EE281 EXPERIMENT 4

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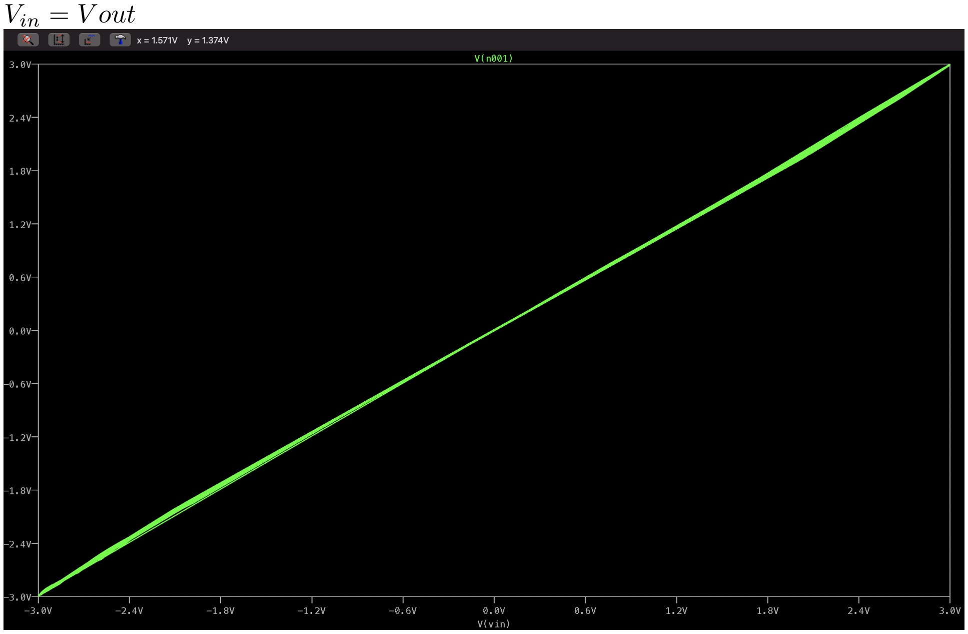
28th of November 2020(Took 6 Hours)

