1. $V_{rising}(t)=V_{DD}(1-e^{(-t/\tau)})$
   $\tau = R_1C$

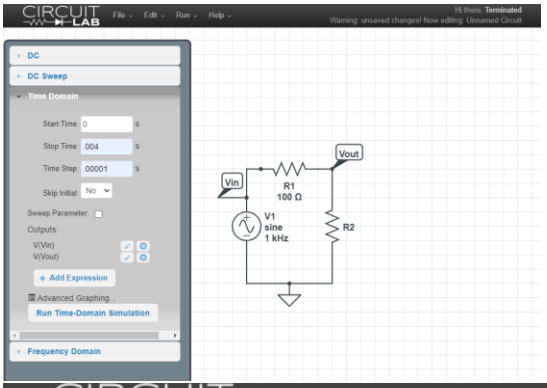
a. $t_{60}=RCln(40)$

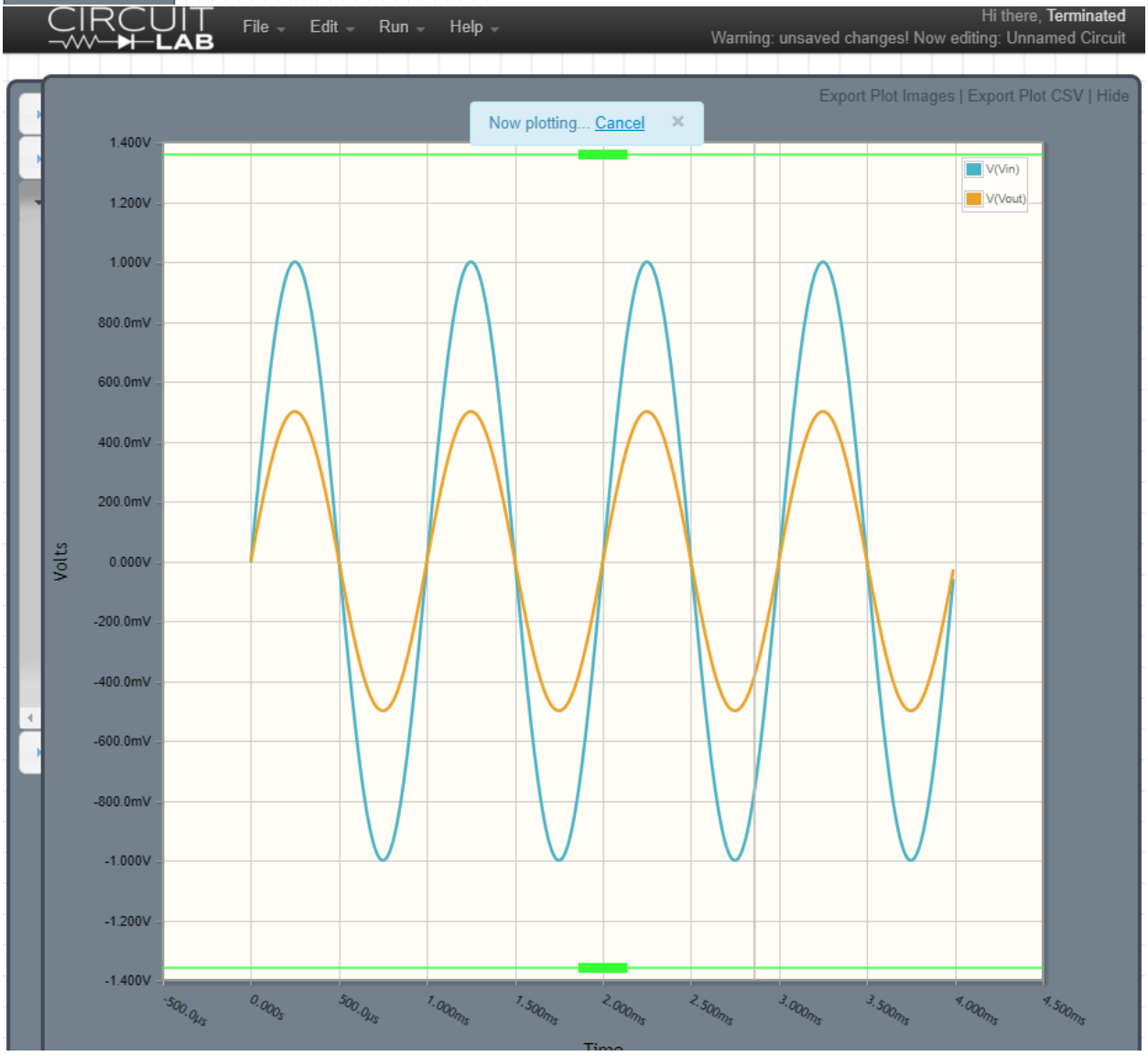
$t_{60}=(500)(1*10^{-12})(ln(40)) = 1.844 * 10^{(-9)}$ seconds

