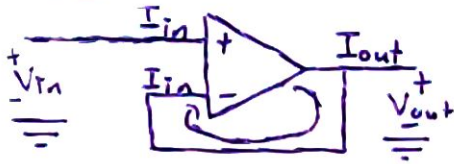


RECAP

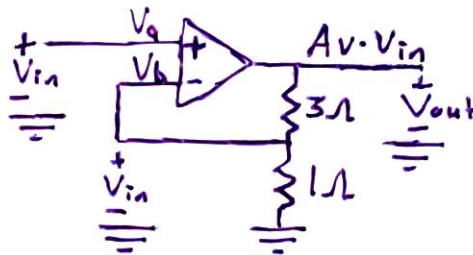


negative feedback
 infinite open loop gain
 no supply, no I_{in} .
 $V_{out} = V_{in} \rightarrow$ Buffer

$V^+ = V^-$

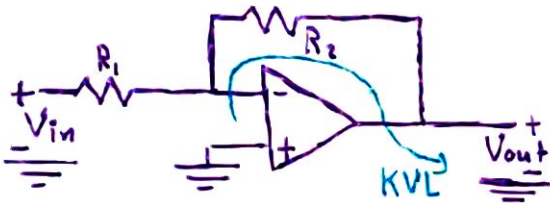
GAIN

$\frac{V_{out}}{V_{in}} = A_v$



$V_a = V_b = V_{in}$
 $V_{out} = A_v \cdot V_{in}$
 $V_{in} = V_{out} \cdot \frac{1}{1+3}$
 $A_v = 4 \leftarrow$

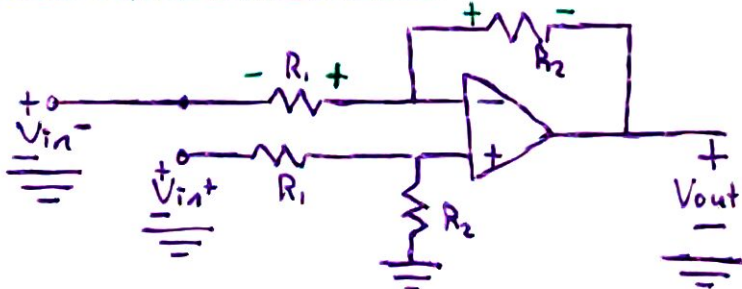
INVERTING GAIN



$I_1 = V_{in}/R_1$
 $I^- = 0 \quad V^- = 0$
 $V_{out} + V_{R2} = 0$

$V_2 = I_1 R_2$
 $V_{out} = -I_1 R_2$
 $V_{out} = -V_{in} \cdot R_2/R_1$
 $A_v = -R_2/R_1$

NVA FOR OP-AMPS



$V_{out} = (V_{in}^+ - V_{in}^-) \cdot R_2/R_1$

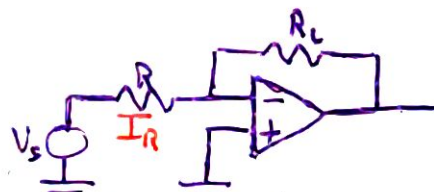
no equation for V_{out}
 $V^+ = V^-$

$I_{R1} = I_{R2}$
 $\hookrightarrow \frac{V^- - V_{in}^-}{R_1} + \frac{V^- - V_{out}}{R_2} = 0$
 $\frac{V^+ - V_{in}^+}{R_1} + \frac{V^+}{R_2} = 0$

CURRENT SOURCE



$I_R = V_s/R$



$I_{RL} = I_R$,
 value of R_L
 is irrelevant!

Replace R_L w/ Ctouch for touchscreen!