Experiment 6

Op-Amp Circuits I

Pre-Lab Report

Question 1:

Prove theoretically that for an ideal op-amp, the relation between the output voltage and the input voltage of the inverting amplifier shown in part A of this experiment is $V_o = -\frac{R_2}{R_1} V_I$.

For an ideal operational amplifier:
Vp=Vn=0 in this case [P is grounded]
I n = I p = 0 A
I1 + I2 = I n = 0 A
Then I1 = - I2 , but I1 = V1 / R1 , and I2 = (V0 - 0) / R2 = -I1 ,
V0 = - I1 * R2 = -V1 (R2/R1)

Question 2:

Prove theoretically that for an ideal op-amp, the relation between the output voltage and the input voltage of the non-inverting amplifier shown in part B of this experiment is $V_o = \left(1 + \frac{R_2}{R_1}\right) V_I$.

Vn = Vp = V1
I n = I p = 0 A
I1 + I2 = 0 A , then I1 = - I2
I1 = - Vn / R1 = -V1/R1 , I2 = (Vo - V1)/R2
Then Vo - V1 = I2*R2 = -I1 * R2 = V1 (R2/R1)
Therefore, Vo = V1 (1 + R2/R1)

Question 3:

Prove theoretically that for an ideal op-amp, the relation between the output voltage and the input voltage of the unity gain non-inverting amplifier shown in part C of this experiment is ***Vo = Vi.***

Vn = Vp = V1
I n = I p = 0 A
Vo=Vn=V1
the gain is then Vo/V1 = 1 [V0 = V1]