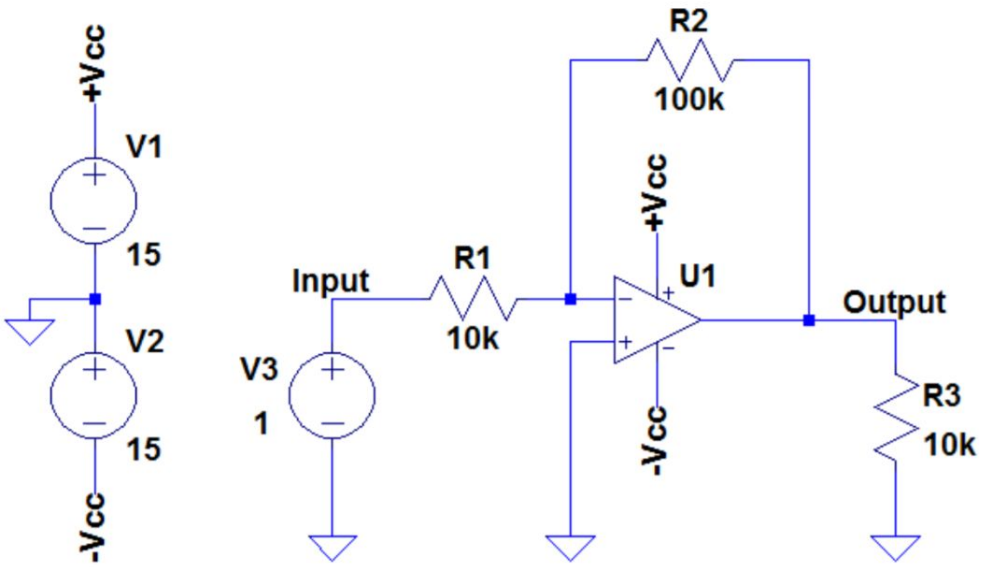
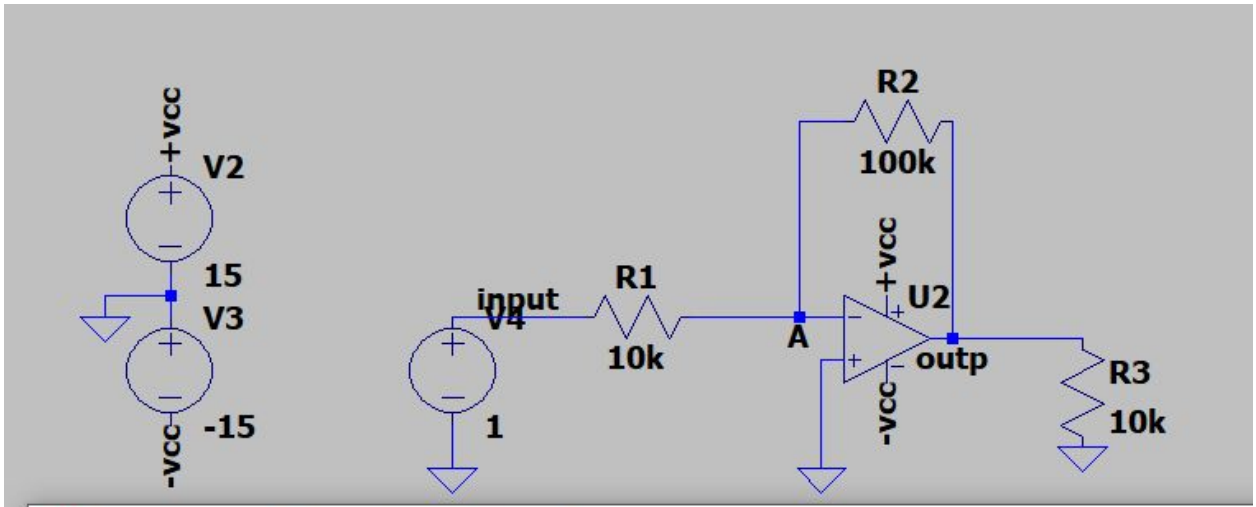
Circuits Lab 11 4/8/2020 Chase Mulder

1. Make this circuit



2. 