1 Preliminary Work

1.1 Question 1

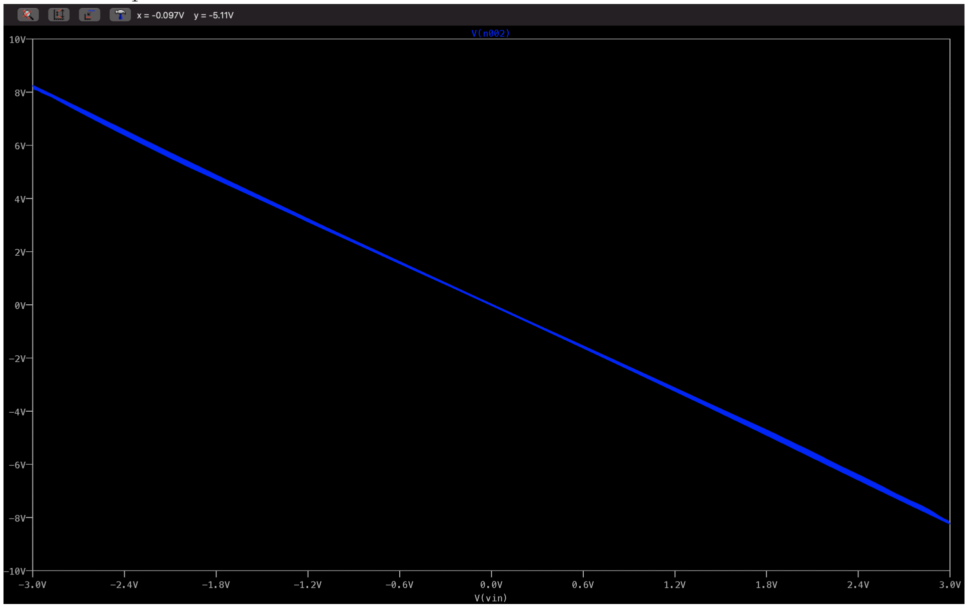
a. $V_3 = V_2$

$V_{in} = Vout$



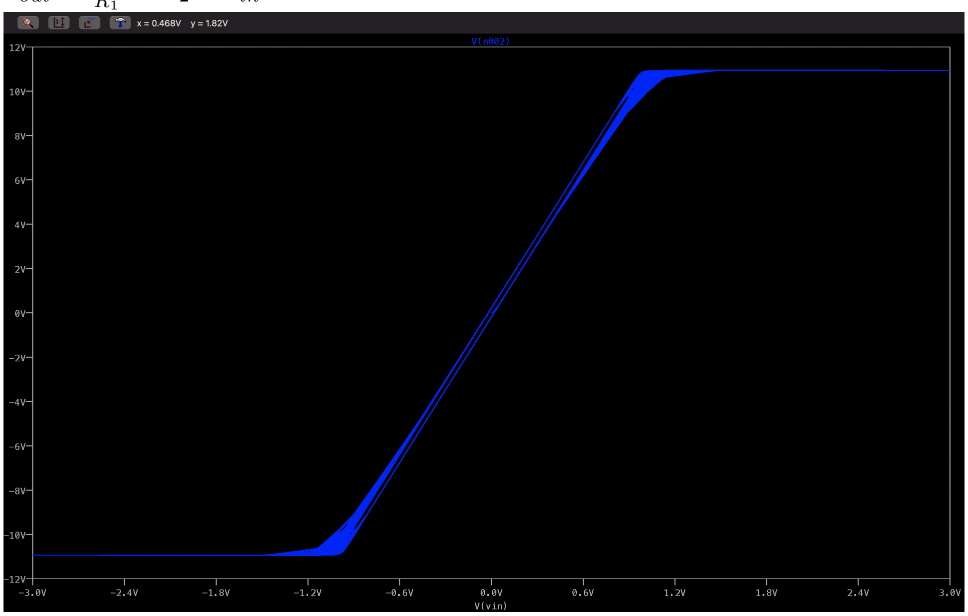
b. $V_3 = V_2 = 0$

$V_{out} = -\frac{V_{in}}{R_1} \times R_2$



c. $V_3 = V_2 = V_{in}$

$V_{out} = \frac{V_{in}}{R_1} \times R_2 + V_{in}$

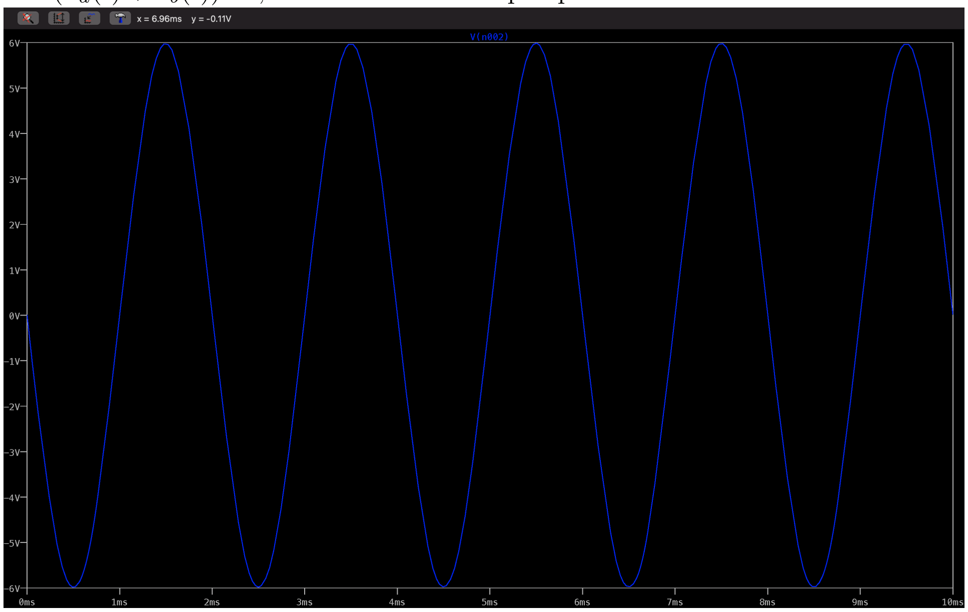


1.2 Question 2

a. $V_3 = V_2 = 0$

$(\frac{V_a(t)}{R_1} + \frac{V_b(t)}{R_2}) \times R_f$