b. 542170061 Hz or .542 GHz

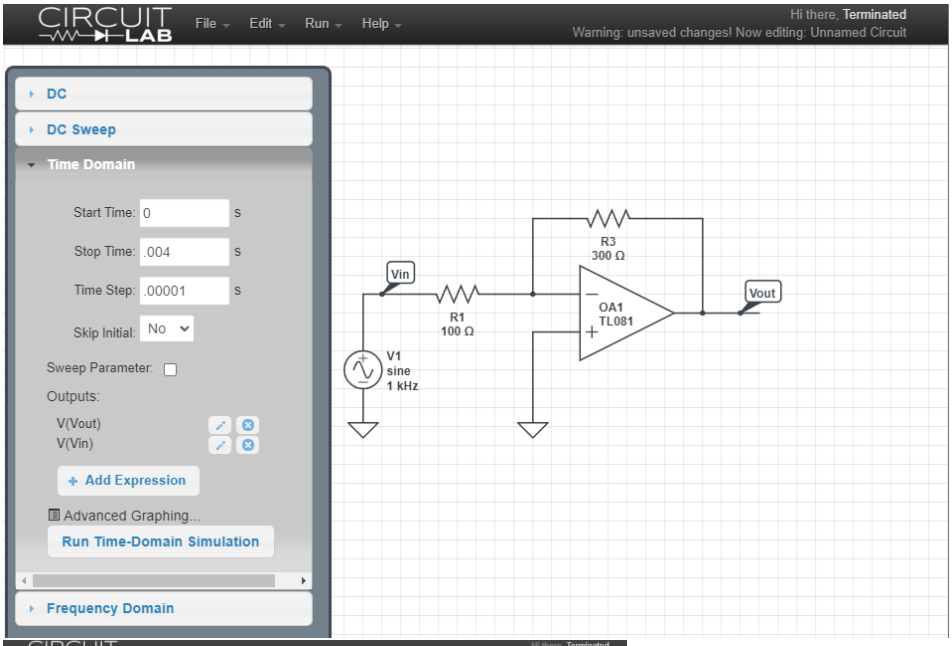
$1/t_{60}=$ 542170061

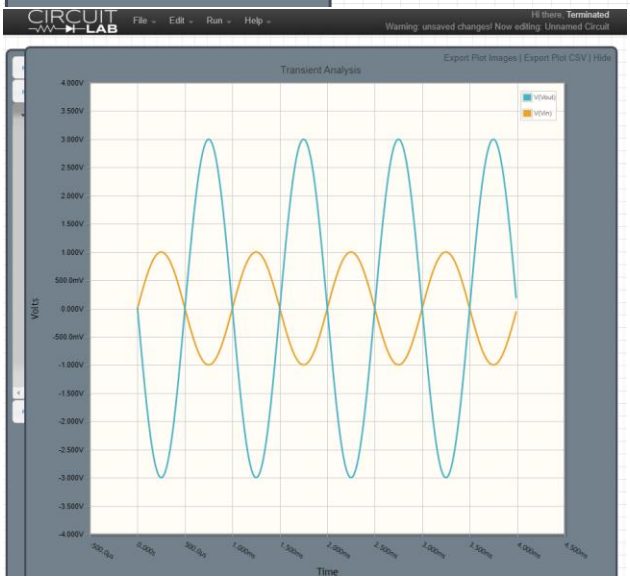
2.


