**REPORT**

*注意事項: 當天demo只需填寫Experiment Result與 Waveform，剩下部分由同學回去自行填寫*

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| **Experiment 1: Difference Amplifier** |

請參考講義 “109電工學實驗 Lab07 ver 1.pdf” 第8頁

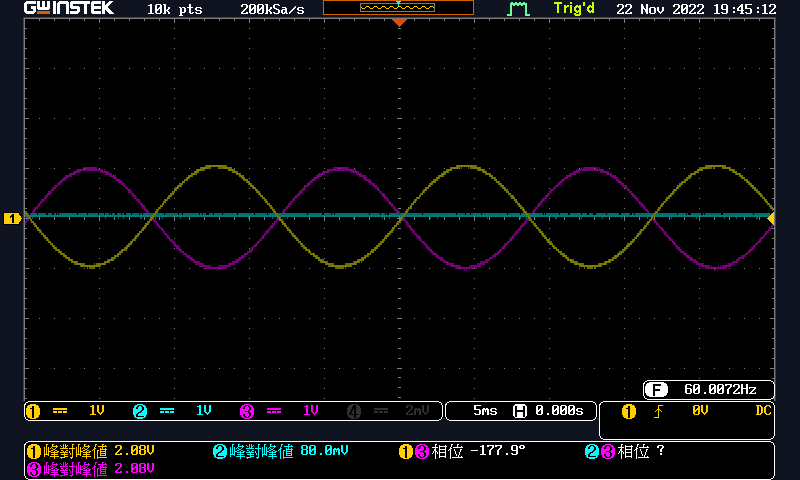
**Write down your pinout. (示波器的通道)**

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| --- | --- |
|  |  |

**2. Differential Mode**

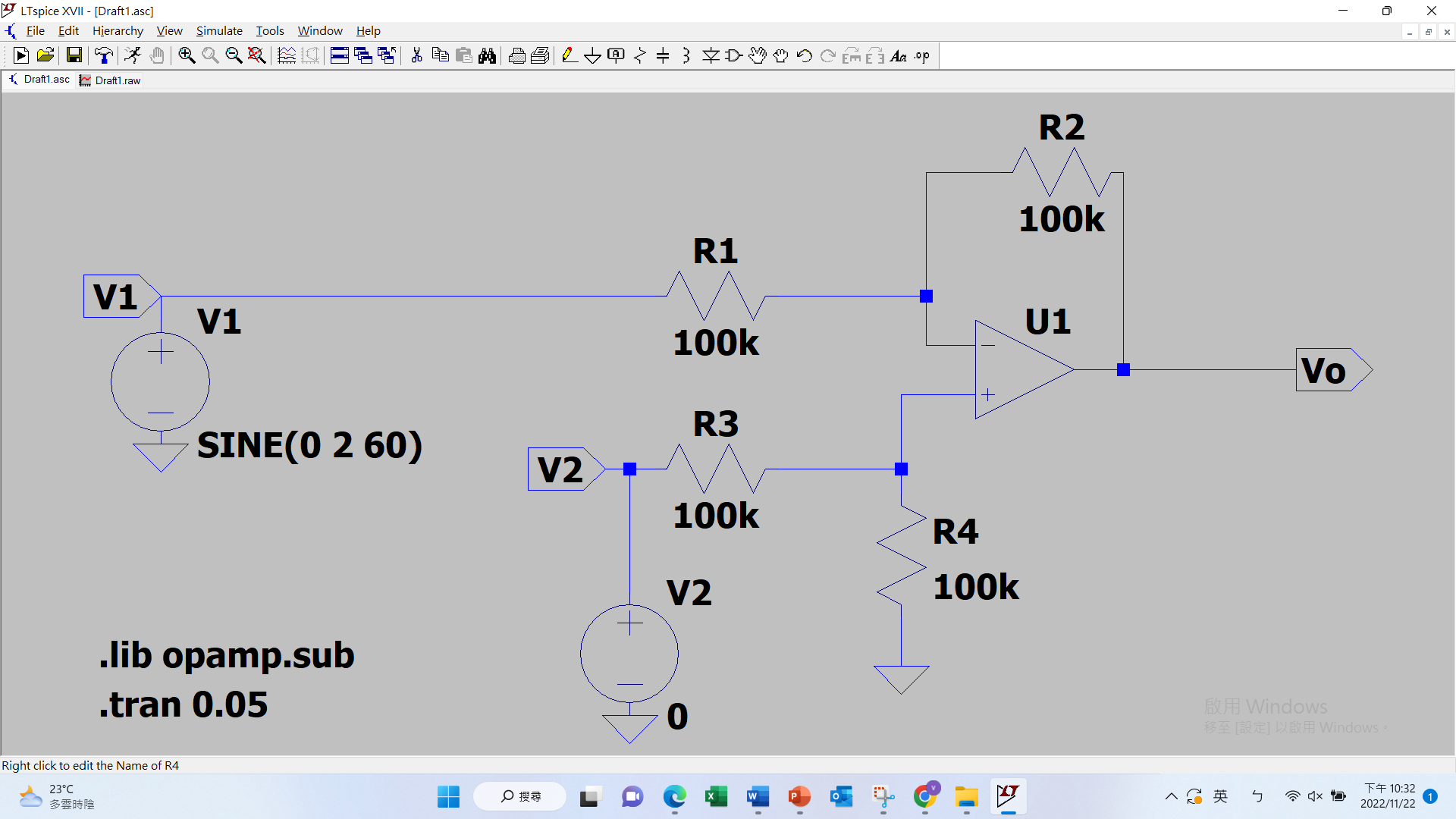
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | v1,pp  (V) | v2,pp  (V) | vd,pp=v2-v1  (V) | vout,pp  (V) | ADM  (V/V) | Phase (vout->v1)  (degree) |
| **Theoretical Result** | **2** | **0** | **-2** | **2** | **-1** | **180** |
| **Experiment Result** | **2.08** | **0.08** | **-2** | **2.08** | **-1.04** | **177.9** |
| **Simulation Result** |  |  |  |  |  |  |
| **Error (%)** | **4** |  | **0** | **4** | **4** | **-1.17** |

P1\_vout , v2 and v1 experiment waveform (一張圖同時呈現三通道的波型，用Meas 顯示Phase)

