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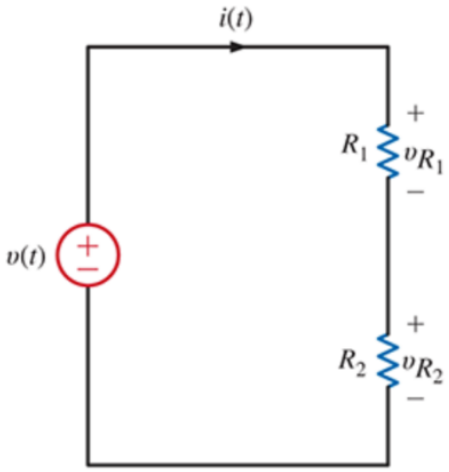
Lab 1: Voltage and Current Measurements

Introduction

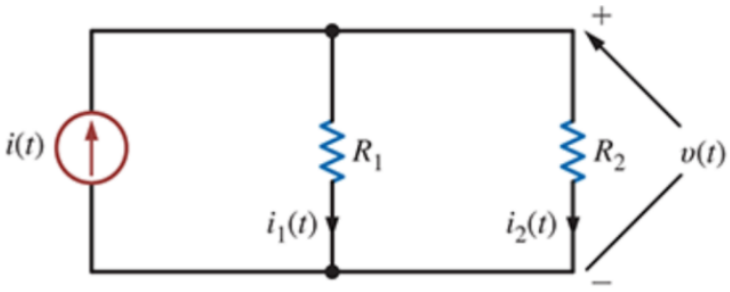
In this lab, we are looking into two different circuits and using two different methods for finding missing measurements. The first circuit will require the voltage divider method to find the voltage across a resistor. The second circuit requires the current divider method to find the different currents and voltages in the circuit. Using Pspice simulator software, we will determine if the simulation agrees with our work done by hand and analyze Kirchoff's voltage and current law.

Voltage Division Method



$$v_{R_2} = \frac{R_2}{R_1 + R_2} v(t)$$

Currrent Division Method

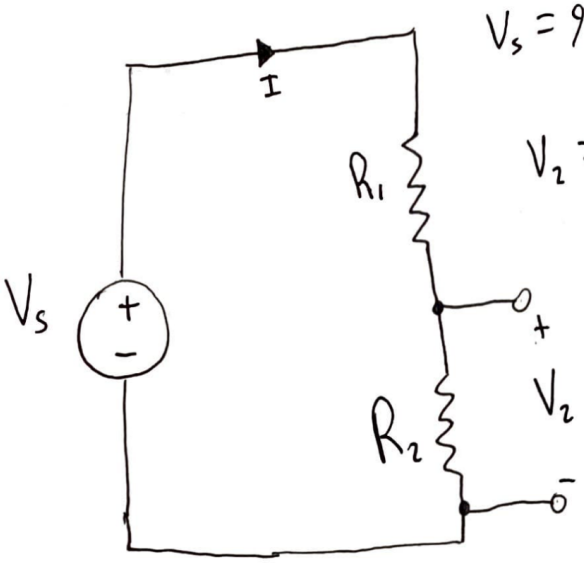


$$i_1(t) = \frac{R_2}{R_1 + R_2} i(t)$$

$$i_2(t) = \frac{v(t)}{R_2} = \frac{R_1}{R_1 + R_2} i(t)$$

Work

Voltage Divider Circuit:



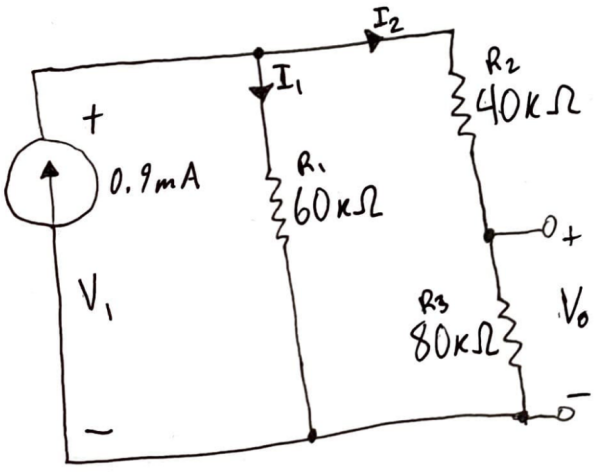
$V_s = 9V$, $R_1 = 60k\Omega$, $R_2 = 30k\Omega$

$V_2 = V_s\left(\frac{R_2}{R_1+R_2}\right) = 9\left(\frac{30}{90}\right) = \frac{9}{3} = \boxed{3V}$

$I = \frac{V}{R} = \frac{9}{90k\Omega} = \boxed{0.1mA}$

$V_2 = 3V,\ I = 0.1mA$

Current Divider Circuit:



$I_{R2} = I_T\left(\frac{R_1}{R_1+R_2+R_3}\right) = 0.9\left(\frac{60}{180}\right)$

$= 0.9\left(\frac{1}{3}\right) = \boxed{0.3mA}$

$I_{R1} = I_T - I_2 = 0.9 - 0.3 = \boxed{0.6mA}$

$V_1 = I_1 R_1 = 0.6(60) = \boxed{36V}$

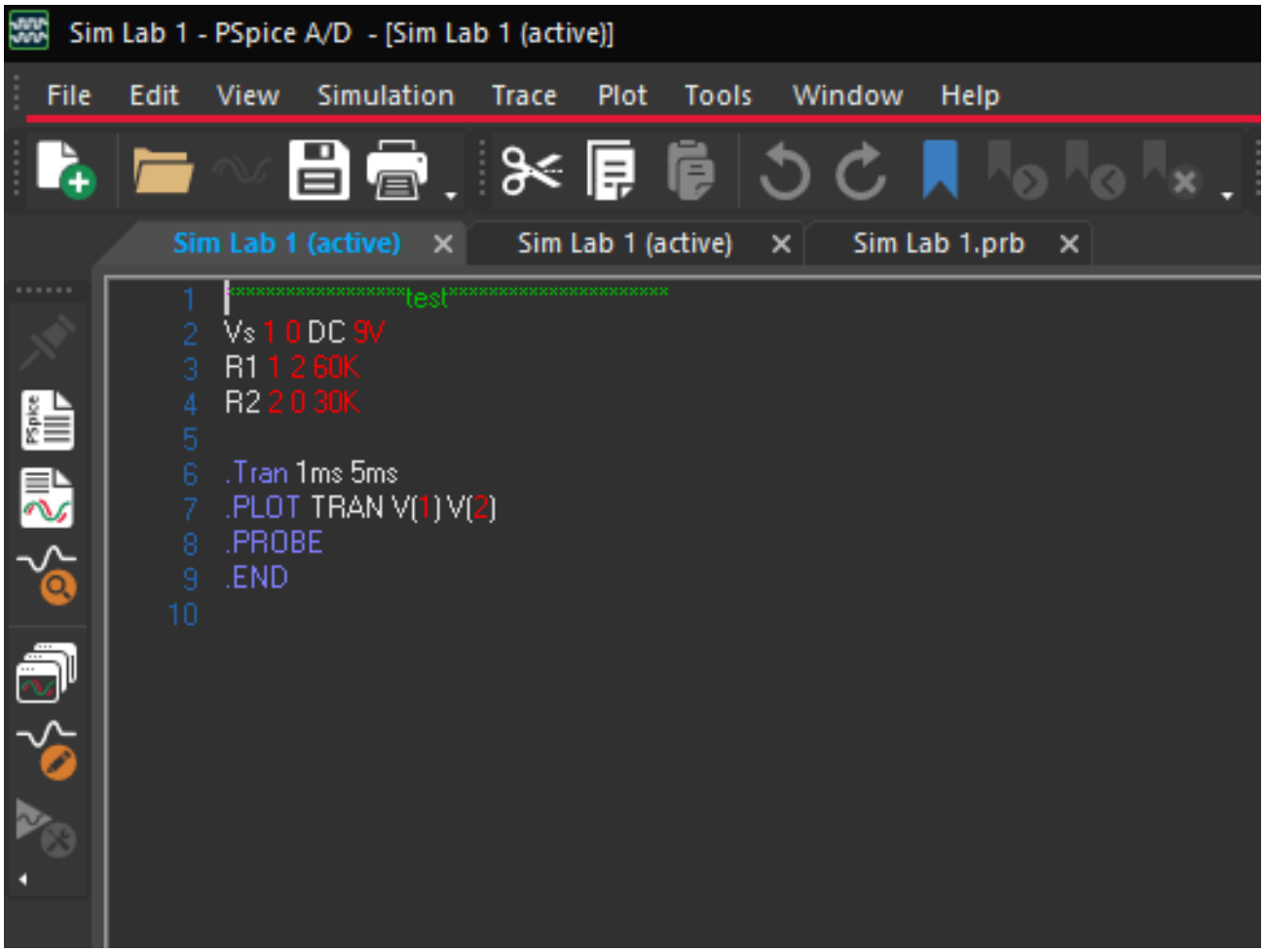
$\boxed{V_2 = I_2 R_3 = 0.3(80) = 24V}$

$V_1 = 36V,\ V_0 = 24V,\ I_1 = 0.6mA,\ I_2 = 0.3mA$

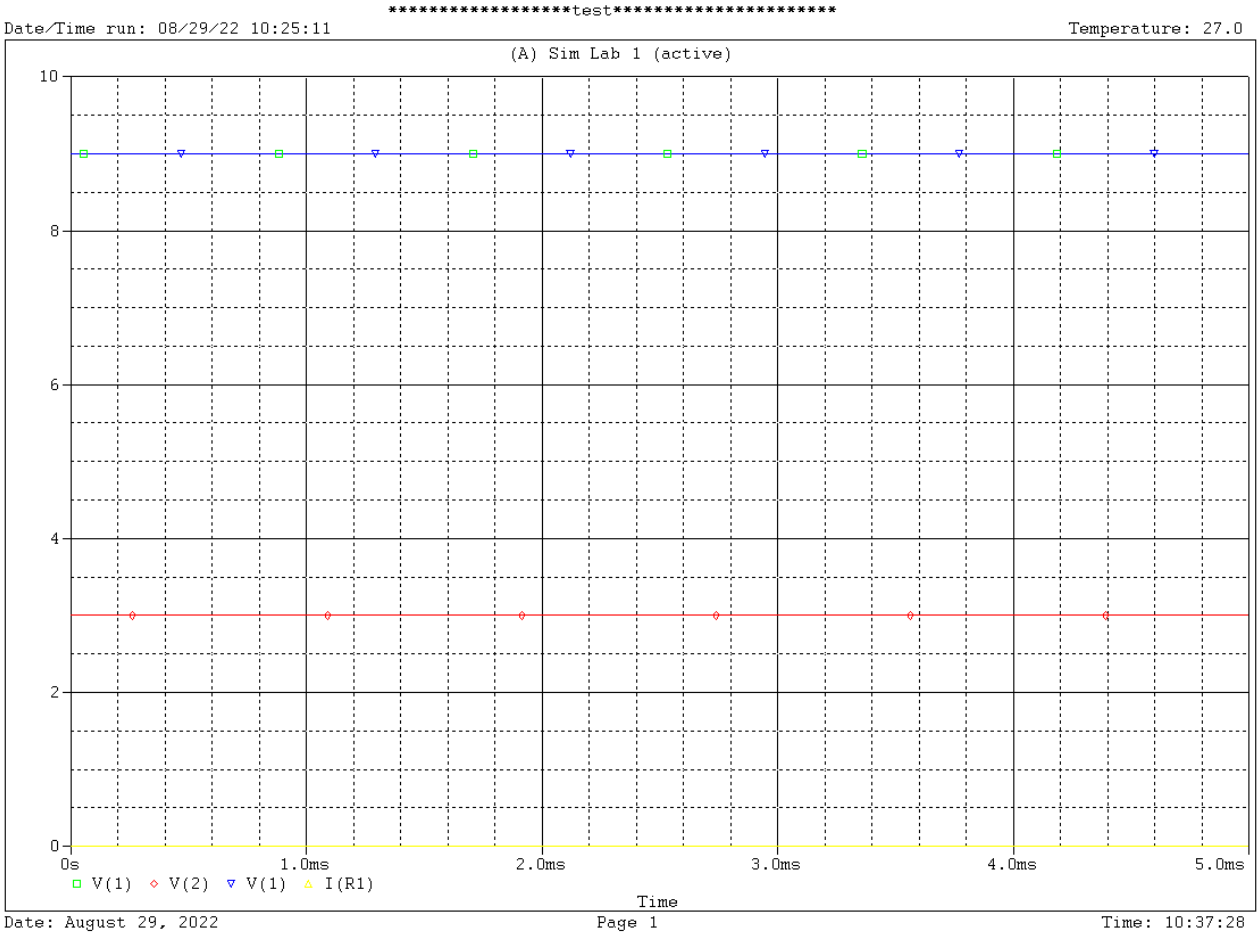
Pspice Simulation

Voltage Divider Circuit:

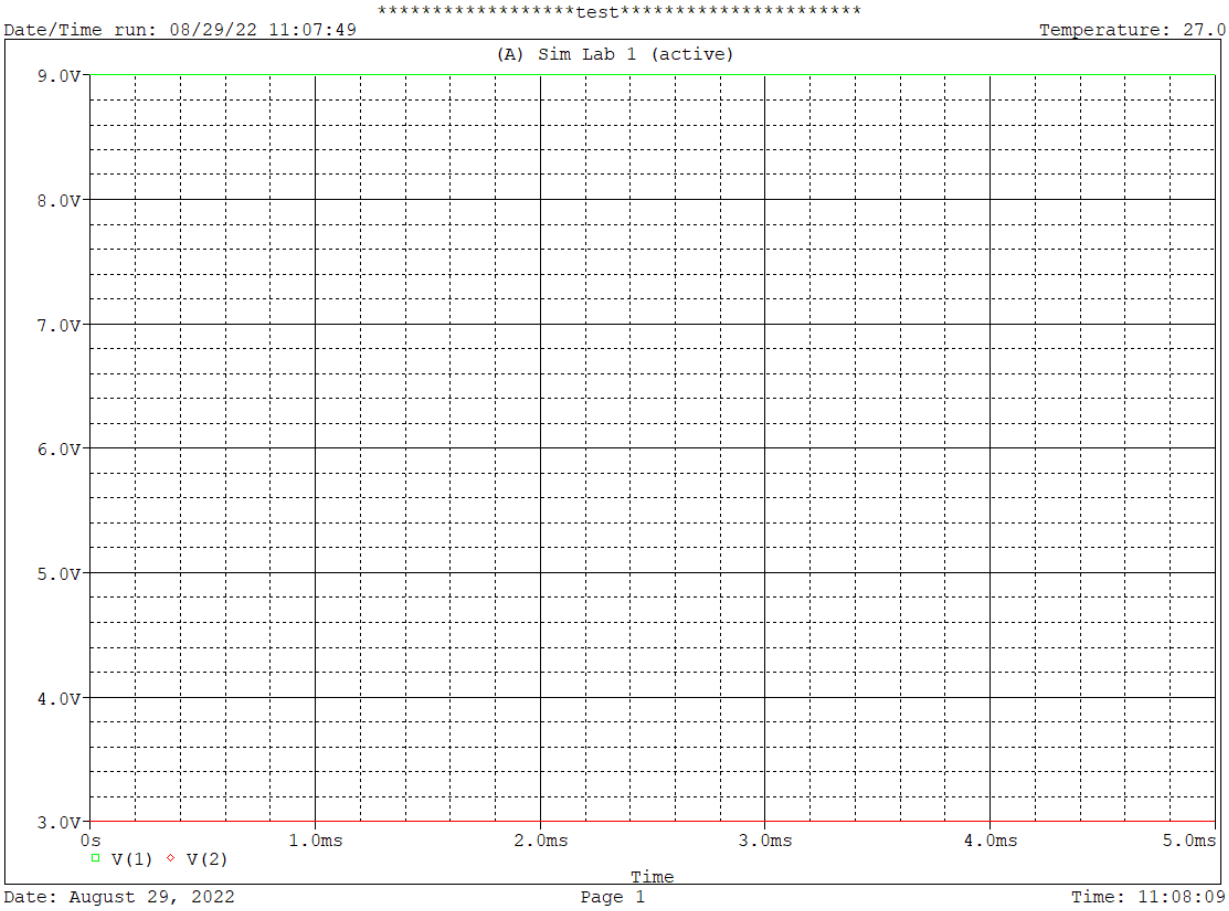
Code used



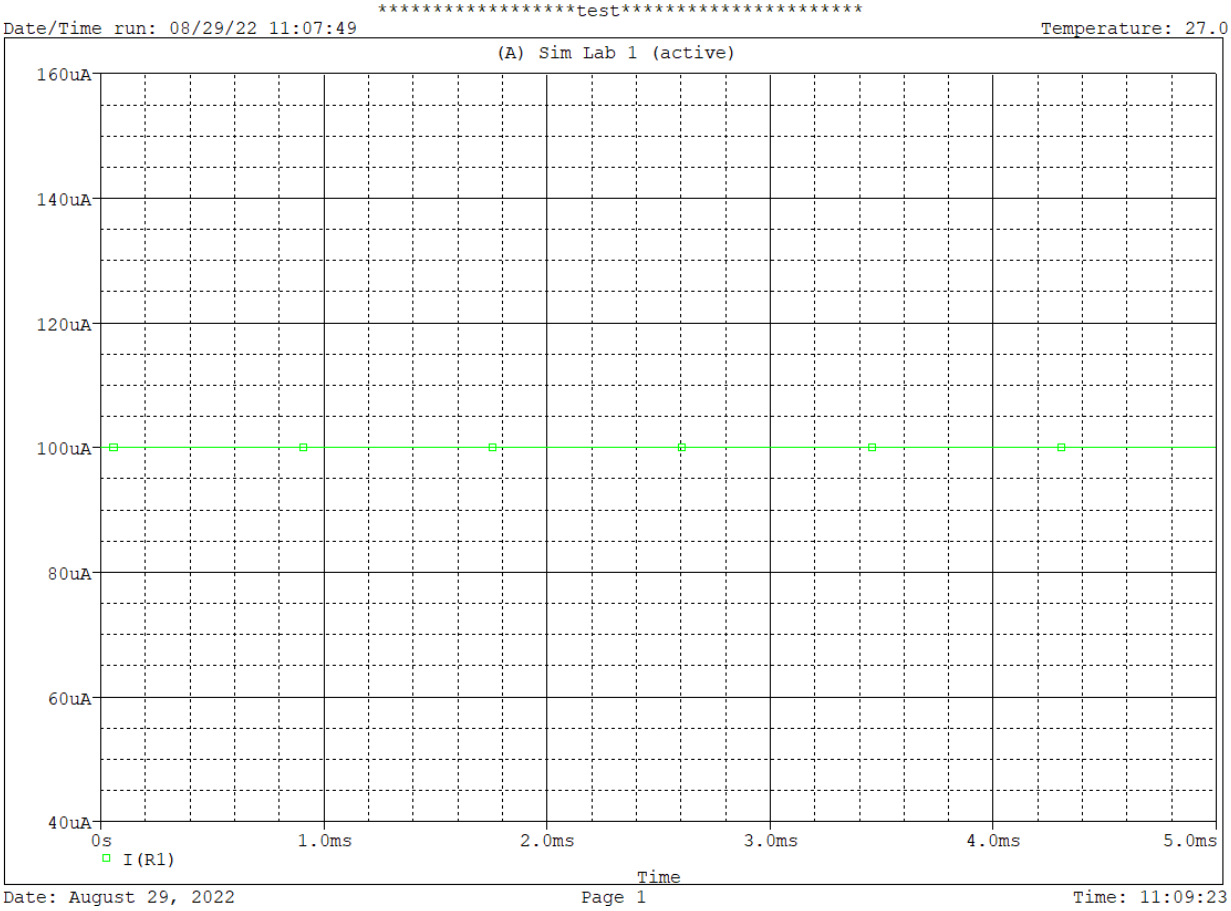
All traces


**********test**********
Date/Time run: 08/29/22 10:25:11
Temperature: 27.0
(A) Sim Lab 1 (active)
10
8
6
4
2
0
0s
1.0ms
2.0ms
3.0ms
4.0ms
5.0ms
V(1)
V(2)
V(1)
I(R1)
Time
Date: August 29, 2022
Page 1
Time: 10:37:28