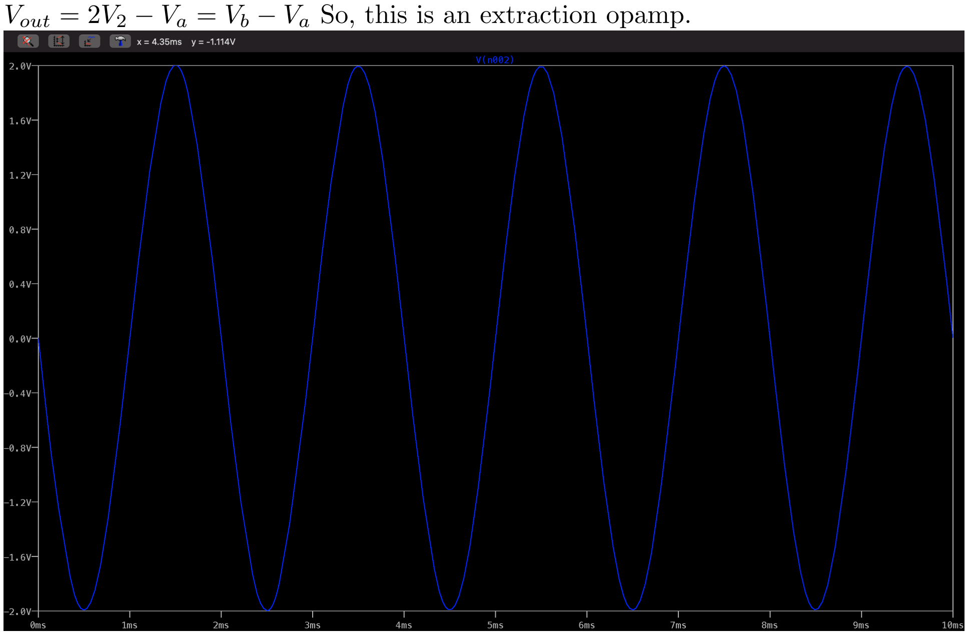
$= -(V_a(t) + V_b(t))$ So, this is an addition opamp.



b. $V_3 = V_2 = \frac{V_b}{R_2+R_4} \times R_4$

$V_{out} = -\frac{V_a - V_2}{R_1} \times R_3 + V_2$

$V_{out} = 2V_2 - V_a = V_b - V_a$ So, this is an extraction opamp.



c. $V_3 = V_2 = \frac{V_in-2}{R_1+R_2} \times R_2 + 2V$

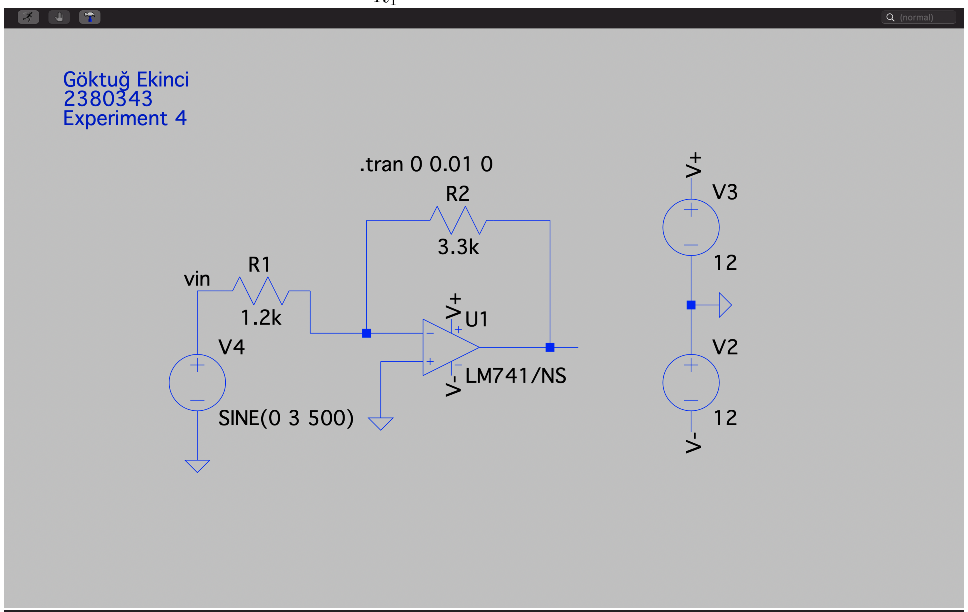
$V_{out} = \frac{V_2}{R_1} \times R_2 + V_2$

