Experiment 7
Op-Amp Circuits II
Pre-Lab Report

Question 1:
Prove theoretically that the relation between V_o and the inputs of the inverting adder in part A of this experiment is given by:

$$v_O = -\left(\frac{R_4}{R_1}v_1 + \frac{R_4}{R_2}v_2 + \frac{R_4}{R_3}v_3\right)$$

Vn = 0 (Apply Node Voltage)
=> (Vn - V1) / R1 + (Vn – V2) / R2 + (Vn - V3) / R3 + (Vn - V0) / R4 + i = 0
But I = 0 & Vn = 0
=> -V1 / R1 - V2 / R2 - V3 / R3 - V0 / R4 = 0
=> V0 = - [(R4 / R1) V1 + (R4 / R2) V2 + (R4 / R3) V3]

Question 2:
Prove theoretically that the relation between V_o and V_I of the integrator in part B of this experiment is given by:

$$V_o = -\frac{1}{RC}\int V_I dt$$

Assumption: Ideal Op-amp.
Vn = Vp
=> Vn = Vp = 0
I(resistor) + I(capacitor) = 0
I(resistor) = V1 / R and I(capacitor) = C dV0 / dt and I(resistor)= - I(capacitor)
=> V1 / R = - C dV0 / dt
=> dV0 / dt = - V1 / RC
Integrate => V0 = -1 / RC ∫ V1 dt

Question 3:

Prove theoretically that the relation between V_o and V_I of the differentiator in part C of this experiment is given by:

$$V_o = -RC\frac{dV_I}{dt}_o$$

Assumption: Ideal Op-amp.
Vn=Vp
=> Vn = Vp = 0
I(resistor) + I(capacitor) =0
I(resistor) = V0 / R and I(capacitor) = C dV1 / dt
=> V0 / R = - C dV1 / dt
=> V0 = - RC dV1 / dt