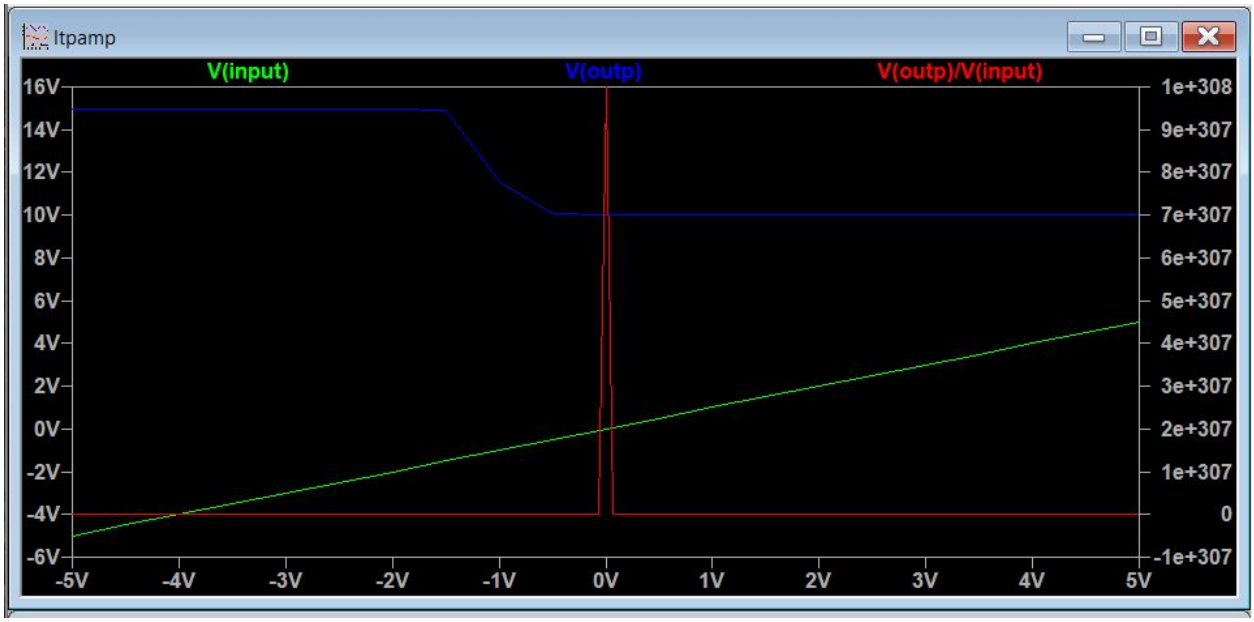
3.