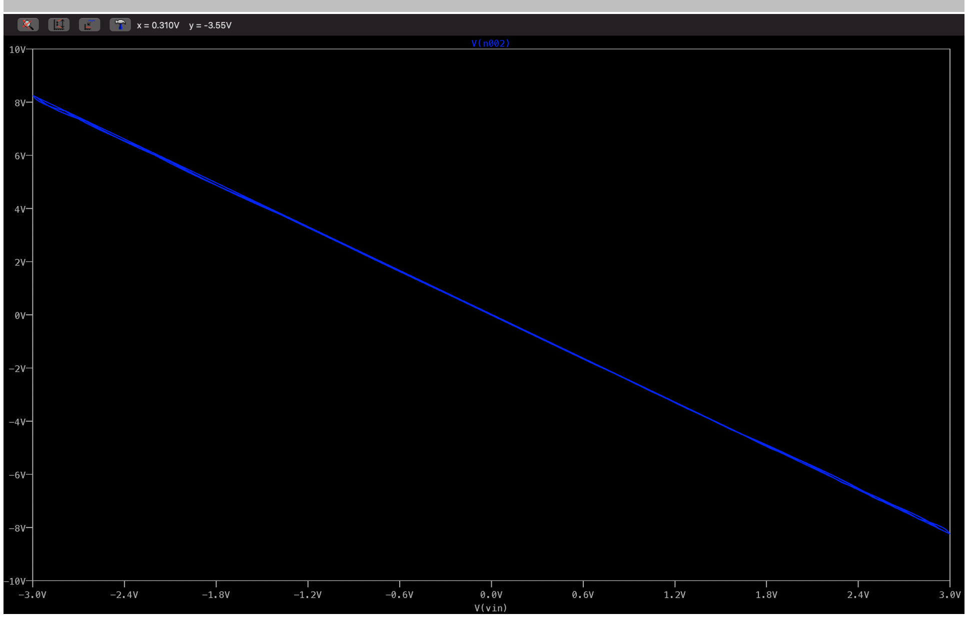
$V_{out} = \frac{33 \times V_{in} - 200}{100}$

2 Experimental Work

2.1 Figure 1&2

Set up the Figure 5 and adjusted voltage source to sinusodial wave form, 500Hz and 3 for amplitude. Added a label right after V_{in}.$V_{out} = -\frac{V_{in}}{R_1} \times R_2$

