2A	3 Ohms	12W
12V	3A	4 Ohms	36W
7.746V	3.873A	2 Ohms	30W

Sample Calculations

$$V = IR$$

$$I = \left(\frac{V}{R} \right) = \left(\frac{12V}{4\Omega} \right) = 3A$$

$$P = VI = (12V)(3A) = 36W$$

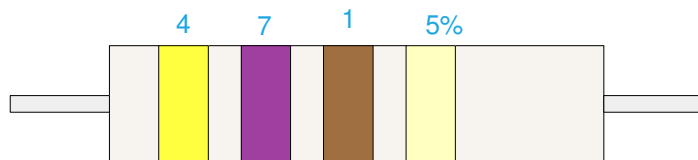
Resistor Color Codes

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

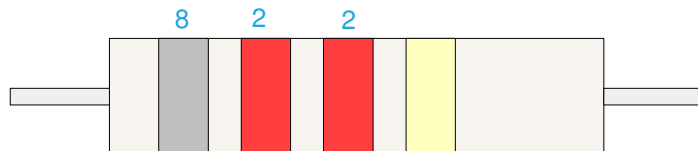
a) Yellow - Violet - Brown

- 4 7 1
- 470 Ohms



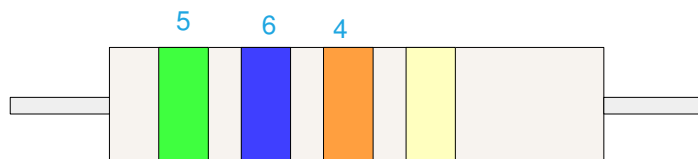
b) Grey - Red - Red

- 8 2 2
- 8.2k Ohms



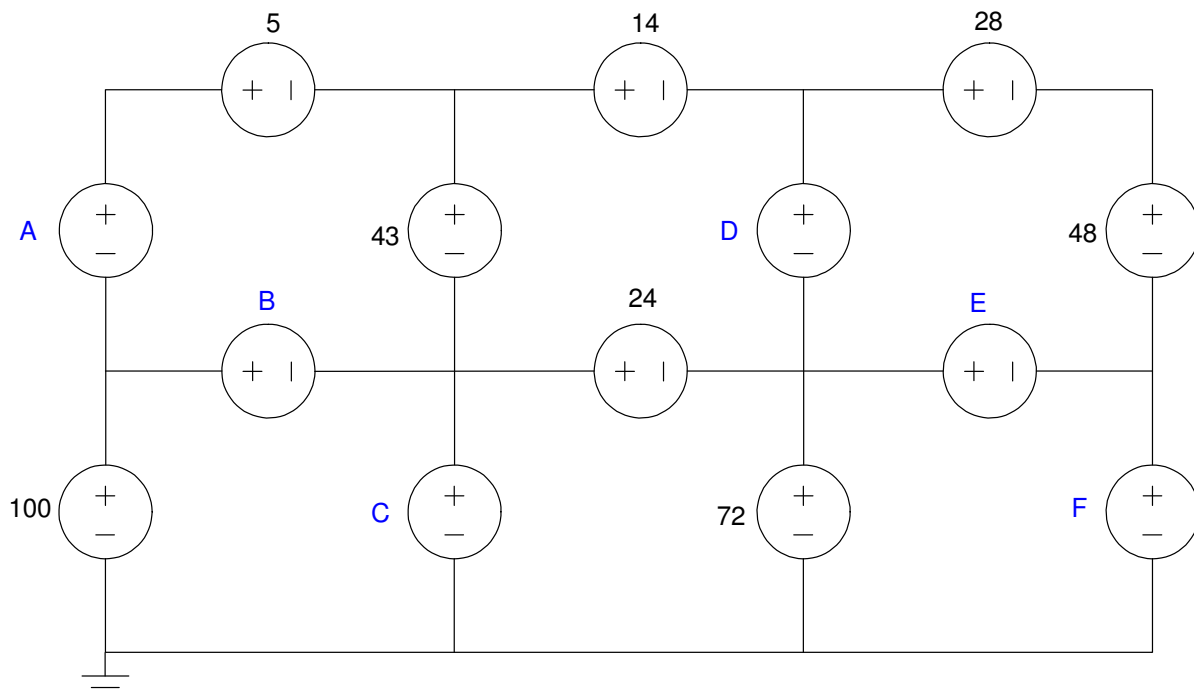
c) Green - Blue - Orange

- 5 6 4
- 56k Ohms



Kirchoff's Laws:

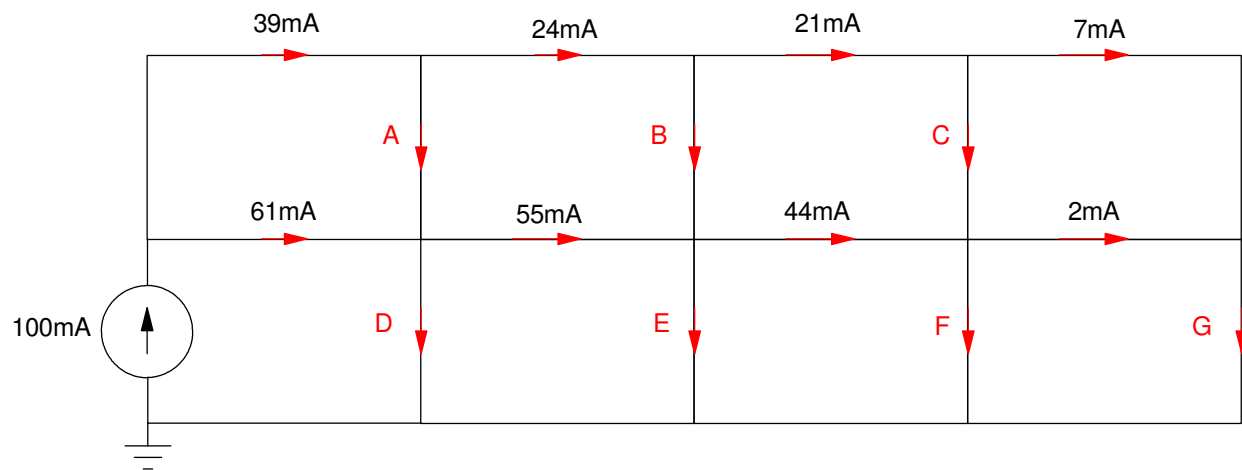
3) Use conservation of voltage to determine the unknown voltages



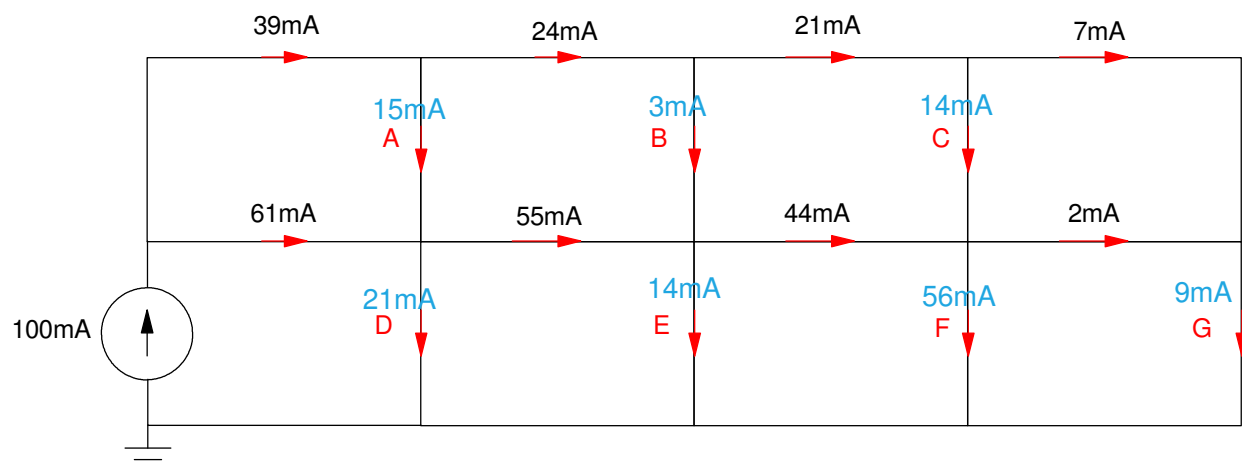
Solution

- $A = 44\text{V}$
- $B = 4\text{V}$
- $C = 96\text{V}$
- $D = 53\text{V}$
- $E = 23\text{V}$
- $F = 49\text{V}$