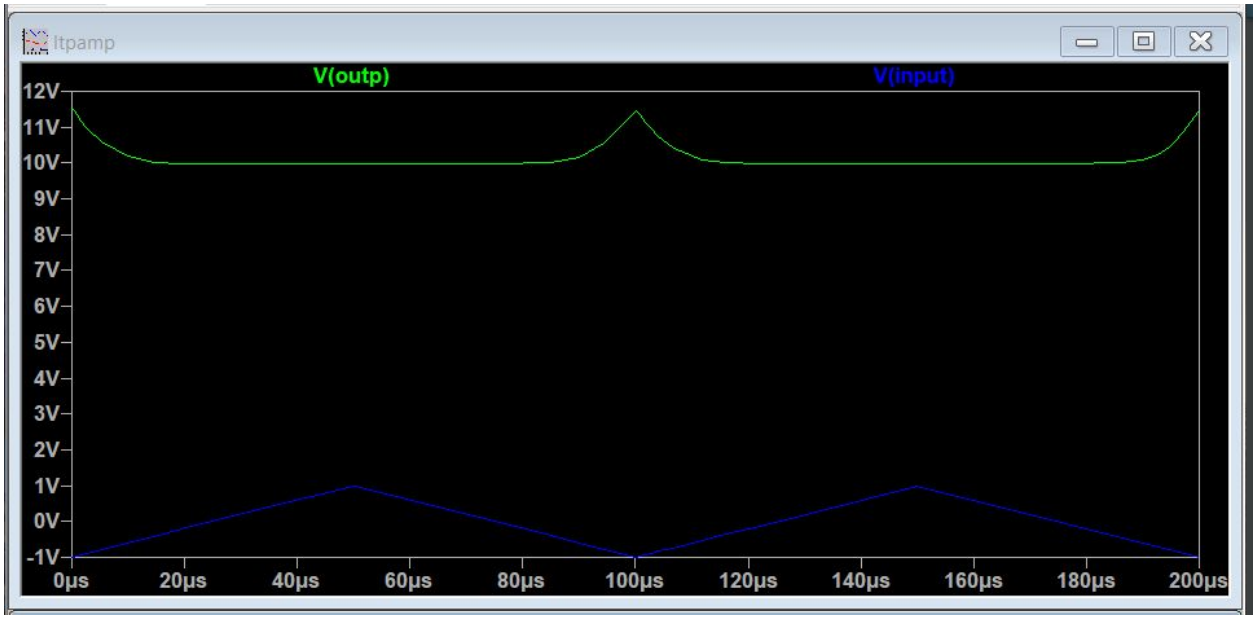


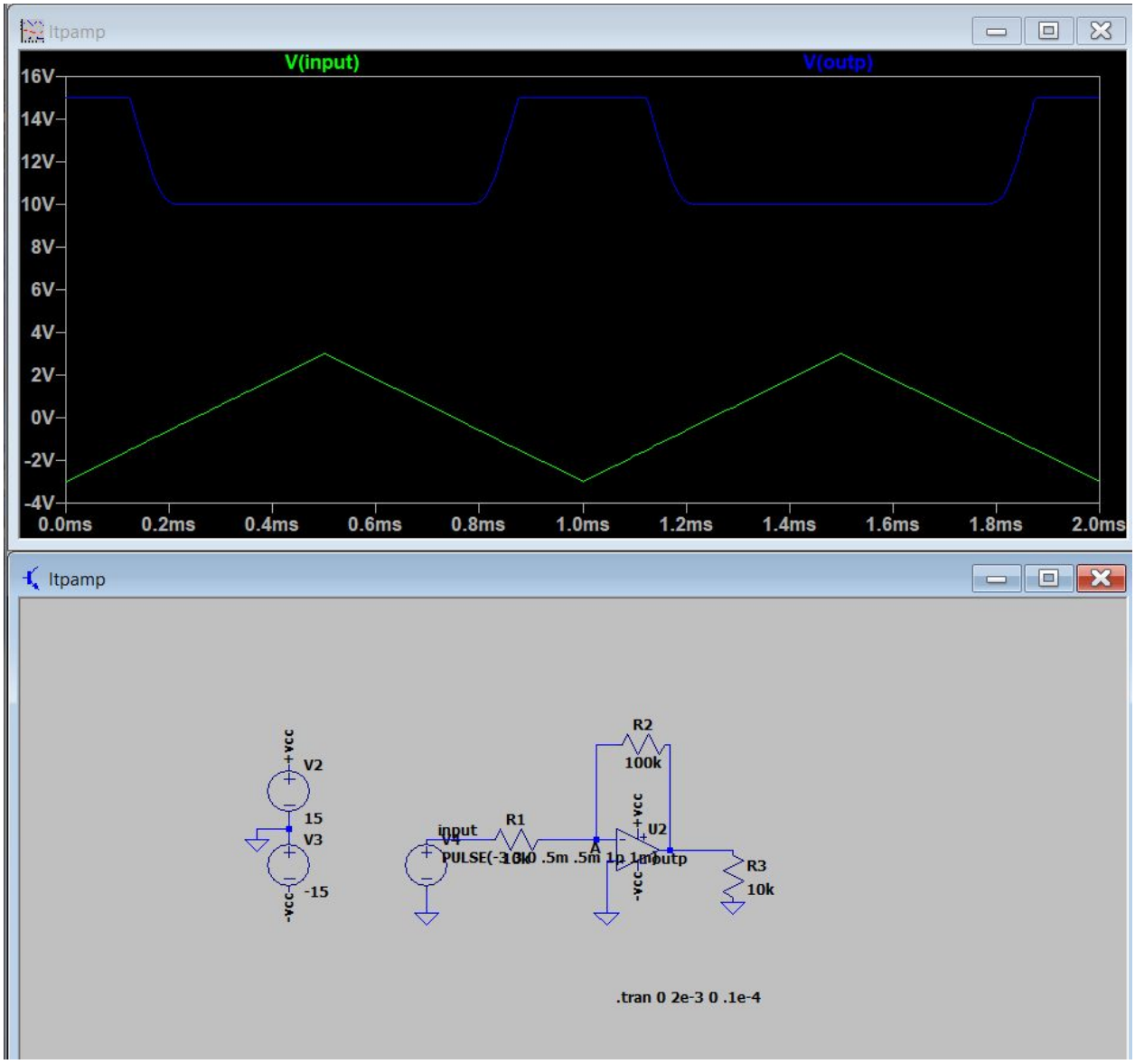
* C:\Users\ickysaladtosser\Desktop\Circuits\ltpamp.asc