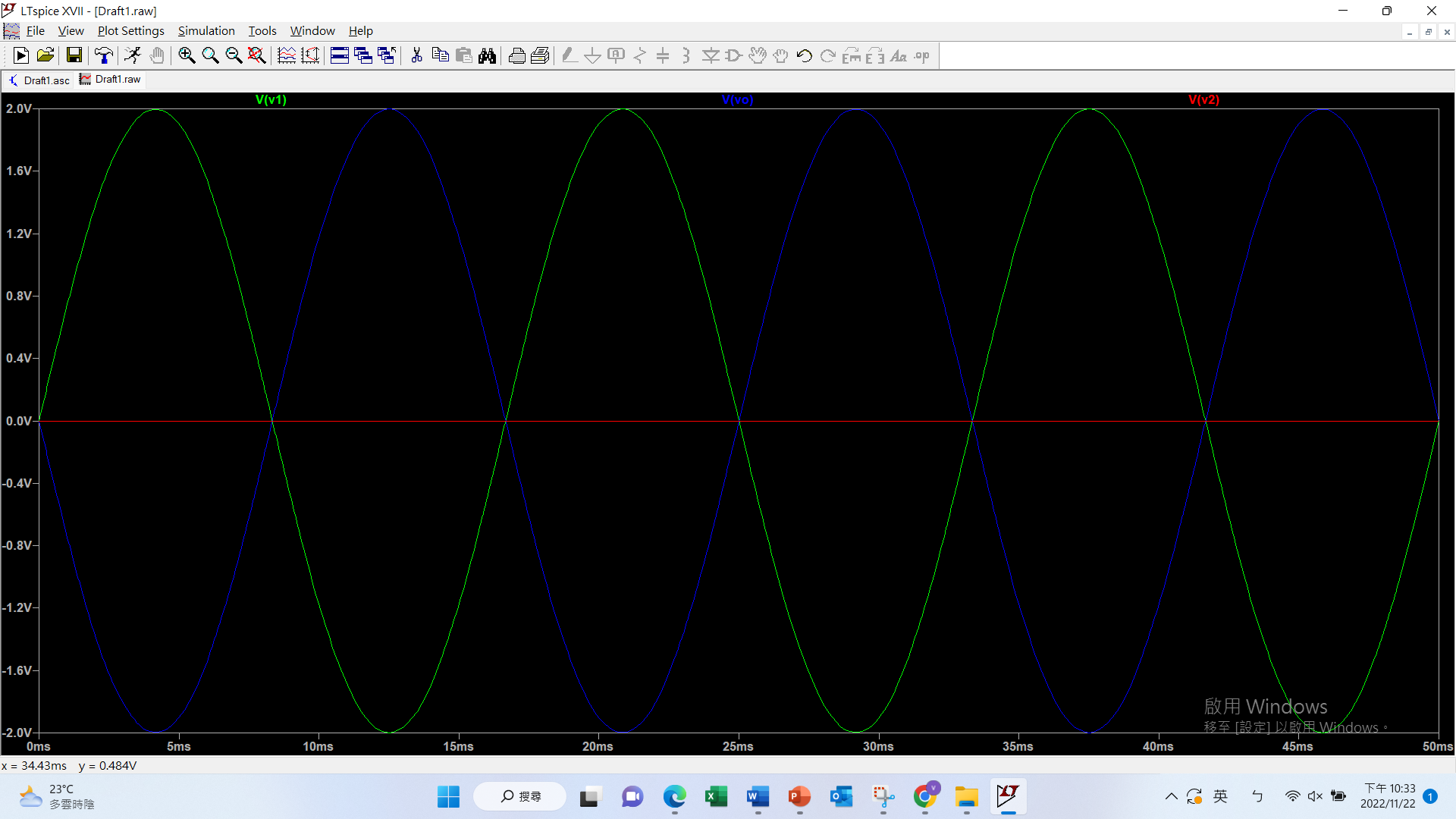


**Simulation:**

P2\_LTspice電路圖



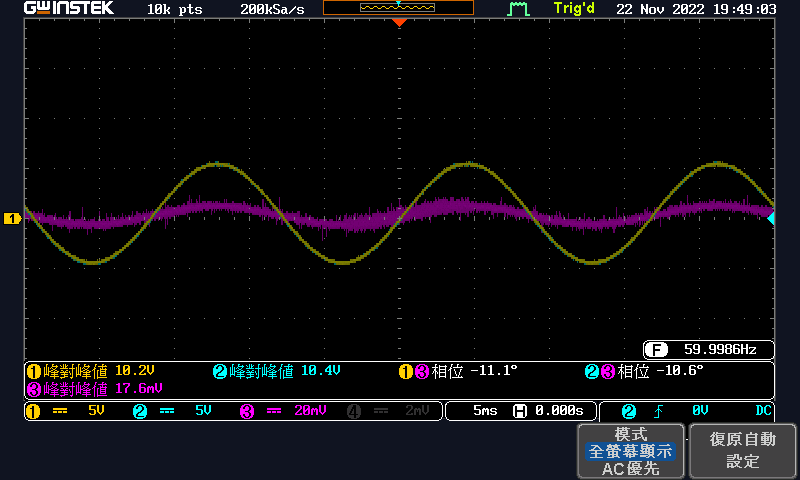
P3\_vout , v2 and v1 simulation waveform