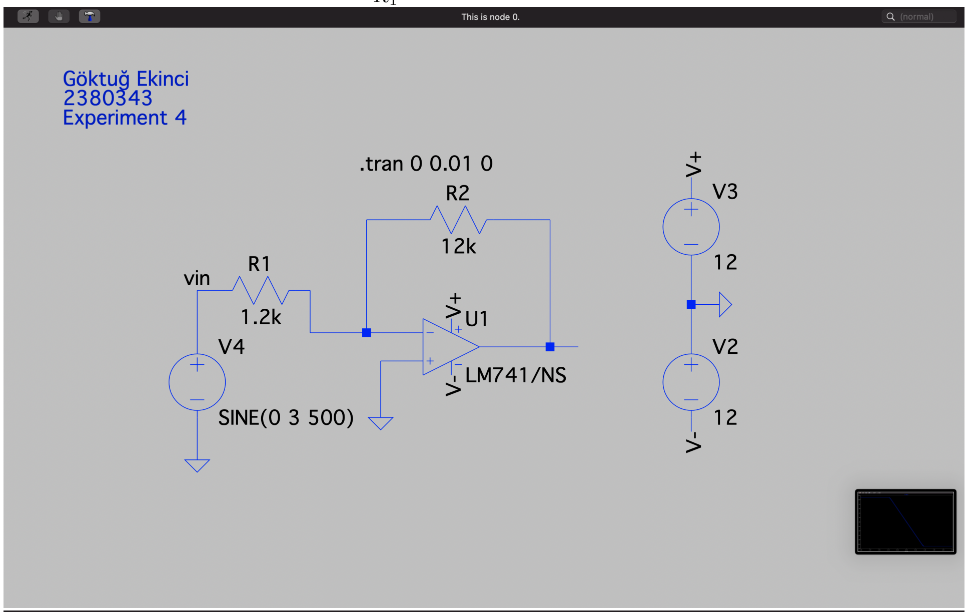


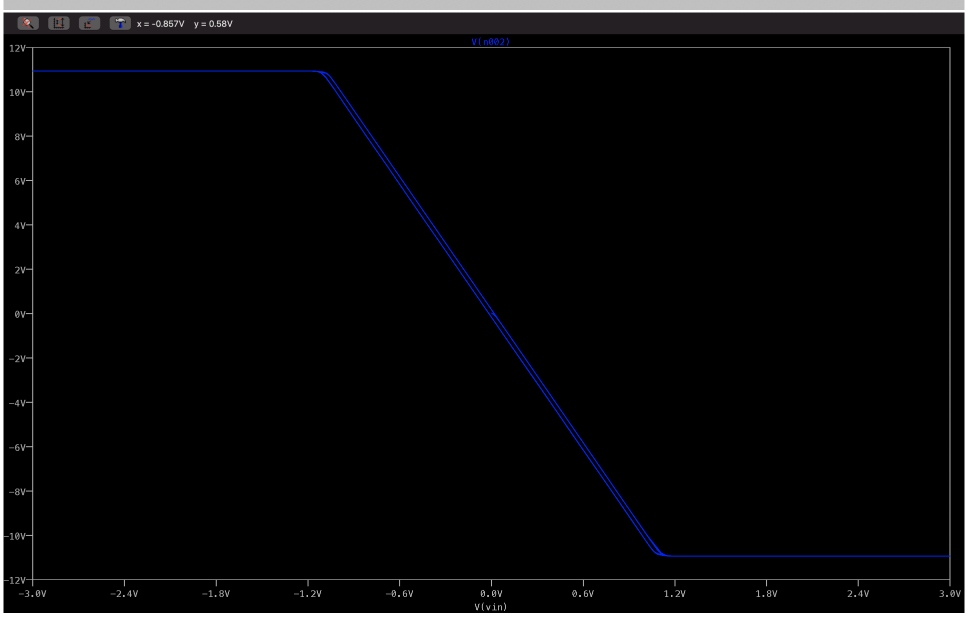


Experimental Gain: 16/6 = 2.67

2.2 Figure 3&4

Set up the Figure 10 and adjusted voltage source to sinusodial wave form, 500Hz and 3 for amplitude. Added a label right after V_{in}.$V_{out} = -\frac{V_{in}}{R_1} \times R_2$