--- Operating Point ---

V(a):	1.81929	voltage
V(input):	1	voltage
V(-vcc):	15	voltage
V(+vcc):	15	voltage
V(outp):	10.0095	voltage
I(R3):	0.00100095	device_current
I(R2):	8.19022e-05	device_current
I(R1):	8.19285e-05	device_current
I(V4):	8.19285e-05	device_current
I(V2):	-0.000331286	device_current
I(V3):	0.000751673	device_current
Ix(u2:1):	-3e-08	subckt_current
Ix(u2:2):	-2.63614e-08	subckt_current
Ix(u2:3):	0.000331286	subckt_current
Ix(u2:4):	0.000751673	subckt_current
Ix(u2:5):	-0.00108285	subckt_current

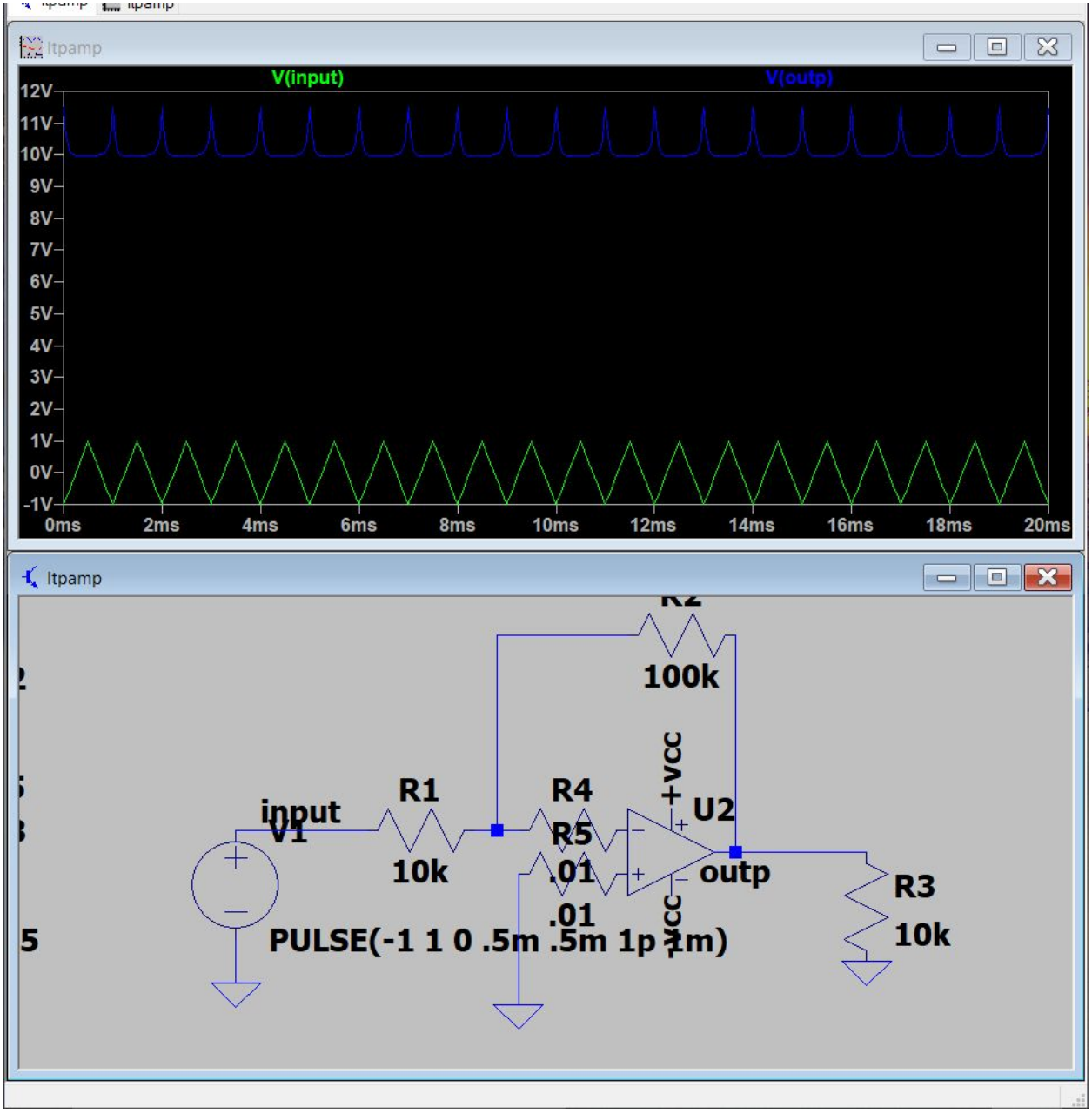
4. 

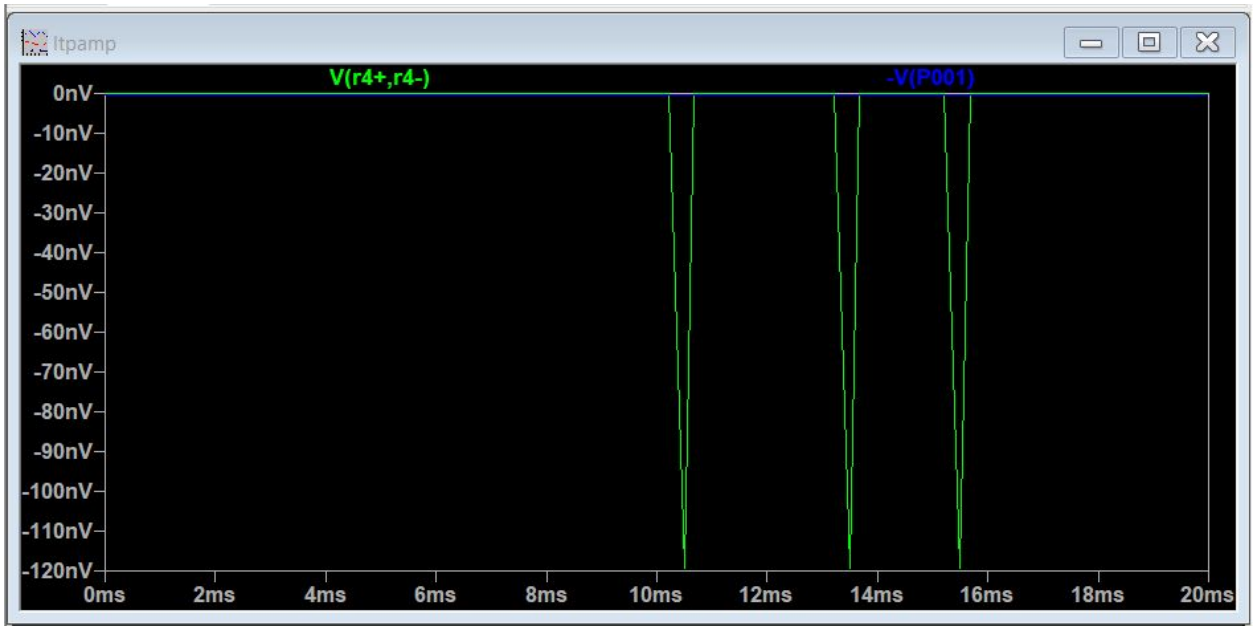
5. To explain the above graph
    a. Red line is the gain and the gain is Voutput/Vinput
    b. Green in Vinput
    c. Blue is Voutput
6. 