4) Use conservation of current to determine the unknown currents



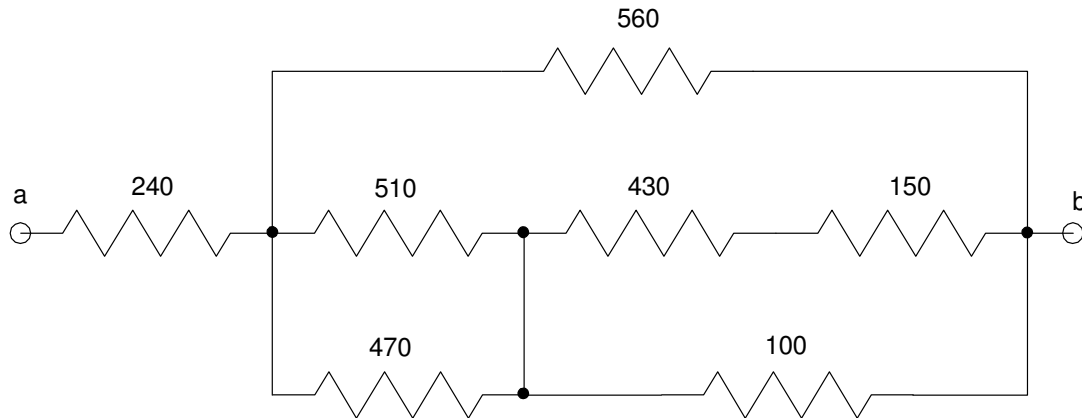
Solution



- A = 15mA
- B = 3mA
- C = 14mA
- D = 21mA
- E = 14mA
- F = 56mA
- G = 9mA
-

Resistors in Series and Parallel

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

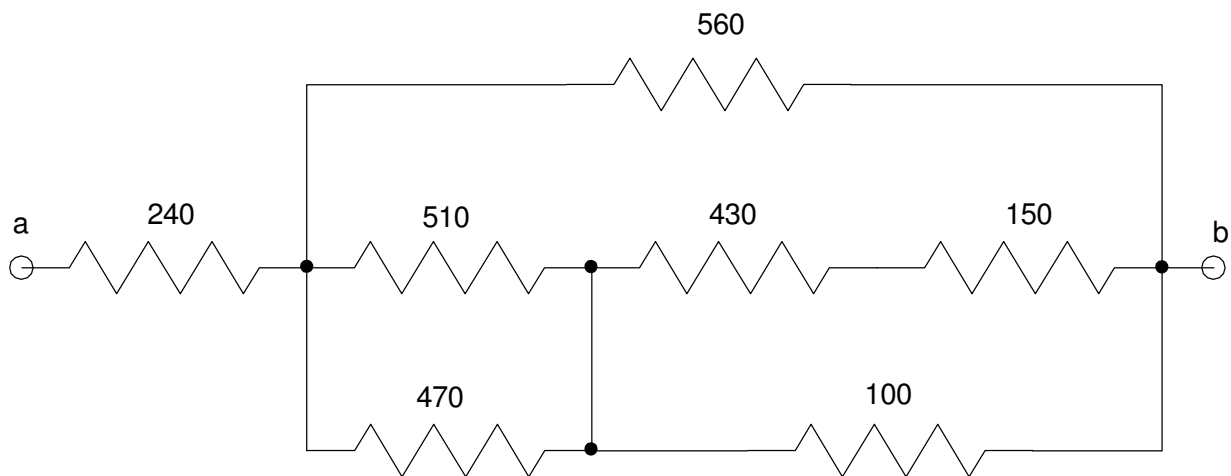


Problem 5 & 6

Using Matlab

```
>> R1 = 150 + 430  
R1 = 580  
>> R2 = 1 / (1/R1 + 1/100)  
R2 = 85.2941  
>> R3 = 1 / (1/510 + 1/470)  
R3 = 244.5918  
>> R4 = R2 + R3  
R4 = 329.8860  
>> R5 = 1 / (1/560 + 1/R4)  
R5 = 207.5953  
>> R6 = R5 + 240  
R6 = 447.5953
```

Using an HP42 (free42 app on your cell phone)



```
150
enter
430
+
```

```
1/x
100
1/x
+
```

```
510
1/x
470
1/x
+
```

```
+
```

```
1/x
560
1/x
+
```

```
240
+
```