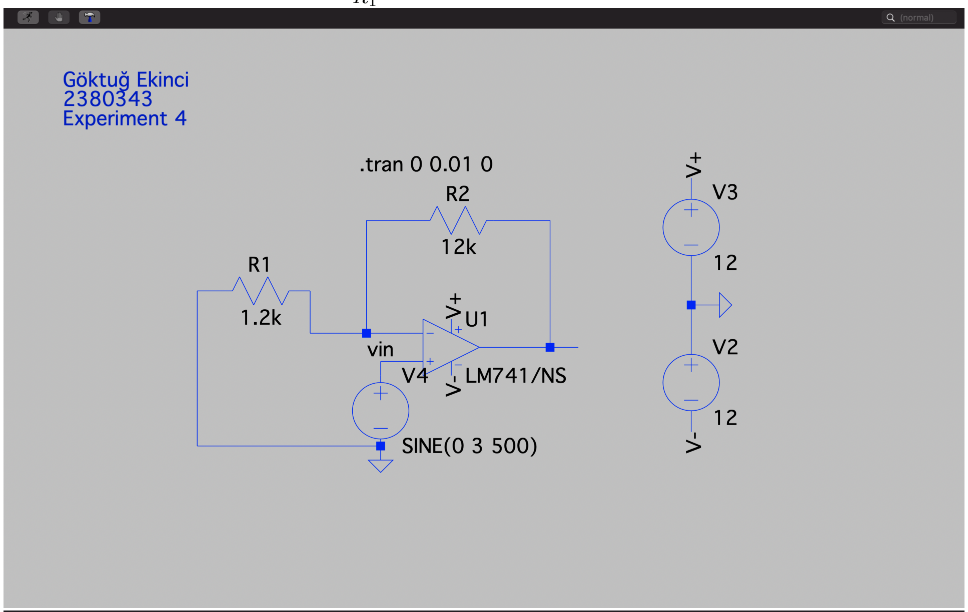


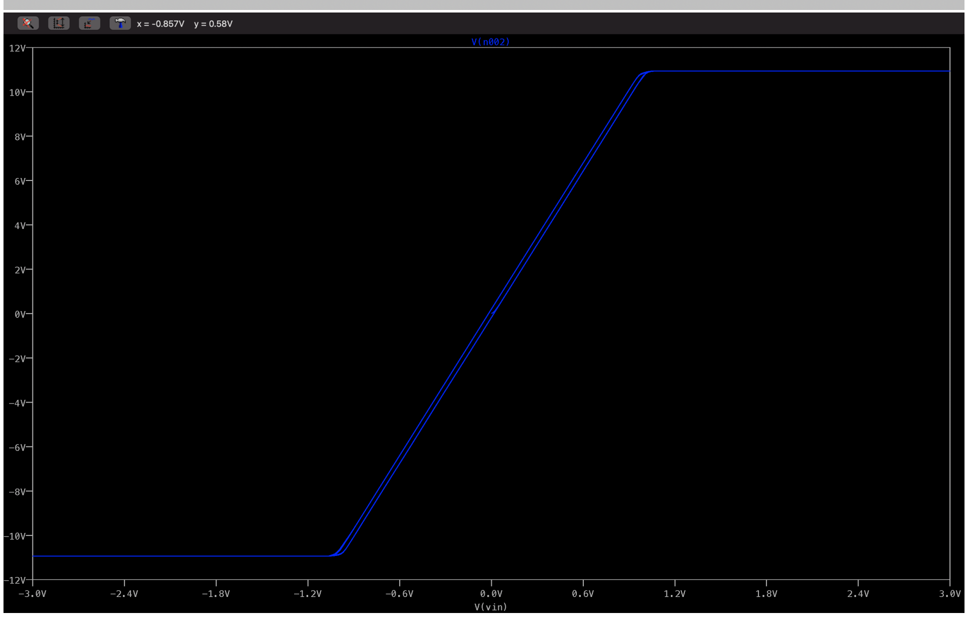


Experimental gain except the saturation: -9.8

2.3 Figure 5&6

Set up the Figure 6 and adjusted voltage source to sinusodial wave form, 500Hz and 3 for amplitude. Added a label right after $V_{in}.V_{out} = \frac{V_{in}}{R_1} \times R_2 + V_{in}$