**3. Common Mode**

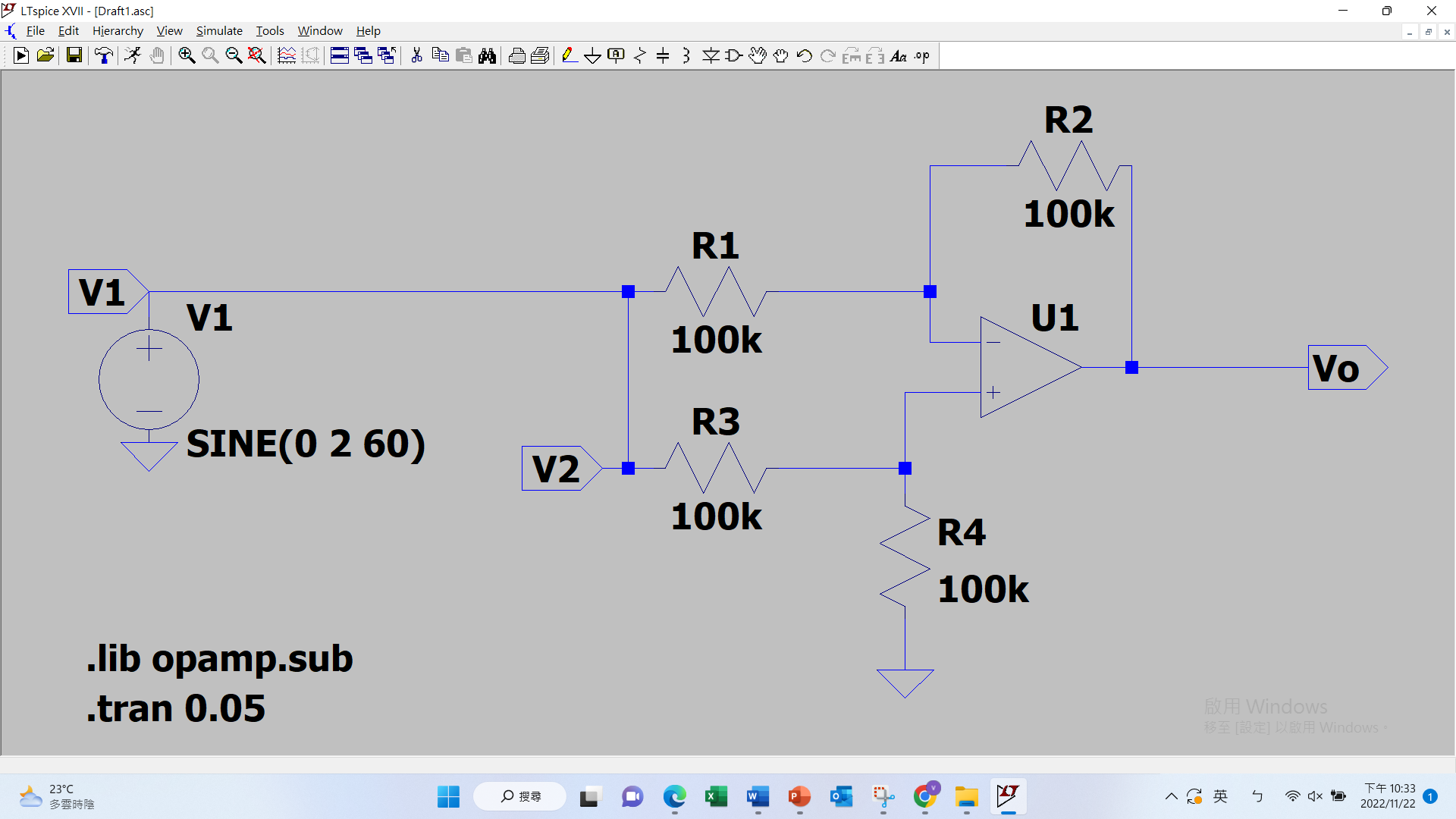
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | v1,pp (V) | vout,pp (V) | ACM (V/V) | Phase (vout->v1)  (degree) |
| **Theoretical Result** | **10** | **0** | **0** | **0** |
| **Experiment Result** | **10.2** | **0.0176** | **0.001725** | **11.1** |
| **Simulation Result** |  |  |  |  |
| **Error (%)** | **2** |  |  |  |

P4\_vout , v2 and v1 experiment waveform (一張圖同時呈現三通道的波型，用Meas 顯示Phase)