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

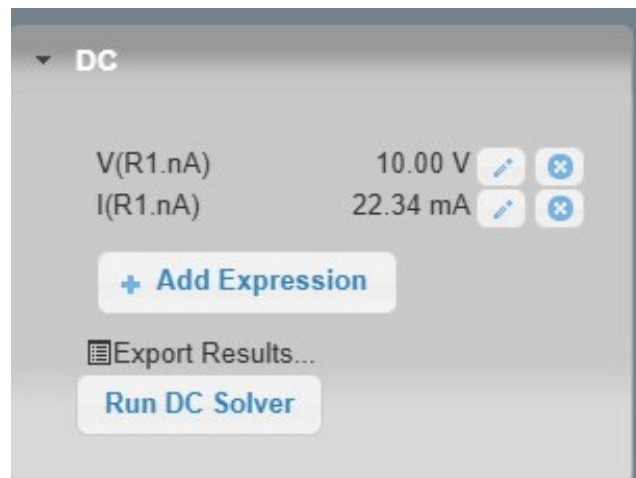
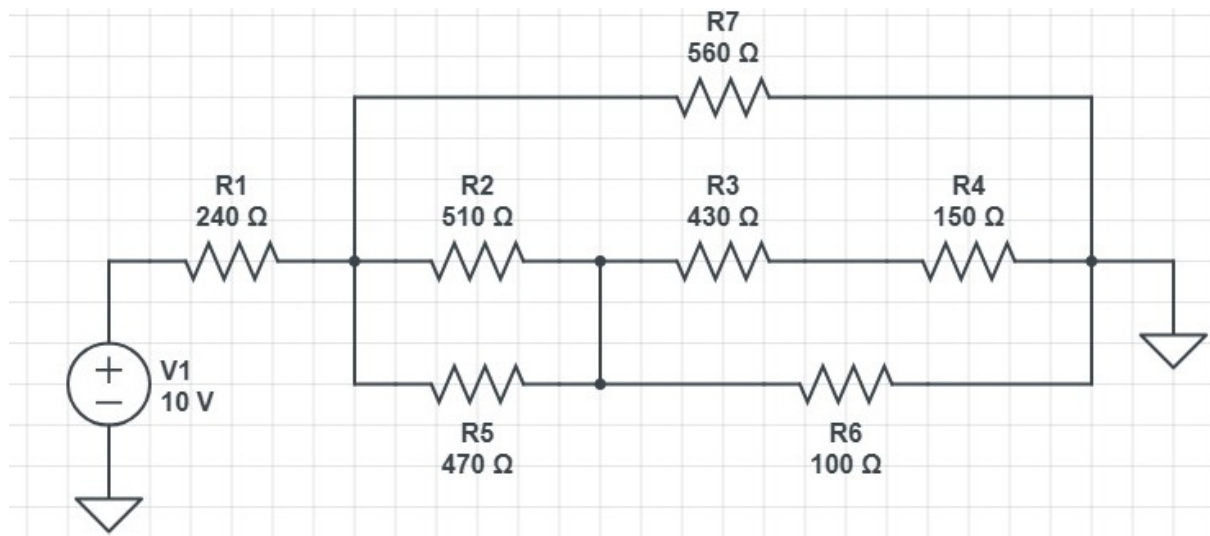
- Apply a 10V source to a and b.
- Determine the current draw from the 10V source
- Calculate the net resistance from $V = IR$

The circuit draws 22.34mA when a 10V source is applied

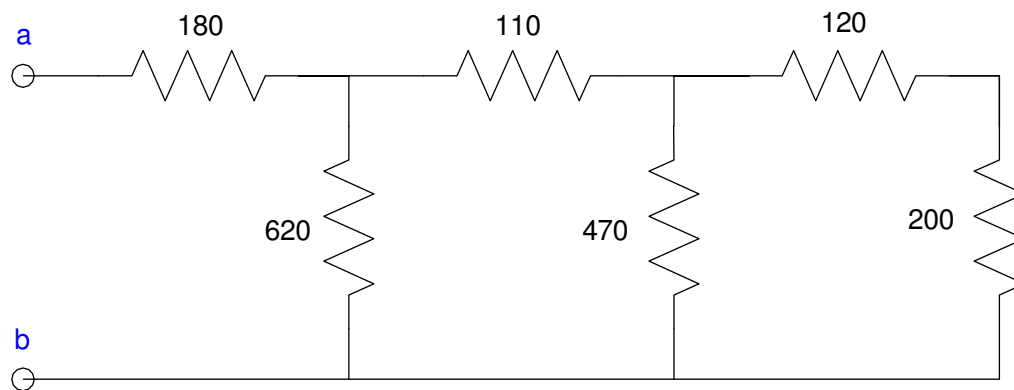
The effective resistance is

$$R = \left(\frac{V}{I} \right) = \left(\frac{10V}{22.34mA} \right) = 447.626\Omega$$