7. 

8. R3 does not affect the gain of the op amp circuit because it's not RF or RS, R2 and R1 affect the gain.

9.


ltpamp
V(input)
V(outp)
12V
11V
10V
9V
8V
7V
6V
5V
4V
3V
2V
1V
0V
-1V
0ms
2ms
4ms
6ms
8ms
10ms
12ms
14ms
16ms
18ms
20ms
ltpamp
100k
R1
R4
+VCC
U2
input
V1
10k
R5
.01
.01
outp
R3
10k
-VCC
PULSE(-1 1 0 .5m .5m 1p 1m)

10. 

11. * C:\Users\ickysaladtosser\Desktop\Circuits\ltpamp.asc

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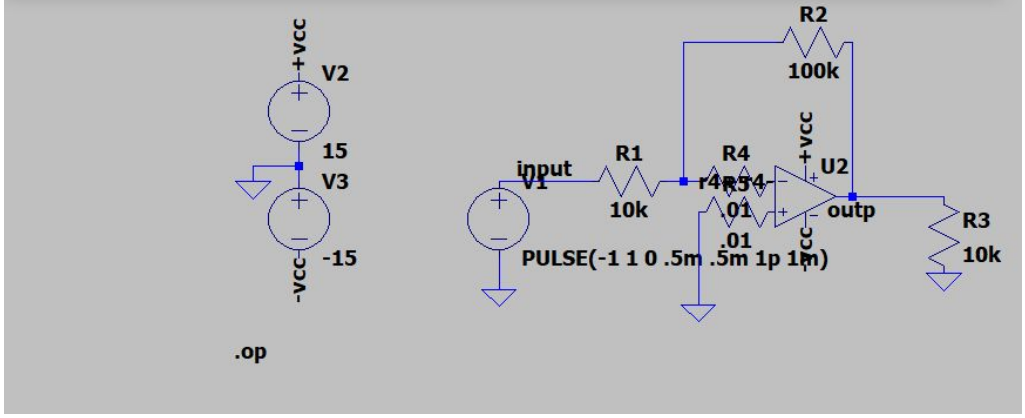
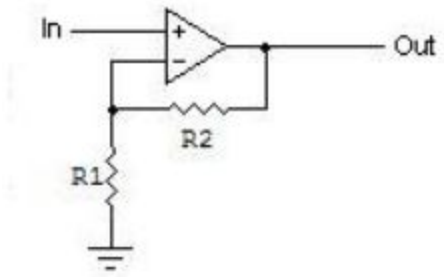
        --- Operating Point ---