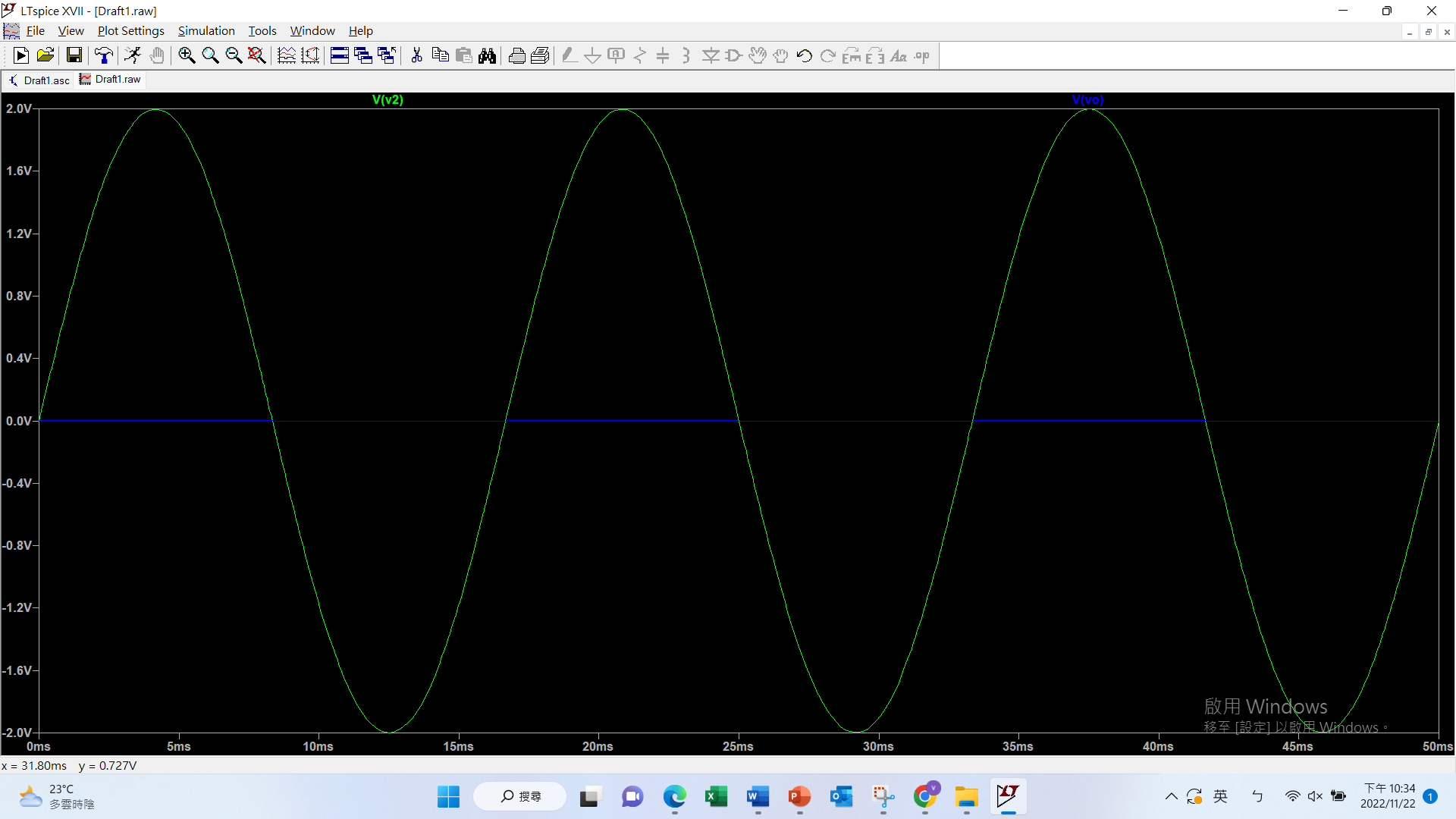


**Simulation:**

P5\_LTspice電路圖



P6\_vout , v2 and v1 simulation waveform



**4. CMRR**

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**5.Discuss:**

In experiment 1, . Therefore, the gain should be . In the first graph, we can see that the gain is -1.04, with an error of 4%. Also, because the waveform is inverted, the phase of should be , and we have an experiment result of with an error of .

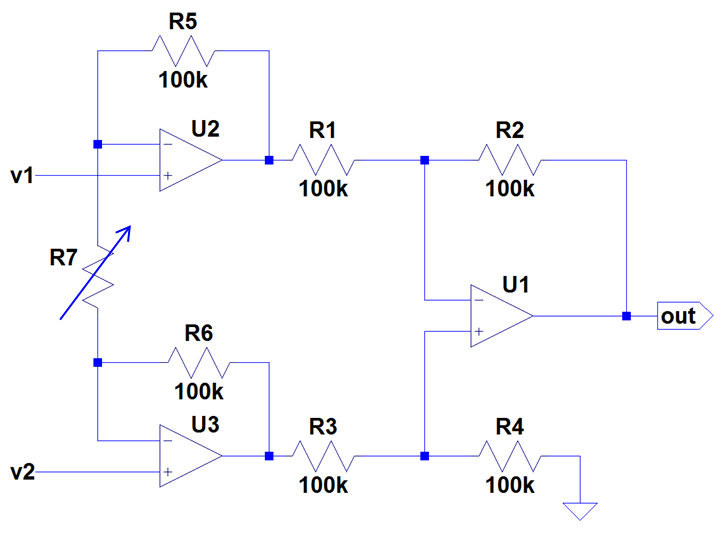
In experiment 2, and is connected. Therefore, the waveform is identical. Since , the output voltage should be approximately 0. We obtain a common mode amplitude of , which is close to 0.

The CMRR is in theory since is 0. We obtain an experiment CMRR of .

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| **Experiment 2: Instrumentation Amplifier** |