- Calculated = 447.5953 Ohms



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



Solving using Matlab

```
>> R1 = 200 + 120
R1 = 320

>> R2 = 1 / (1/R1 + 1/470)
R2 = 190.3797

>> R3 = R2 + 110
R3 = 300.3797

>> R4 = 1 / (1/R3 + 1/620)
R4 = 202.3463

>> R5 = R4 + 180
R5 = 382.3463
```

HP42 Calculator

```
200
enter
120
+

1/x
470
1/x
+
1/x

110
+

1/x
620
1/x
+
1/x

180
+
```



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 $V = IR$

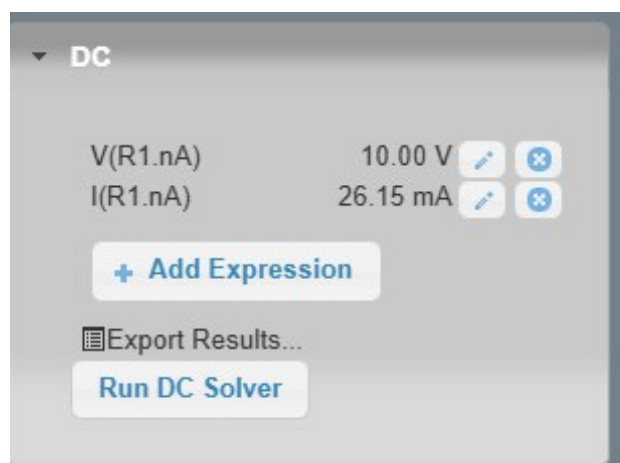
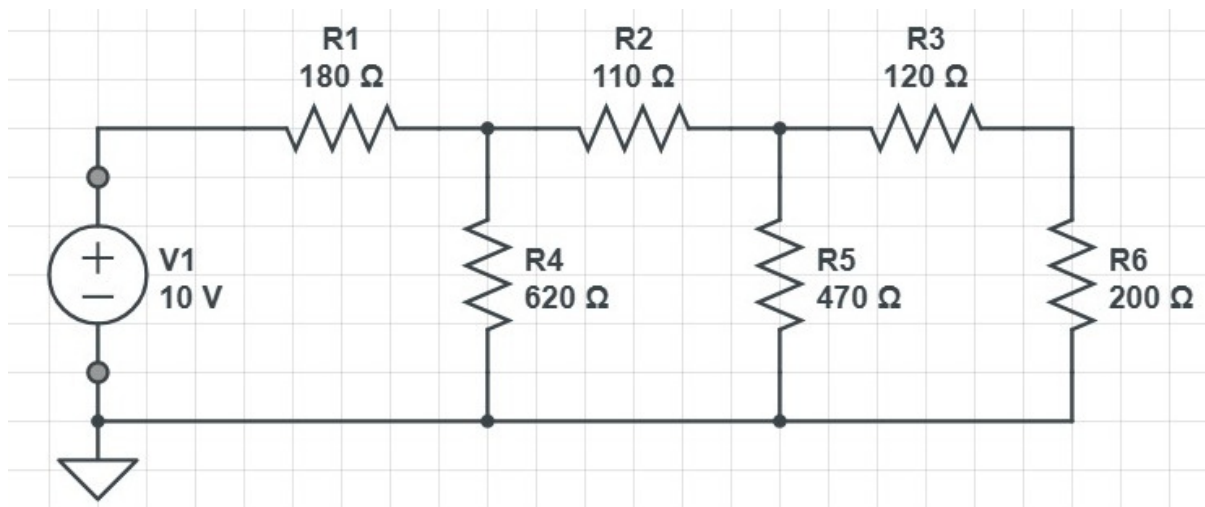
From CircuitLab

