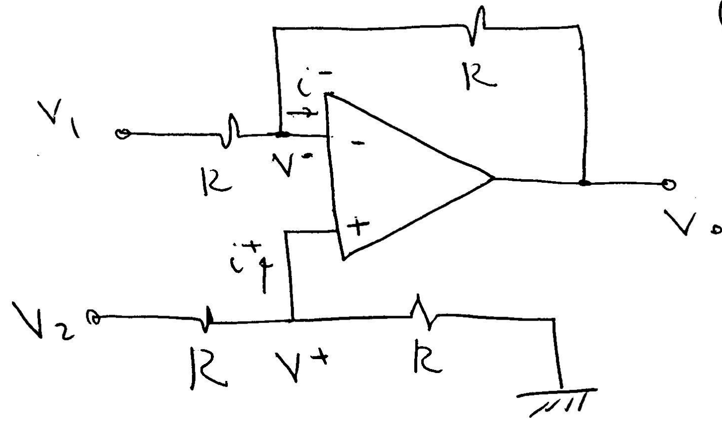


If $V_1 = V_2 = V_{in}$, what is the value of V_o?

$V^+ = \frac{V_2}{2}$ because $i^+ = 0$

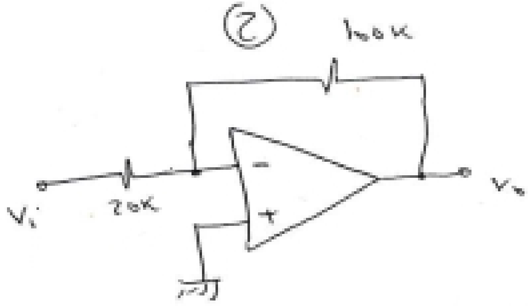
But as $V^- = V^+ \Rightarrow V^- = \frac{V_2}{2}$

Because $i^- = 0$ we have $V^- = \frac{V_o}{2} + \frac{V_1}{2}$

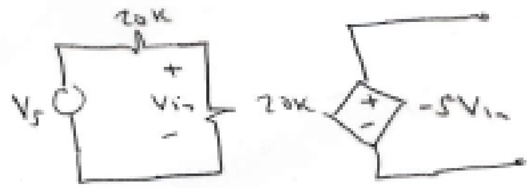
$\therefore \frac{V_o}{2} + \frac{V_1}{2} = \frac{V_2}{2} \Rightarrow V_o = V_2 - V_1 = 0V$

What is the input resistance looking int. V_2? looking into V_1? what is the output resistance?

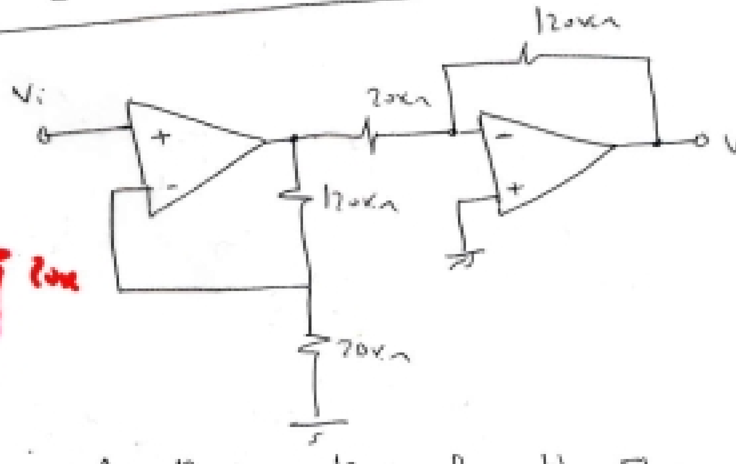
②

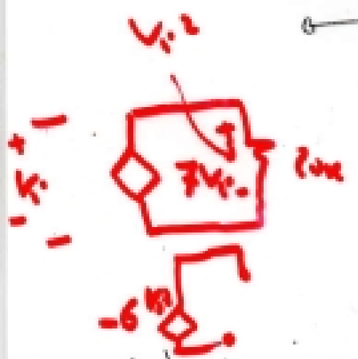


What is the value of the output voltage if the input is connected to a source with $V_s(t) = 0.1 \sin \omega t$ & $R_s = 20k\Omega$?



$$V_{in} = \frac{V_s}{2} \Rightarrow V_o = -5V_{in} = -0.25 \sin \omega t$$





What is A_v, R_{in} & R_{out} for the shown amplifier?

(3)

