- Part 3

$i_a = i_b = i_{s_2}$ $\quad i_a = \dfrac{V_{s2} - V_{N2}}{R_A}$

$V_{N2} = V_{p2}$ $\quad i_b = \dfrac{V_{N2} - V_{out2}}{R_B}$

$$\frac{V_{s2}}{R_A} - \frac{V_{N2}}{R_A} = \frac{V_{s2} - V_{N2}}{R_A} = \frac{V_{N2} - V_{out2}}{R_B} = \frac{V_{N2}}{R_B} - \frac{V_{out2}}{R_B}$$

$$\frac{V_{s2}}{R_A} - \frac{V_{N2}}{R_A} - \frac{V_{N2}}{R_B} = -\frac{V_{out2}}{R_B}$$

note: ($V_{p2} = 0$ so $V_{N2} = 0$)

$$\frac{V_{s2}}{R_A} = -\frac{V_{out2}}{R_B} \Rightarrow \boxed{\frac{-R_B}{R_A} = \frac{V_{out2}}{V_{s2}} = A_{v2}}$$

using previous values of R_A & R_B

we set : $\dfrac{-20k\Omega}{10k\Omega} = A_{v2} = -2 \frac{V}{V}$

- Part 4

using the gain calculated $\dfrac{V_{out2}}{V_{s2}} = -2 \frac{V}{V}$, $-\dfrac{V_{out2}}{2} = V_{s2}$

$$R_{in_2} = \frac{V_{s2}}{i_{s2}} = \frac{-V_{out2}}{2\, i_{s2}} = \frac{-V_{out2}}{2\left(\frac{-V_{out2}}{R_B}\right)} = \frac{R_B}{2}$$