CIRCUIT LAB
File
Edit
Run
Help
DC
DC Sweep
Time Domain
Start Time 0 s
Stop Time .004 s
Time Step .00001 s
Skip Initial No
Sweep Parameter
Outputs:
V(Vin)
V(Vout)
Add Expression
Advanced Graphing...
Run Time-Domain Simulation
Frequency Domain
Vout
Vin
R1
100 Ω
V1
sine
1 kHz
R2


CIRCUIT LAB
File
Edit
Run
Help
Hi there, Terminated
Warning: unsaved changes! Now editing: Unnamed Circuit
Export Plot Images | Export Plot CSV | Hide
Now plotting... Cancel
V(Vin)
V(Vout)
1.400V
1.200V
1.000V
800.0mV
600.0mV
400.0mV
200.0mV
0.000V
-200.0mV
-400.0mV
-600.0mV
-800.0mV
-1.000V
-1.200V
-1.400V
Volts
-500.0µs
0.000s
500.0µs
1.000ms
1.500ms
2.000ms
2.500ms
3.000ms
3.500ms
4.000ms
4.500ms
Time

3.



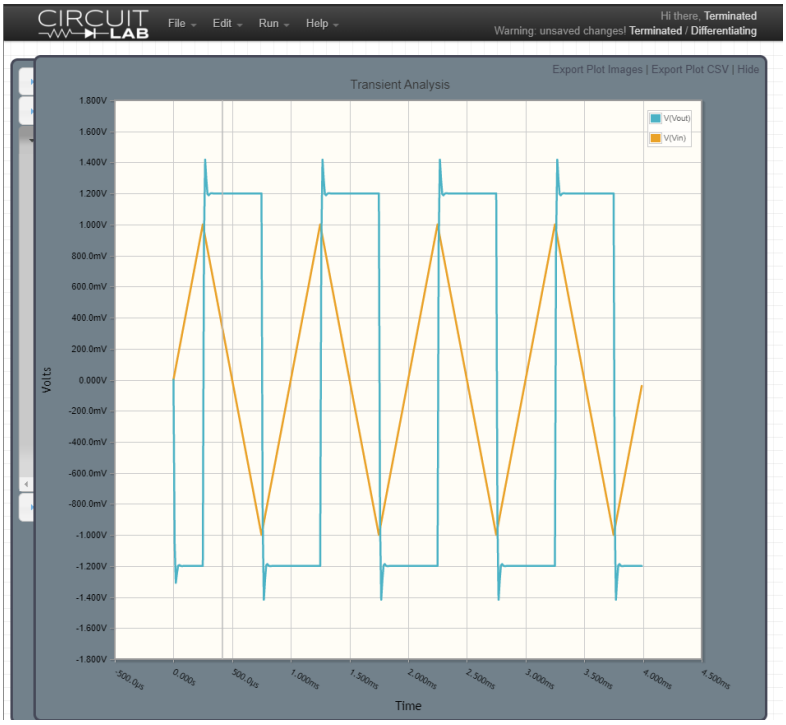


Vout=-(r2/r1)*vin

-(300/100)*1=-3

The calculated output is the same as the simulated input

4.



The relationship between the input and the output is simply a derivative. The sawtooth quickly changes the sign of its slope, and that is reflected by the output jumping up and down very quickly. The derivative is just the slope, and the slope of a saw tooth is a square wave.

5.

a. 297/89 = 3.38 V

b. max: 9(3.135/(5.32 + 3.135)) = 3.534 V

min: 9(3.465/(5.88 + 3.465)) = 3.38 V

$V_{out}=v(r_2/(r_1+r_2))$

6.

A system that I use on campus is my car. I use it to drive to the dining halls and shops nearby.

Analog: there are many analog components in a car, probably the most iconic one is the speedometer, moving in relation to the movement of the car. Another system is music, when I play music in my car it is an analog signal coming from the speakers into my ears.

Digital: Nowadays, there are lots of digital components in cars, one that I use all the time is the backup camera. The transfer of the signal from the camera on the back of my car is a digital signal, and the screen that is used to show me the camera output is also digital.