

# Inverting Operational Amplifier

## Student Group

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## Inverting Operational Amplifier

### Gain of Op-Amp

Build the following circuit in [figure 1](#) with the power supply and a multimeter.



Fig. 1: Inverting Op-Amp

$U_{DD} = 10\text{ V}$ ,  $U_{SS} = -10\text{ V}$ ,  $R_1 = 100\text{ k}\Omega$

Calculate the necessary value for  $R_2$ , so that the output  $U_{OUT}$  is  $+1.5\text{ V}$ .  
Use the supply voltage of the operational amplifier for  $U_{IN}$ .

$U_{IN} =$

$$R_2$$

**Analysis of inverting input currents**

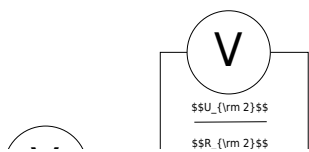


Fig. 2: Inverting Op-Amp: Analysis of currents of the inverting input

$U_{DD} = 10\text{V}$ ,  $U_{SS} = -10\text{V}$ ,  $R_1 = 100\text{k}\Omega$   
 Use the values from [figure 1](#) for  $U_{IN}$ ,  $U_{OUT}$ ,  $R_2$ .

Complete the reference arrows in the schematic of the circuit.  
 Determine the the currents  $I_1$  and  $I_2$  indirectly by measuring the voltage across known resistors  
 and calculate the algebraic sum of the currents at node  $N_{12}$  using Kirchhoff's Current Law (KCL).

$$U_1 =$$

$$U_2 =$$

$$I_1 =$$

$$I_2 =$$

$V_{N12}$

### Analysis of inverting input voltages

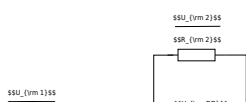


Fig. 3: Inverting Op-Amp: Analysis of virtual GND of the inverting input

$U_{DD} = 10V$ ,  $U_{SS} = -10V$ ,  $R_1 = 100k\Omega$   
 Use the values from [figure 1](#) for  $U_{IN}$ ,  $U_{OUT}$ ,  $R_2$ .

Complete the reference arrows in the schematic of the circuit.  
 Take the values for  $U_1$ ,  $U_2$ ,  $U_{OUT}$  from [figure 2](#).  
 Calculate the voltage  $U_{12}$  using Kirchhoff's Voltage Law (KVL) within one of the possible circuit loops. Mark the chosen loop in the circuit.  
 Verify your calculated result by measuring  $U_{12}$ .

$U_1 =$

$U_2 =$

$U_{OUT} =$

$U_{OUT} =$

Calculated  $U_{12} =$

Measured  $U_{12} =$

Analyse the physical significance of the potential at  $N_{12}$  relative to GND (defined as  $U_{12}$ )

in the context of the operational amplifier's input configuration. What do you observe?

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What happens if you short-circuit  $R_2$  (the feedback resistor)?  
Experimentally verify this effect and explain the observed behavior regarding the output voltage.

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