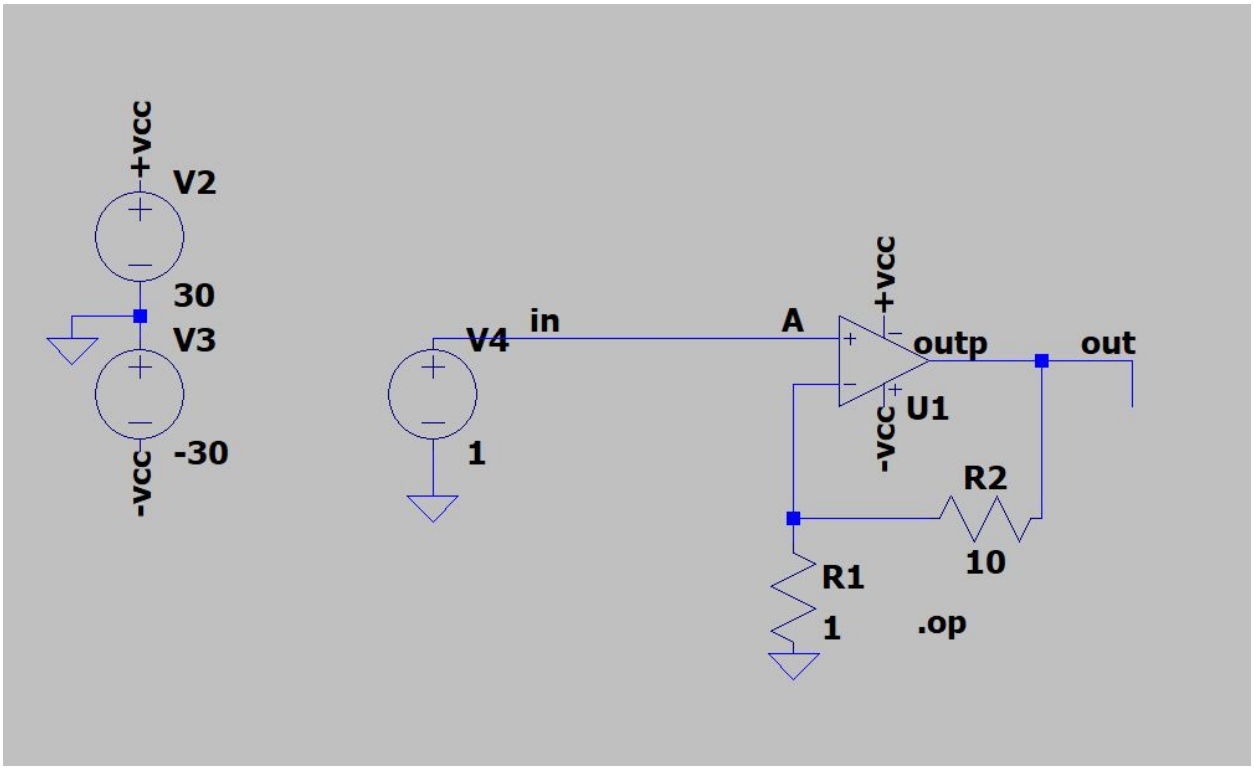
V(r4+):         0.136443        voltage
V(input):       -1              voltage
V(-vcc):        15              voltage
V(+vcc):        15              voltage
V(outp):        11.4979         voltage
V(r4-):         0.136443        voltage
V(p001):        3e-10           voltage
I(R5):          3e-08           device_current
I(R4):          2.97271e-08     device_current
I(R3):          0.00114979      device_current
I(R2):          0.000113615     device_current
I(R1):          0.000113644     device_current
I(V1):          0.000113644     device_current
I(V2):          -0.00115757     device_current
I(V3):          0.000105927     device_current
Ix(u2:1):       -3e-08          subckt_current
Ix(u2:2):       -2.97271e-08    subckt_current
```



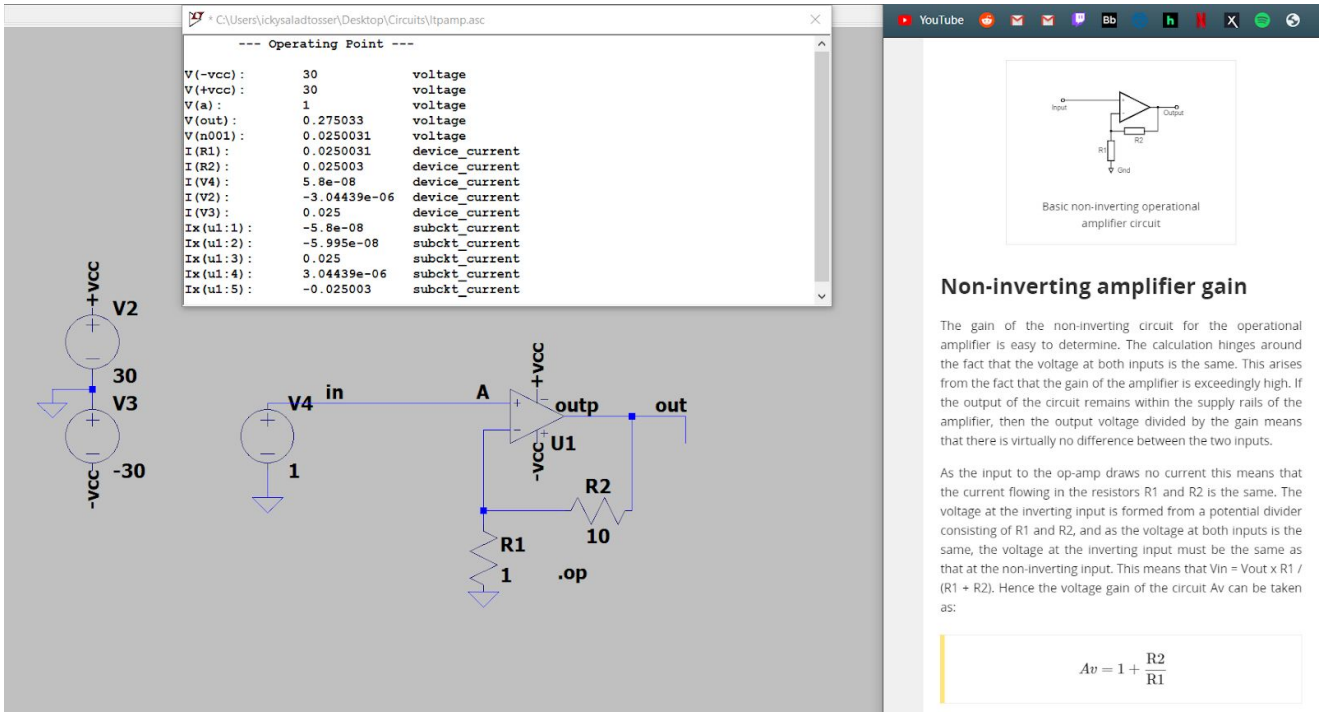
12. For a non-inverting amp, the gain is:

Gain = 1 + (R2/R1)

13. 

14. 

15. This circuit should have a gain of 11
16. Gain 11 means a one volt in equals 11 volts out
17. Technically we'd need another inverting op amp because the vout will be -11
18. Conclusion
    a. Op amp doesn't violate kcl. The saturation in the op amp is what is creating the current.
    b. Part 1 step 8 we found there's almost no current flowing into the op amp. V=IR, so having almost no current would result in very little voltage. If this current was 0 then we'd have a virtual short.
    c. How well did the 11V/V non inverting op amp do?



d. The non inverting op amp with gain of 11 is not simulating in LTSpice properly, but the hand calculation on paper checks out with a non inverting op amp circuit found on the internet. In the circuit R2/R1 + 1 will give the gain of the circuit. The values chosen for R2 is 10 ohms and R1 is 1ohm because 10/1 = 10 then +1 equals 11 gain voltage. I'm a little confused as to why the LT simulation is failing, but I have a suspicion it's to do with the rails +vcc and -vcc. In a non inverting op amp circuit the rail will be the output, so if a 1v comes in then the positive rail will be the output.