請參考講義 “109電工學實驗 Lab07 ver 1.pdf” 第14頁

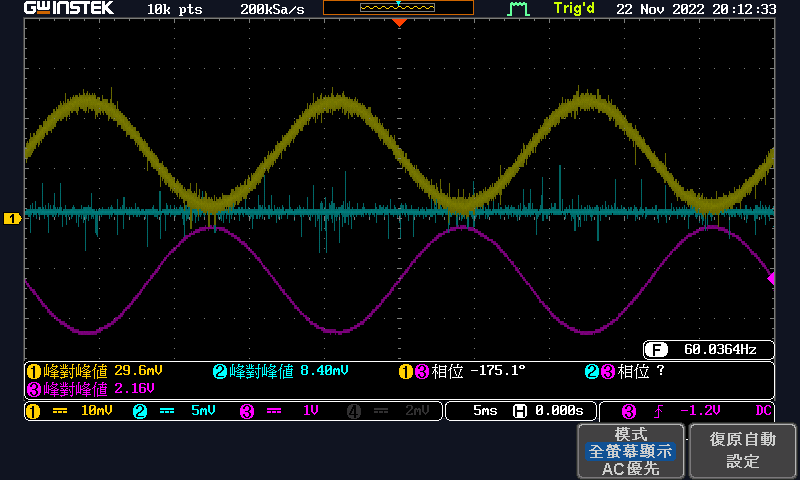
**Write down your pinout. (示波器的通道)**



2. Differential Mode

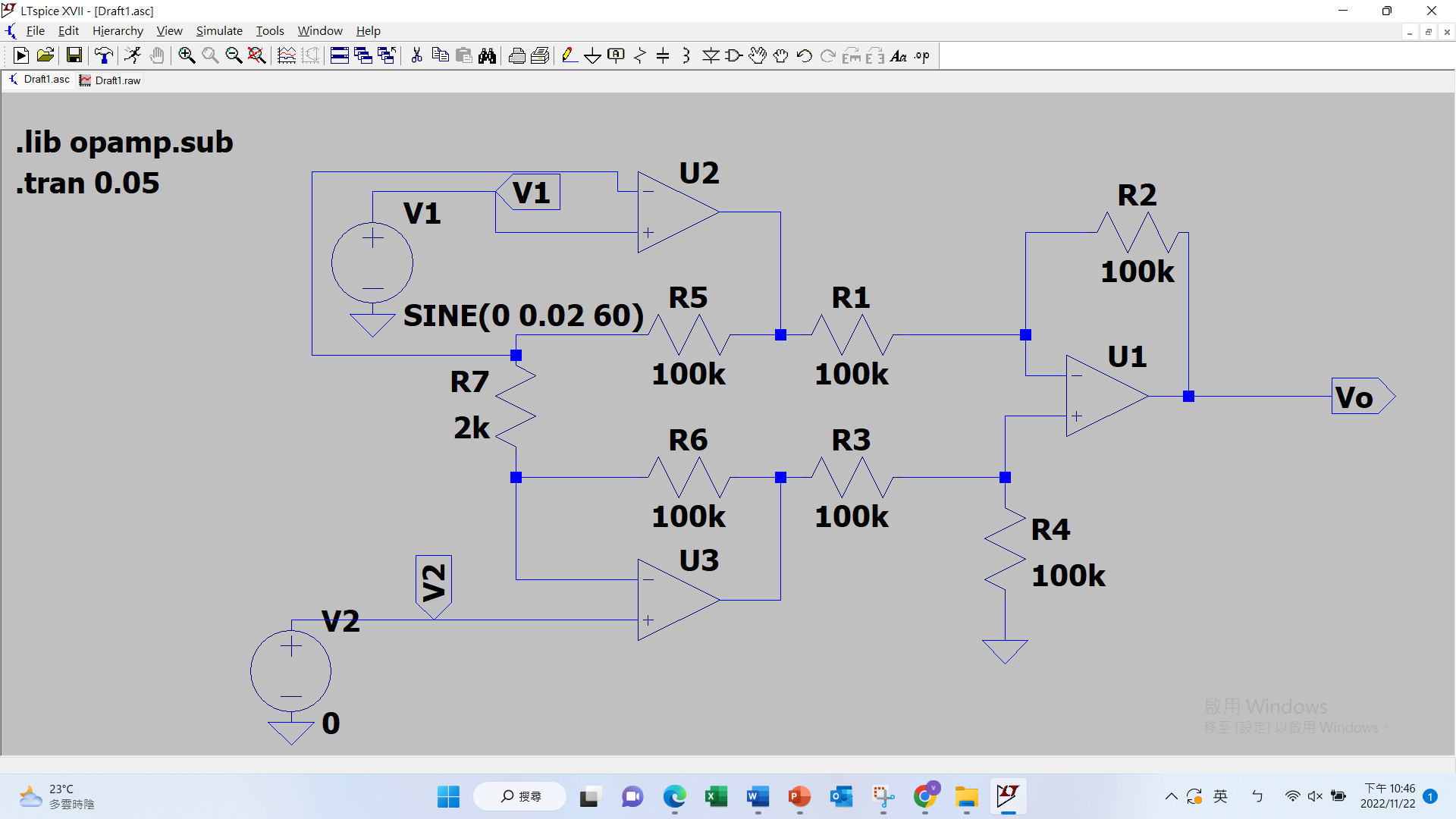
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | v1,pp  (V) | v2,pp  (V) | vd,pp=v2-v1  (V) | vout,pp  (V) | ADM  (V/V) | Phase (vout->v1)  (degree) |
| **Theoretical Result** | **0.02** | **0** | **-0.02** | **-2.02** | **101** | **180** |
| **Experiment Result** | **0.0296** | **0.00840** | **-0.0212** | **-2.16** | **101.89** | **175.1** |
| **Simulation Result** |  |  |  |  |  |  |
| **Error (%)** | **48** |  | **6** | **6.93** | **0.88** | **-2.72** |

P7\_vout , v2 and v1 experiment waveform (一張圖同時呈現三通道的波型，用Meas 顯示Phase)