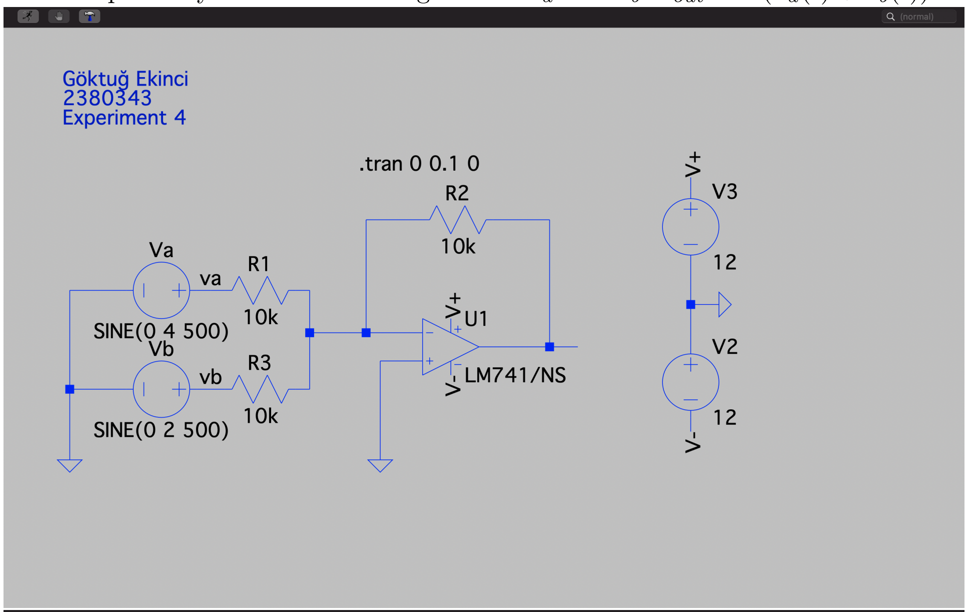


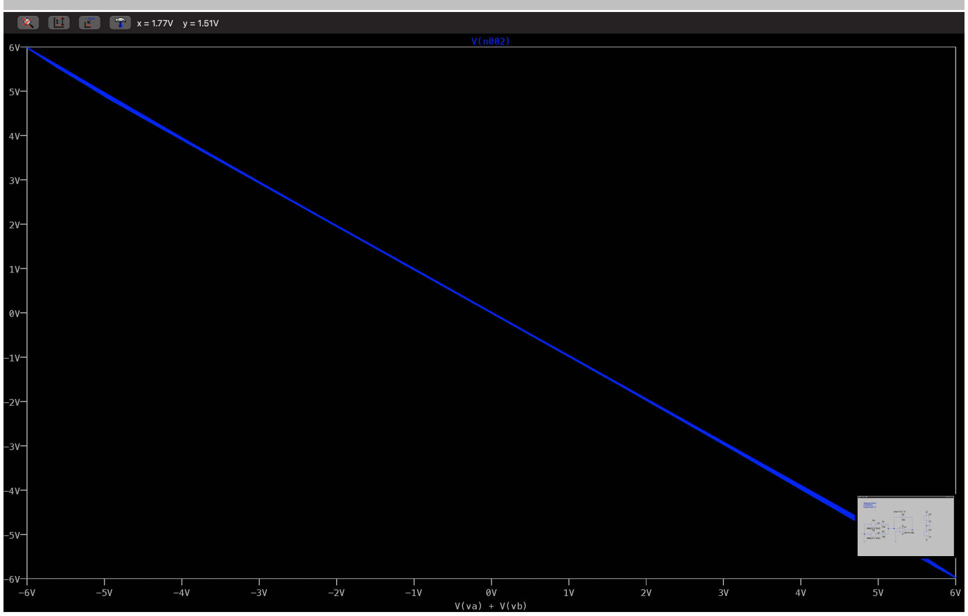


Experimental gain except the saturation: 10.3

2.4 Figure 7&8

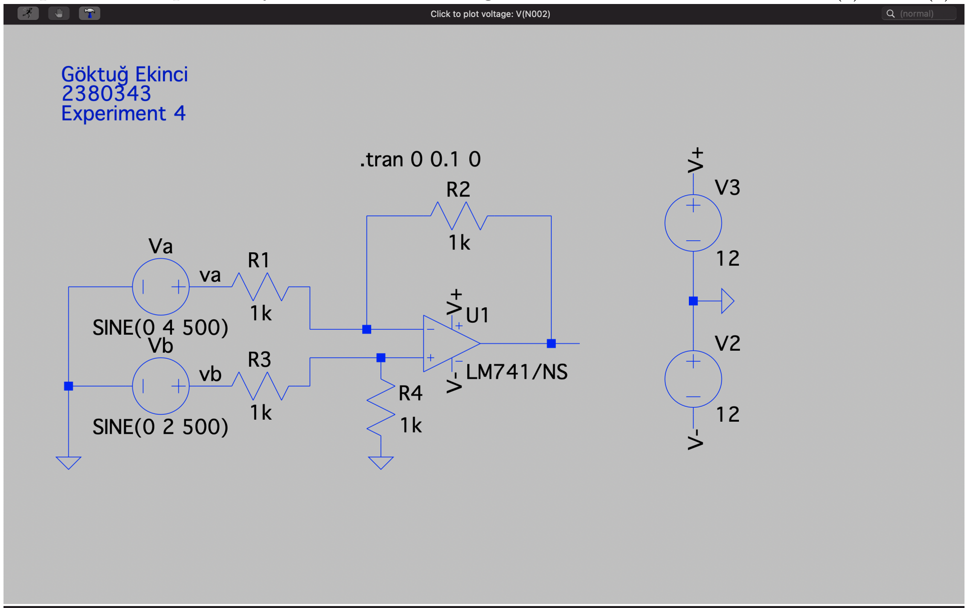
Set up the Figure 7 and adjusted voltage sources to sinusodial wave form, 500Hz for both and 2,4 for amplitudes respectively. Added a label right after V_a and V_b .$V_{out} = -(V_a(t) + V_b(t))$

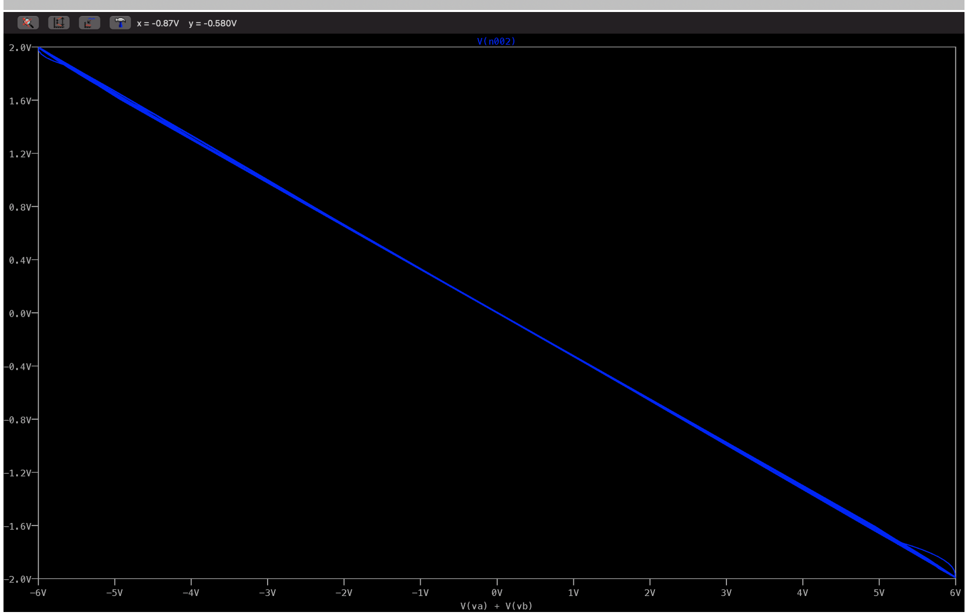




2.5 Figure 9&10

Set up the Figure 8 and adjusted voltage sources to sinusodial wave form, 500Hz for both and 2,4 for amplitudes respectively. Added a label right after V_a and V_b .$V_{out} = V_b(t) - V_a(t)$