- When you apply a 10V source
- 26.15mA is drawn

The effective resistance is

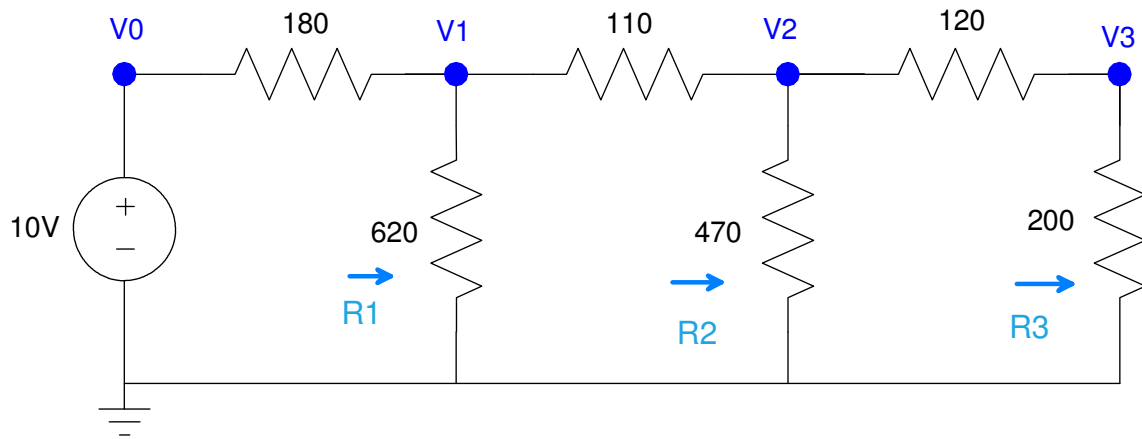
$$R = \left(\frac{V}{I} \right) = \left(\frac{10V}{26.15mA} \right) = 382.4092\Omega$$

- Calculated = 382.3463 Ohms



Voltage Division

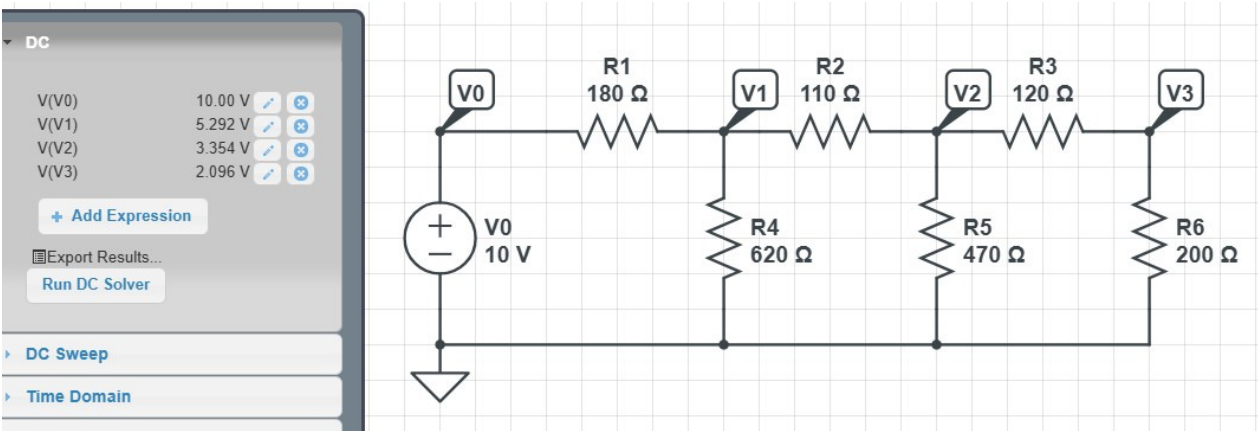
9) Use voltage division to find V_1 , V_2 , and V_3 .



In Matlab

```
>> R3 = 200;  
>> R2 = 1 / (1/470 + 1/(120 + R3))  
  
R2 = 190.3797  
  
>> R1 = 1 / (1/620 + 1/(110 + R2))  
  
R1 = 202.3463  
  
>> V0 = 10  
  
V0 = 10  
  
>> V1 = R1 / (R1 + 180) * V0  
  
V1 = 5.2922  
  
>> V2 = R2 / (R2 + 110) * V1  
  
V2 = 3.3542  
  
>> V3 = R3 / (R3 + 120) * V2  
  
V3 = 2.0964  
  
>>
```

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



Calculations match CircuitLab

	V0	V1	V2	V3
Calculations	10.0000 V	5.2922 V	3.3542 V	2.0964 V
CircuitLab	10.00 V	5.292 V	3.354 V	2.096 V