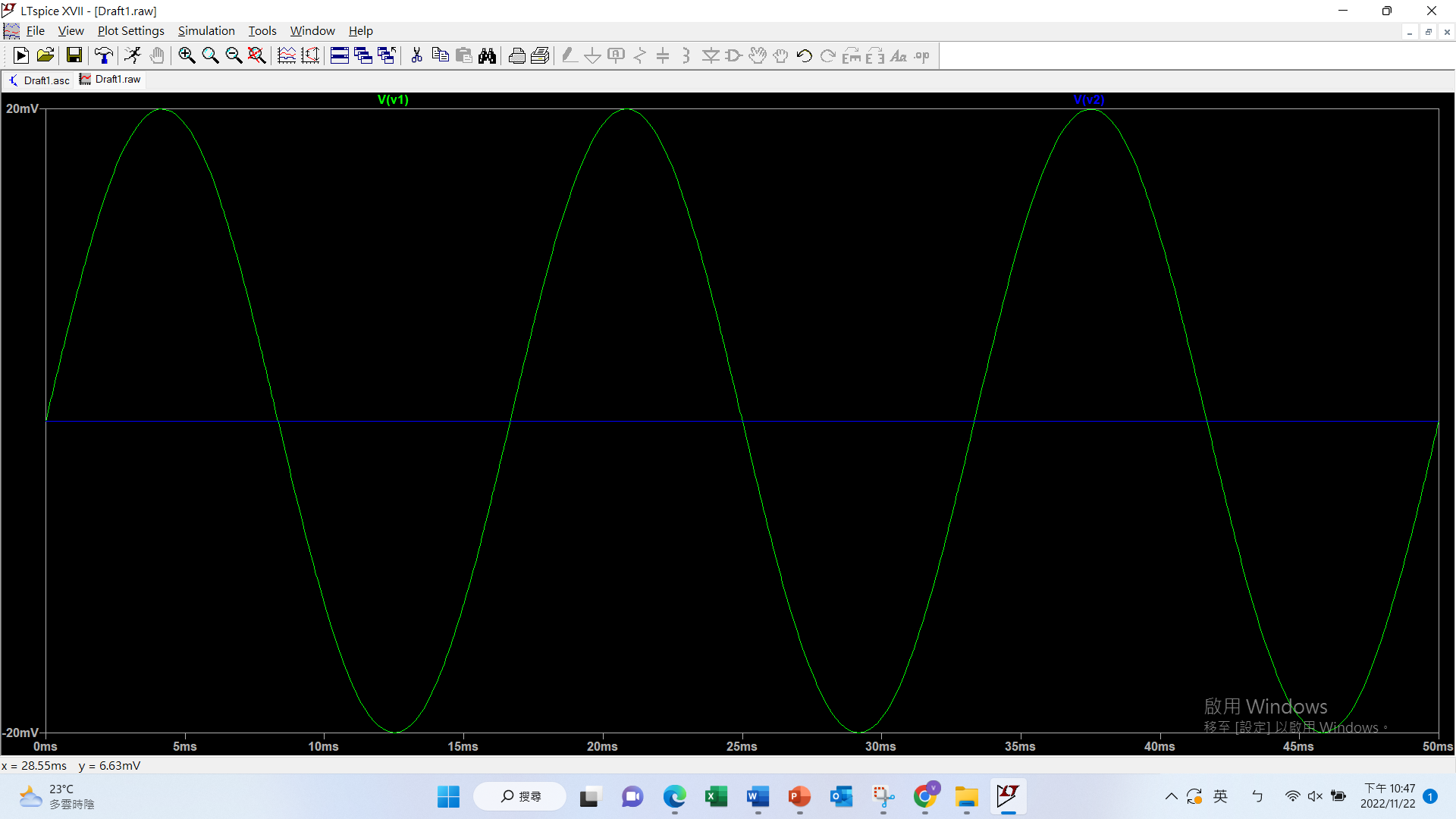


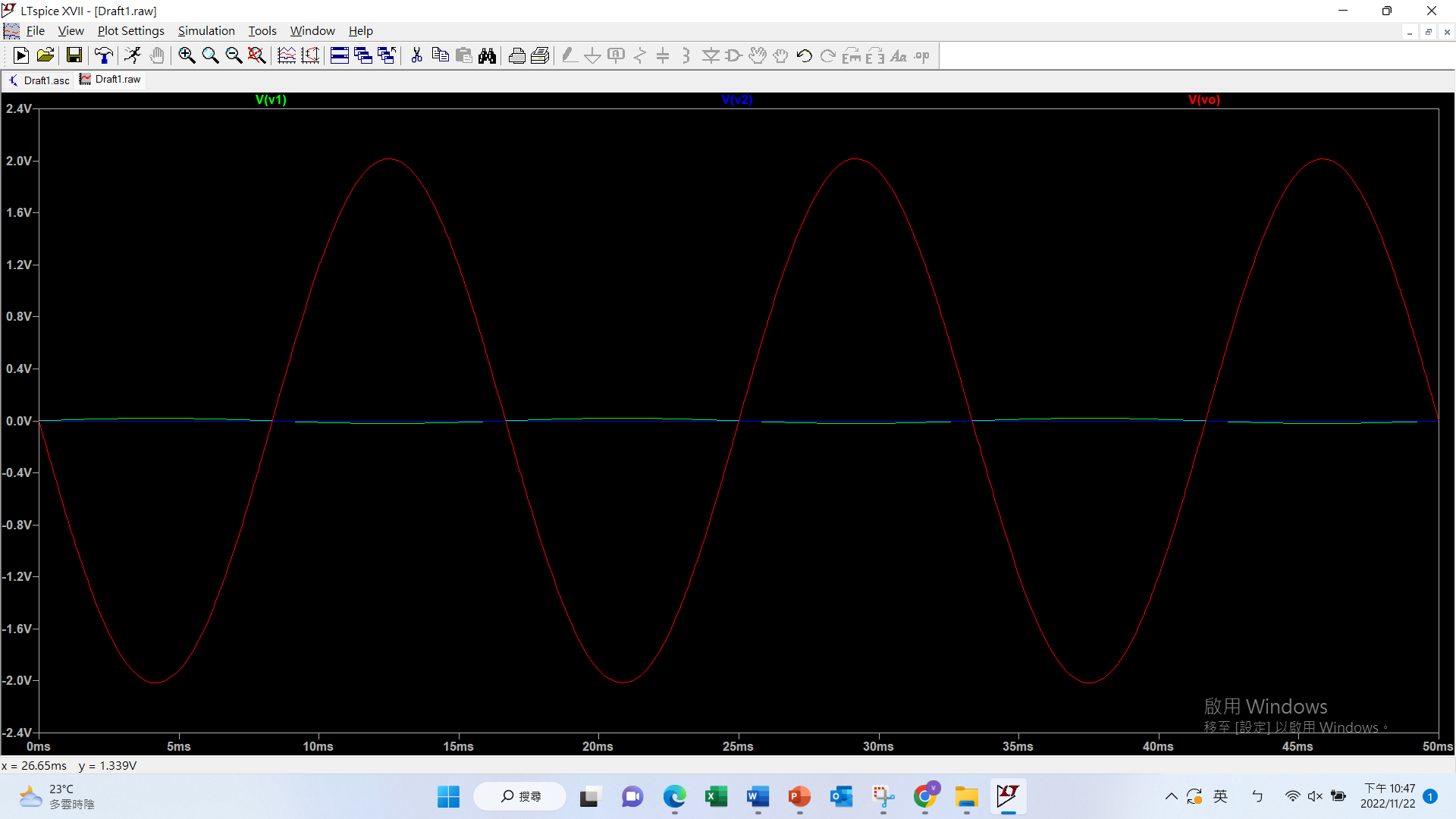
**Simulation:**

P8\_LTspice電路圖



P9\_vout , v2 and v1 simulation waveform

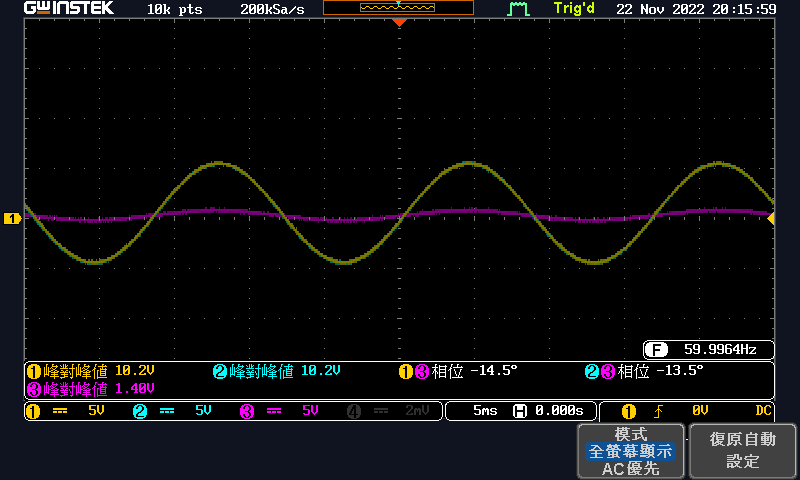




3. Common Mode

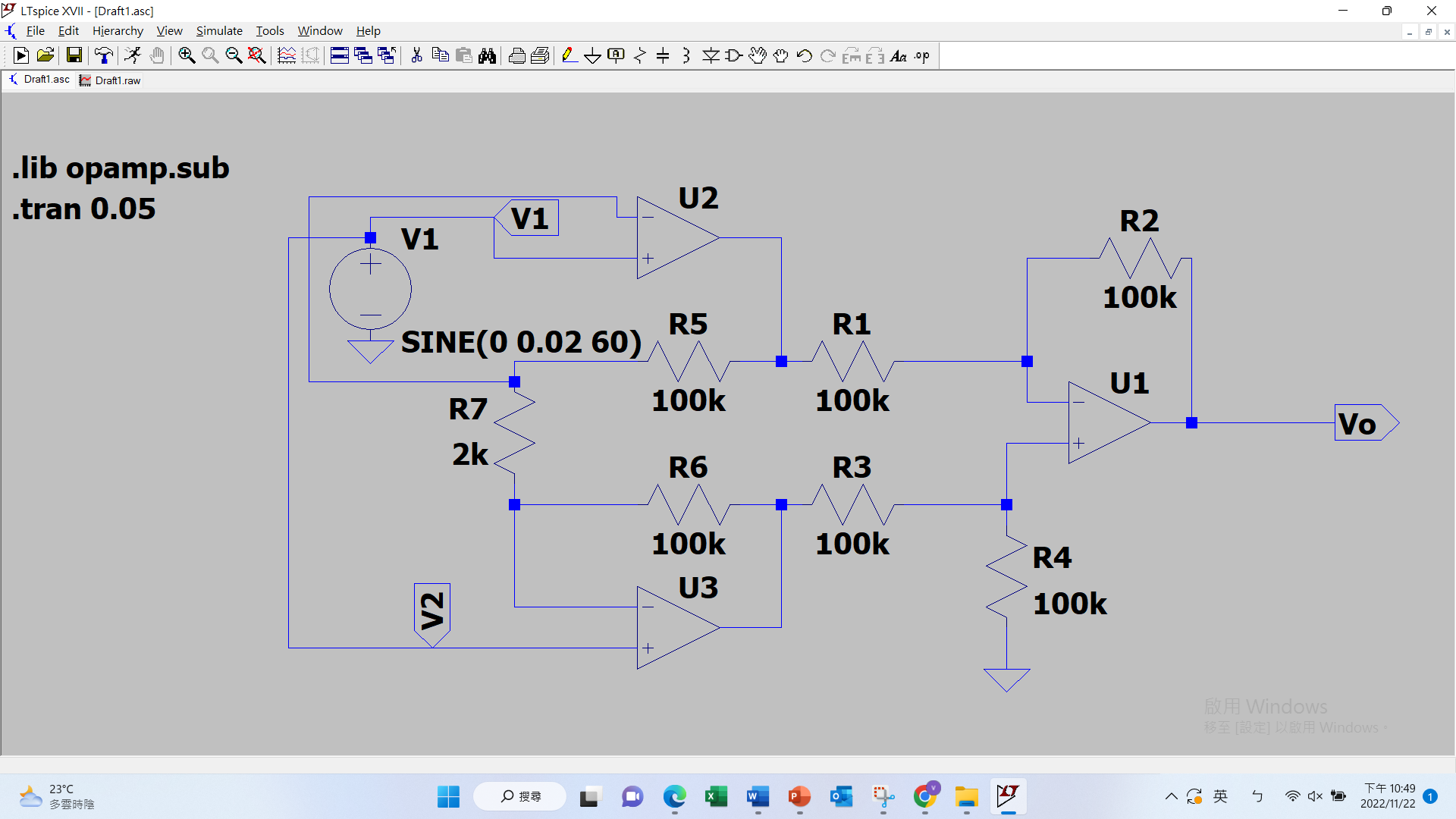
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | v1,pp (V) | vout,pp (V) | ACM (V/V) | Phase (vout->v1)  (degree) |
| **Theoretical Result** | **10** | **0** | **0** | **0** |
| **Experiment Result** | **10.2** | **1.4** | **0.14** | **14.5** |
| **Simulation Result** |  |  |  |  |
| **Error (%)** | **2** |  |  |  |

P10\_vout , v2 and v1 experiment waveform (一張圖同時呈現三通道的波型，用Meas 顯示Phase)