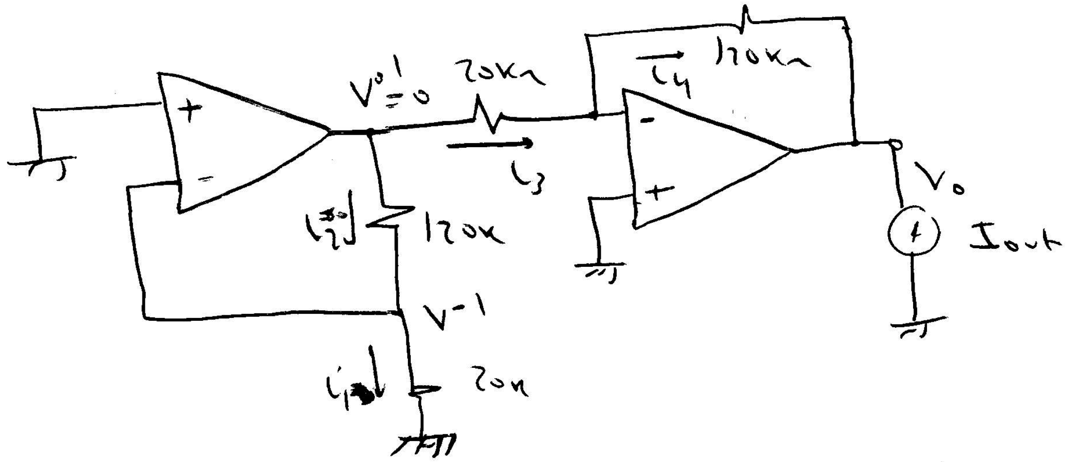
$A_V = A_{V1} * A_{V2}$

$= \left(1 + \frac{120k}{20k}\right) * \left(-\frac{120k}{20k}\right)$

$A_V = 7 * -6 = -42$

$R_{in} = \infty$, ~~Rout~~

To get R_{out} we form the circuit

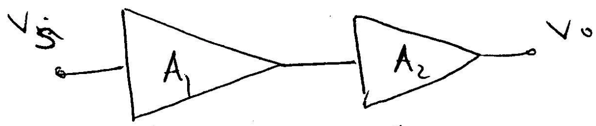


$V^{+1} = 0 = V^{-1} \Rightarrow i_1 = 0 = i_2 \Rightarrow V_o^1 = 0$

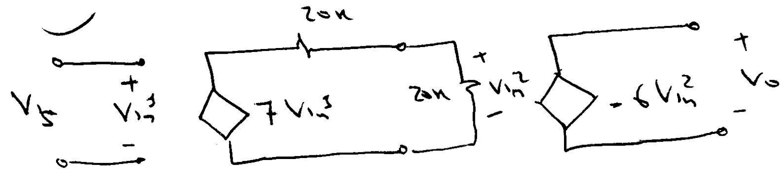
$V^{-2} = 0 \Rightarrow i_3 = 0 = i_4 \Rightarrow V_o = 0$

$\therefore \frac{V_o}{I_{out}} = 0 \quad R_{out} = 0$

Repeat the previous example for the shown circuit



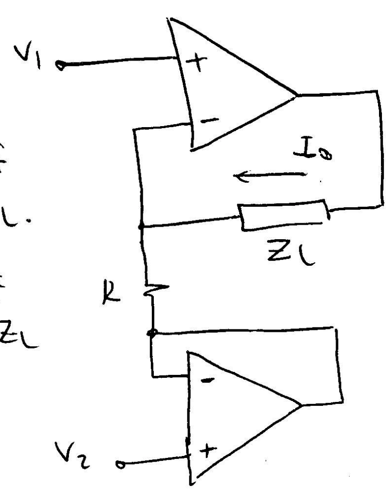
$A_{V1} = 7$	$A_{V2} = -6$
$R_{in} = \infty$	$R_{in} = 20k$
$R_{out} = 20k$	$R_{out} = 0$

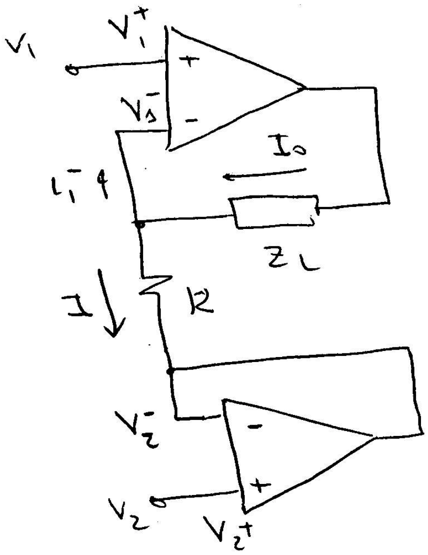


$$V_{in}^2 = 7V_{in}^1 * \frac{20k}{20k+20k} = \frac{7}{2}V_{in}^1 = \frac{7}{2}V_s$$

$$V_o = -6\,V_{in}^2 = -\frac{42}{2}V_s = -21$$

Find I_o as a function of V_1, V_2, R and Z_L. What is R_{out} looking into Z_L

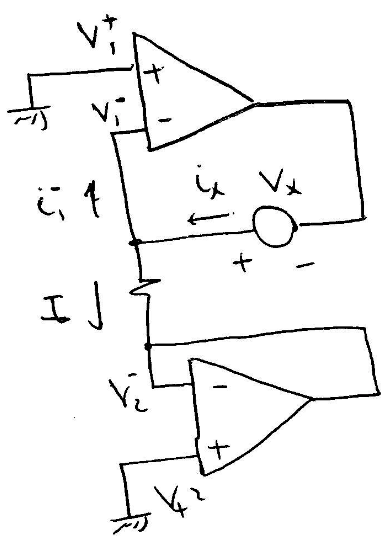




$$V_1^+ = V_1 = V_1^- \quad \text{and} \quad V_2^+ = V_2 = V_2^-$$

$$I = \frac{V_1^- - V_2^-}{R} = \frac{V_1 - V_2}{R} = I_o \quad \text{because } i_1^- = 0$$

$$\therefore \; I_o = \frac{V_1 - V_2}{R} \quad (\text{independent of } Z_L)$$



$V_1^+ = 0 = V_1^-$

$V_2^+ = 0 = V_2^-$

$I = \frac{0 - 0}{R} = 0$

but $i_x = I$ (because $i_1^- = 0$)

$\therefore \; i_x = 0$

$\therefore \; R_{out} = \frac{V_x}{i_x} = \infty$