Voltages traces

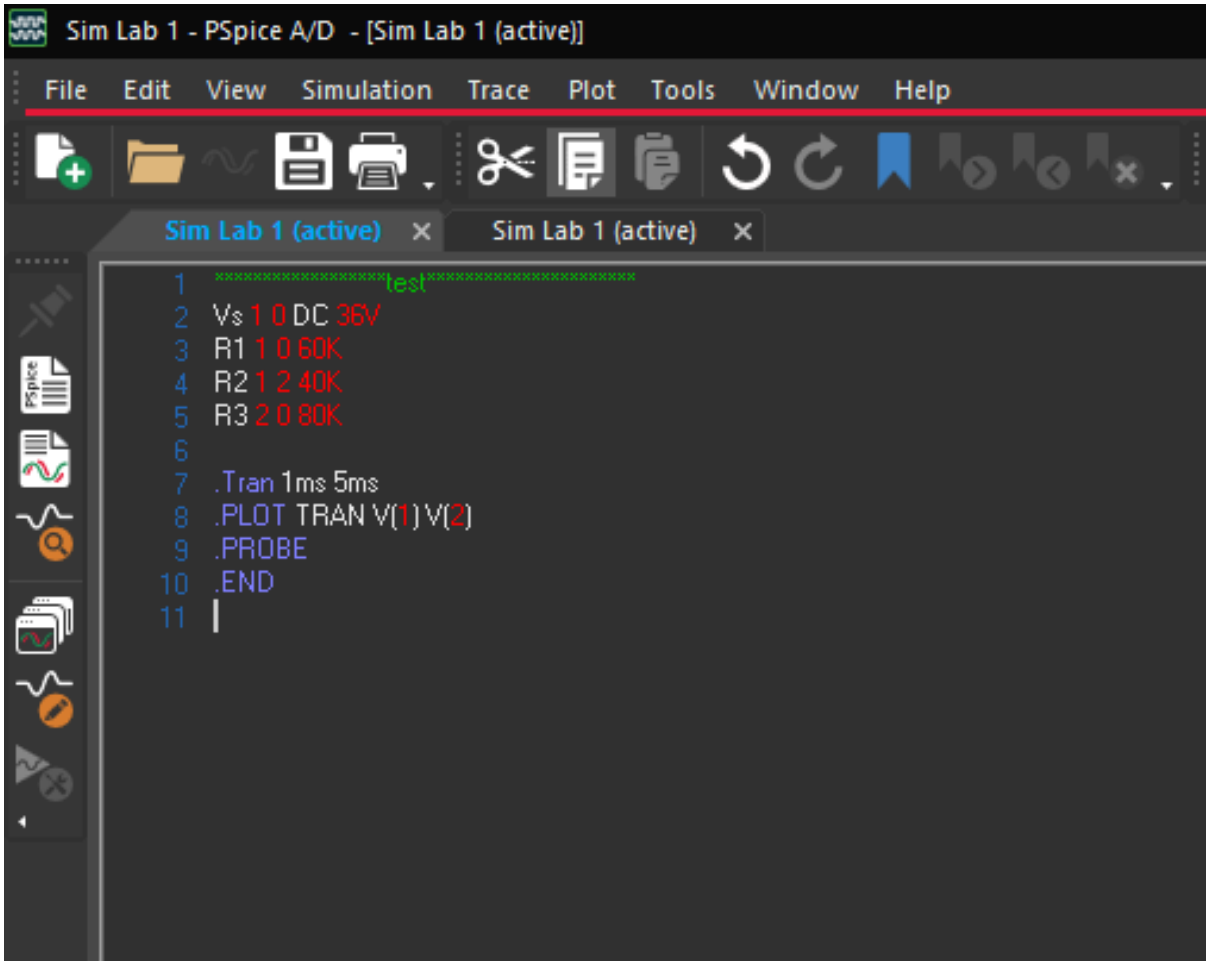


Currrent trace