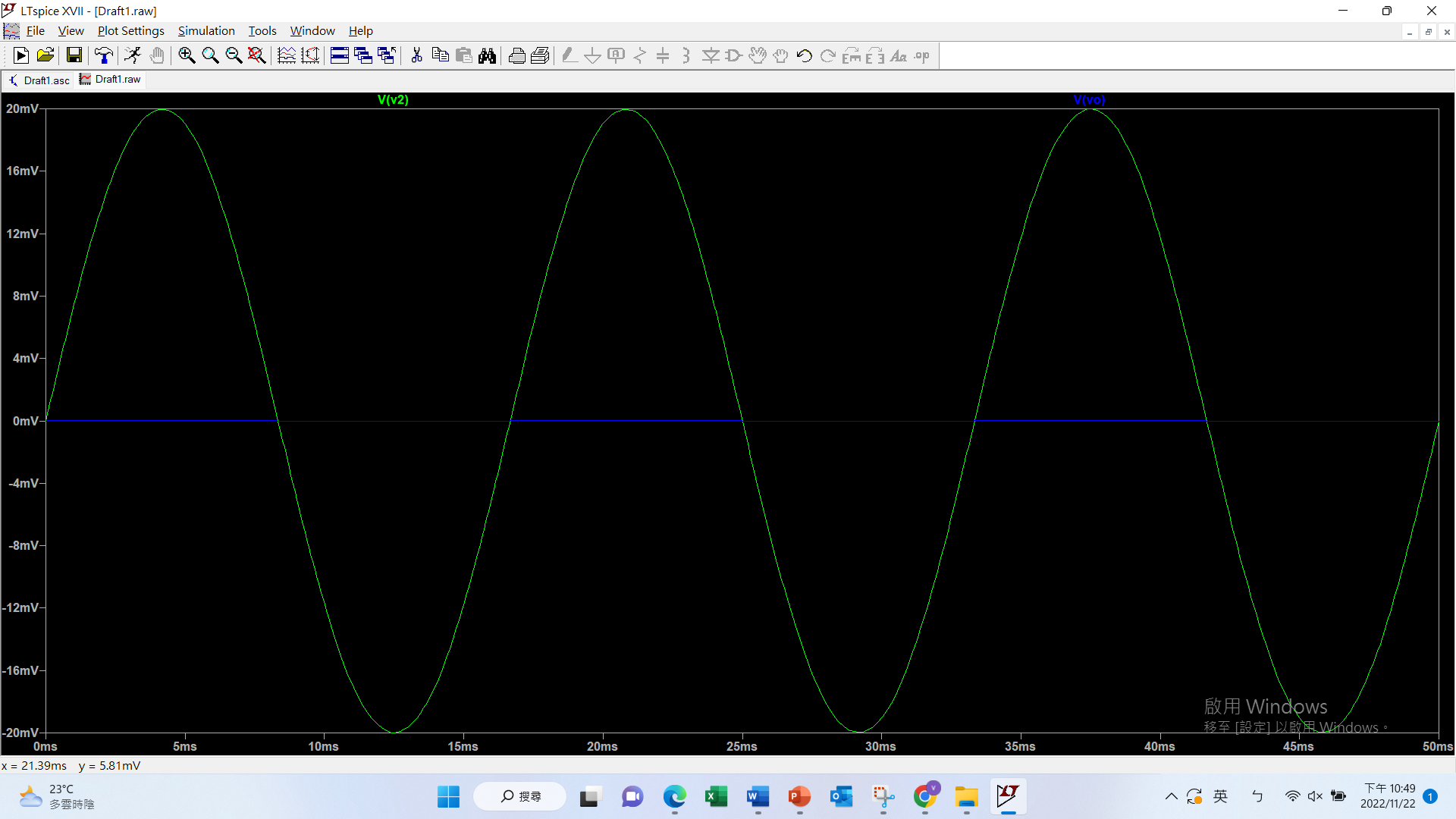


**Simulation:**

P11\_LTspice電路圖



P12\_vout , v2 and v1 simulation waveform



**4. CMRR**

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**5.Discuss:**

The theoretical result is similar to experiment 1, except the differential mode amplitude is 101.Also, the experiment result is approximately equal to the theoretical result, except of first figure. This is because the input wave has , and our wave generator cannot generate a precise waveform of this small.

Although we cannot generate the small precise waveform, we still obtain with an error of .

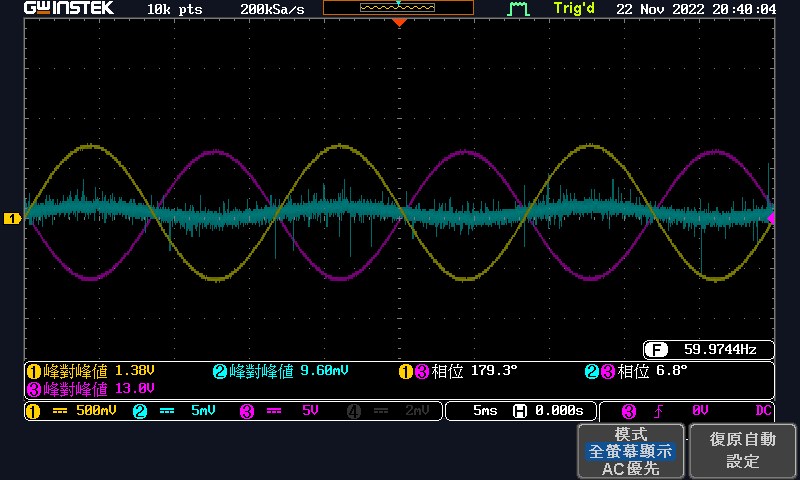
|  |
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| **Experiment 3: Difference Amplifier** |

**Write down your pinout. (示波器的通道)**

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| --- | --- |
|  |  |

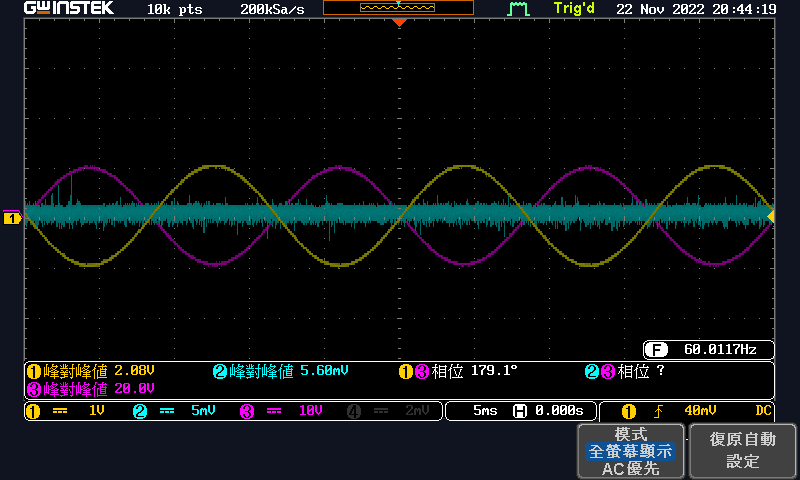
**2. Differential Mode (R1 = 100Ω, R2 = 1kΩ)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | v1,pp  (V) | v2,pp  (V) | vd,pp=v2-v1  (V) | vout,pp  (V) | ADM  (V/V) | Phase (vout->v1)  (degree) |
| **Experiment Result** | **1.38** | **0.0096** | **-1.3704** | **13** | **-9.49** | **-179.3** |



**3. Differential Mode (R1 = 10kΩ, R2 = 100kΩ)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | v1,pp  (V) | v2,pp  (V) | vd,pp=v2-v1  (V) | vout,pp  (V) | ADM  (V/V) | Phase (vout->v1)  (degree) |
| **Experiment Result** | **2.08** | **0.0056** | **-2.0744** | **20** | **-9.64** | **-179.1** |



**4. Compare the difference between the two difference amplifiers, and explain why.**

By observing, we can find out that the amplitudes of two experiment are similar, but the resistors we used in two experiments are different.

This is because the ratio for both experiment is 10. Although we have different resistors, as long as the ratio of resistors are the same, we will obtain identical results.