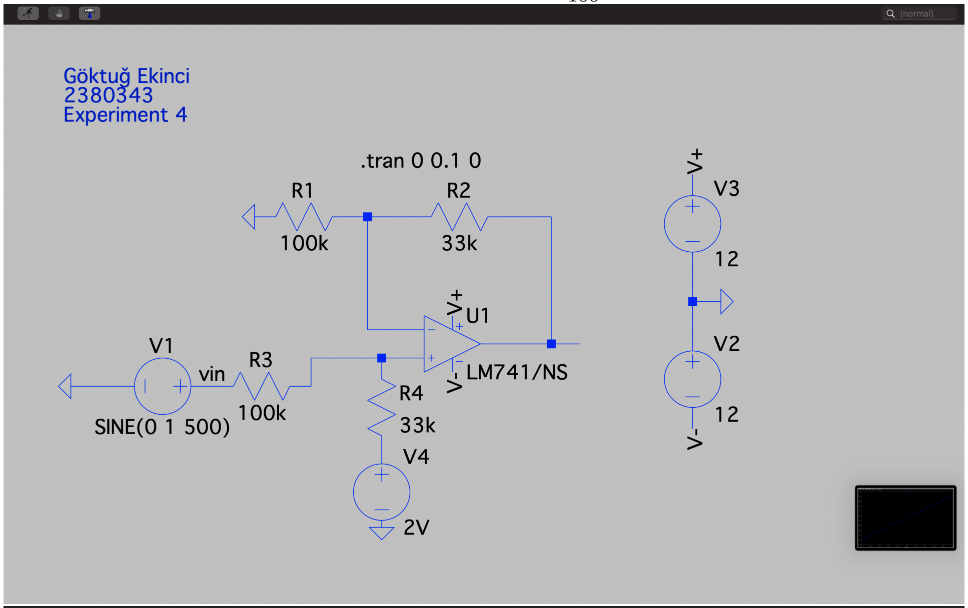


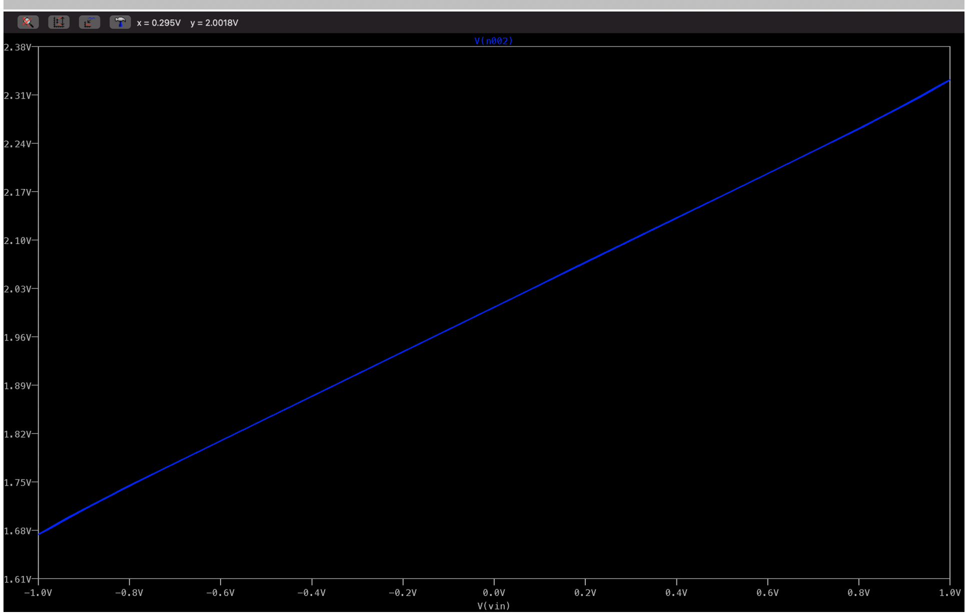


Slopes are both -1 $= V_{out}/V_{in}$.

2.6 Figure 11&12

Set up the Figure 9 and adjusted voltage source to sinusodial wave form, 500Hz and 1 for amplitude respectively. Added a label right after V_{in} .$V_{out} = \frac{33 \times V_{in} - 200}{100}$





Slope: 33/100.

3 Conclusion

Why do the outputs saturate? In some way, OPAMP is a function that reflects the result of inputs, but it is not using the input voltages to reflect the output; instead, it uses the separate voltages that we give to it. Even the output must be very high, it cannot produce extra voltage other than we give to it, so in some point it saturates on the given voltage values to it.

What may happen if the inputs are not grounded correctly? Since the output just dependent on the input values and not grounding them may cause miscalculation of output values and unexpected results.