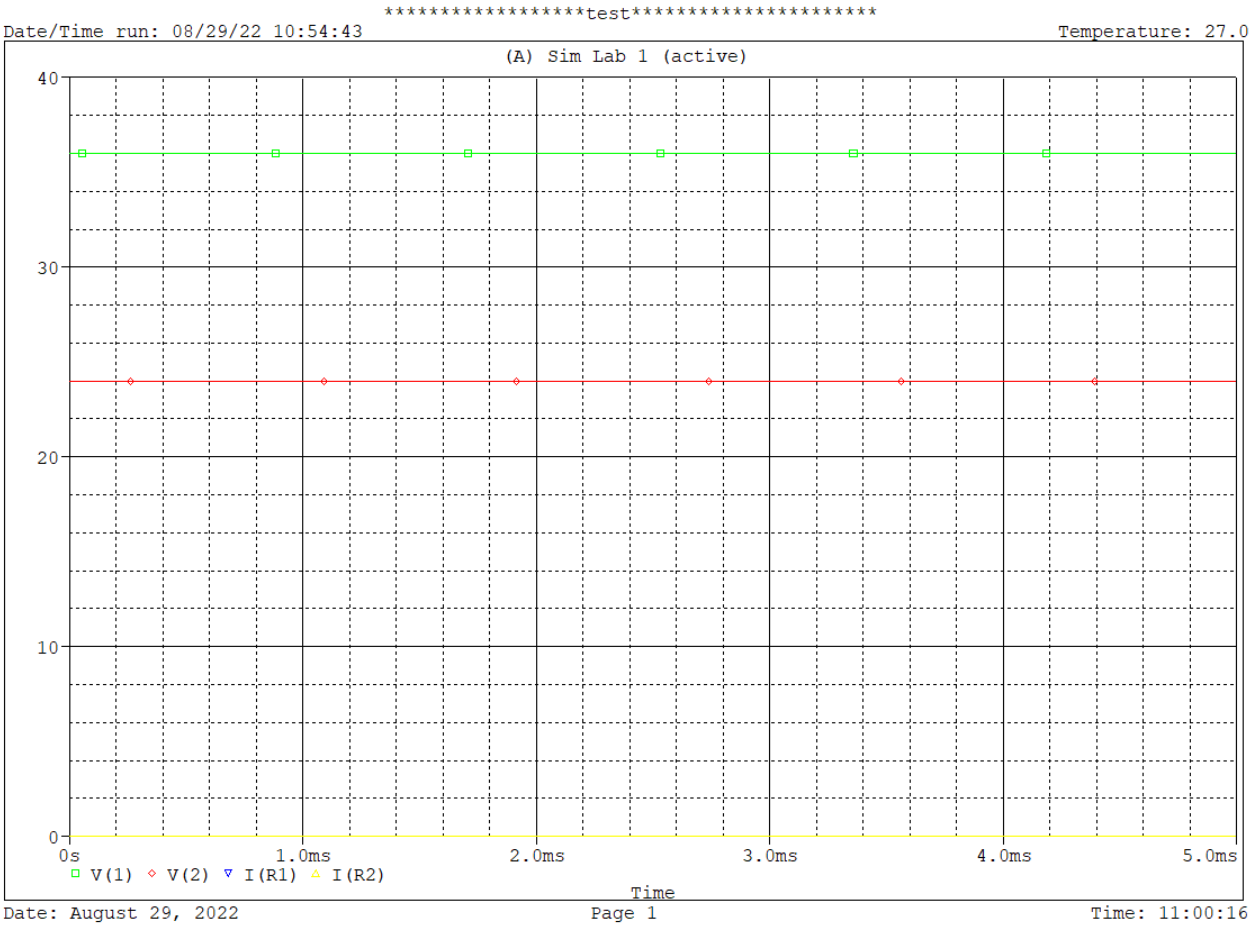


Current Divider Circuit:

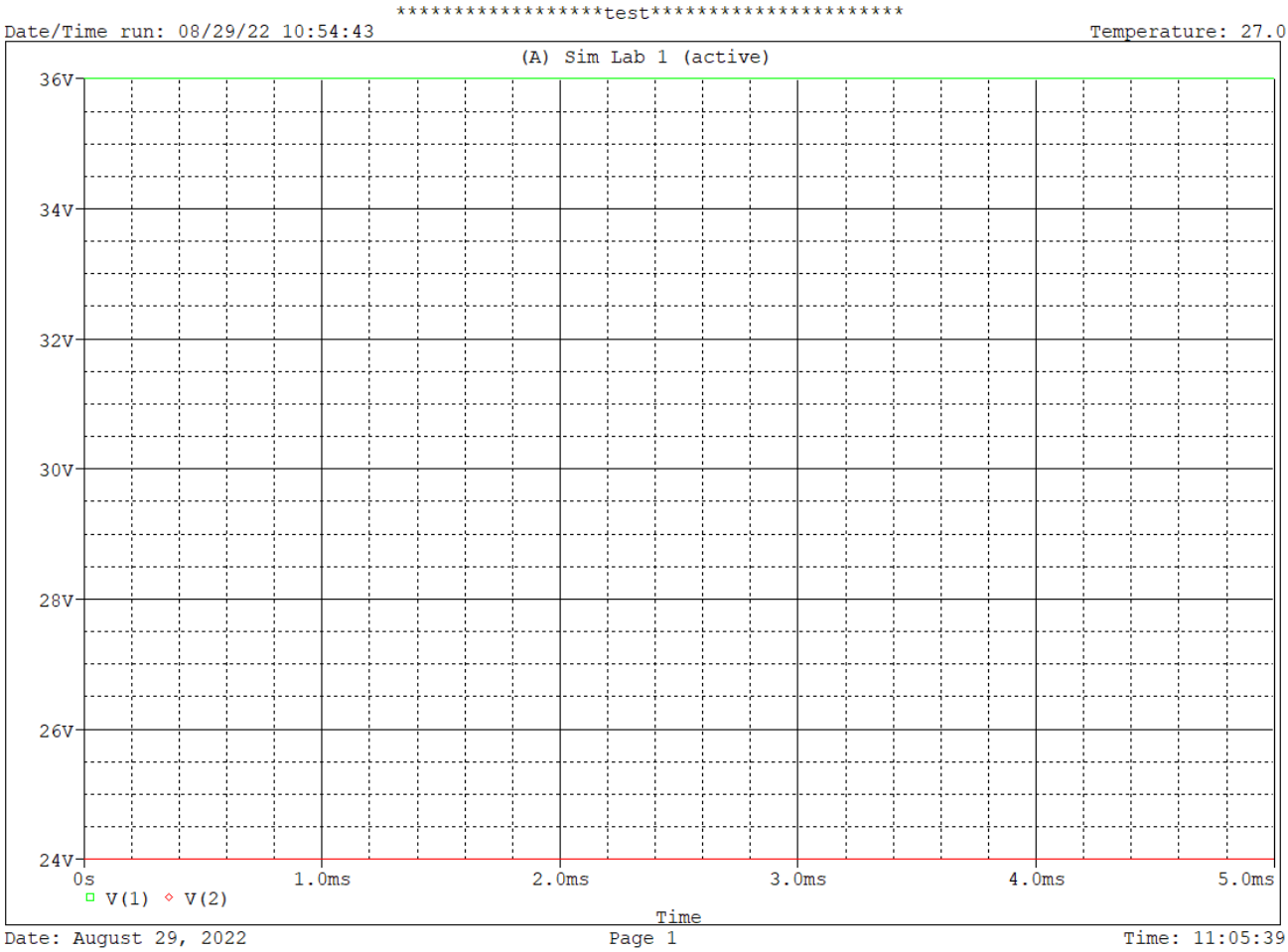
Code used



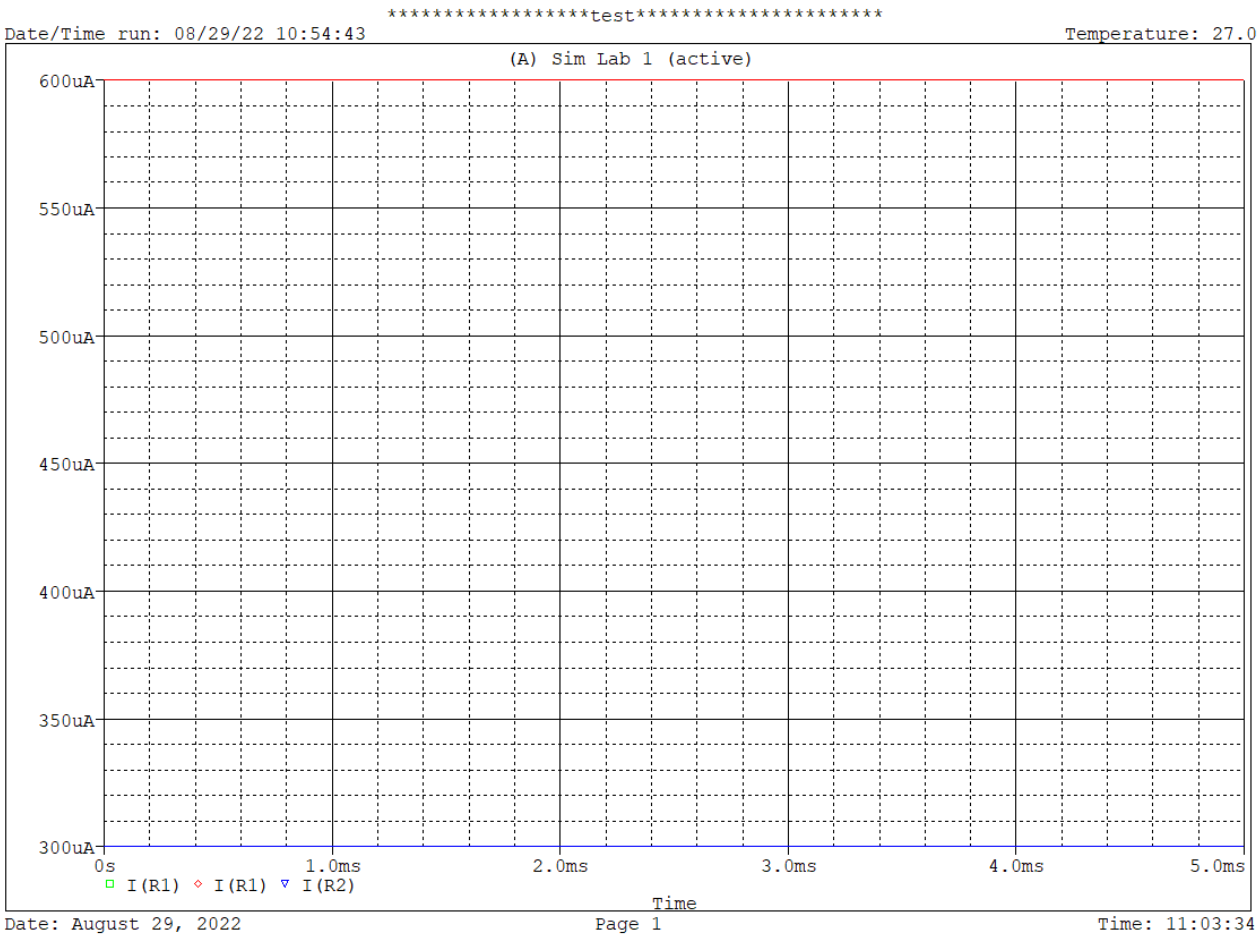
All traces


**********test**********
Date/Time run: 08/29/22 10:54:43
Temperature: 27.0
(A) Sim Lab 1 (active)
40
30
20
10
0
0s
1.0ms
2.0ms
3.0ms
4.0ms
5.0ms
V(1) V(2) I(R1) I(R2)
Time
Date: August 29, 2022
Page 1
Time: 11:00:16

Voltage traces



Current Traces



Conclusion

During this lab, I learned how to apply voltage division and current division method to find missing measurements of a circuit. I also learned how to use pspice simulator to find any measurement in a circuit. Looking at the handwritten work as compared to the Pspice simulation, we can conclude that both results are the same and that the answers are correct. Additionally, we can check our answers using KVL and KCL by applying them to a circuit, for instance:

Voltage Divider Circuit - KVL: $V_T = 0 => V_1 + V_2 + V_3 = 0 => 9V - 6V - 3V = 0$

Current Divider Circuit - KCL: $I_T = 0 => I_1 + I_2 + I_3 = 0 => 0.9mA - 0.6mA - 0.3mA = 0$