Formulas:

$$A_V = \frac{g_{m1}\, g_{m6}}{g_{o1}\, g_{o6}} = 223{,}87$$

- $C_H = 1{,}25\,pF$
- $GBW_2 = \frac{g_{mp②}}{2\pi C_H} = \frac{g_{m1}}{2\pi C_H} = 17000$ → get g_{m1}
- $P_① = \frac{g_{m6}}{C_L} \approx 3\,GBW$ → get g_{m6}
- $C_H = \frac{C_L}{4} = 1{,}25\,pF$

$g_{o4} \ll g_{o1}$ and $g_{o5} \ll g_{o6}$

$R_1 = R_2$ and $R_3 = R_4$

- $C_L = 5\,pF$

$$\Rightarrow g_{m6} = 3 \cdot 17000 \cdot 2\pi \cdot 5 \cdot 10^{-12}$$
$$= 1{,}6022 \cdot 10^{-6}$$
$$\Rightarrow g_{m1} = 17000 \cdot 2\pi \cdot 1{,}25 \cdot 10^{-12}$$
$$= 1{,}3352 \cdot 10^{-7}$$
$$\Rightarrow g_{o1} \cdot g_{o6} = \frac{g_{m1} \cdot g_{m6}}{223{,}87} = \frac{1{,}6022 \cdot 10^{-6} \cdot 1{,}3352 \cdot 10^{-7}}{223{,}87}$$
$$= 9{,}5557 \cdot 10^{-16}$$

Voltage drops V_{DS} over transistors:

$M_1 = -0{,}336\,V = M_2 \rightarrow p$

$M_3 = 0{,}336\,V = M_4 \rightarrow n$

$M_7 = -0{,}336\,V \rightarrow p$

$M_8 = -0{,}550\,V = M_5 \rightarrow p$

$M_6 = 0{,}550\,V \rightarrow n$

Get g_{o1} and g_{o6} → want most gain first stage:

→ assume $V_{OV} = 0\,V$ for all

→ gain of 223,87

⇒ first stage gain of 46,546 → choose $L = 1000n$

⇒ $\frac{g_{m1}}{g_{o1}} = 46{,}546 \Rightarrow g_{o1} = \frac{g_{m1}}{46{,}546} = 2{,}8685 \cdot 10^{-9}$

⇒ gain second stage $\approx \frac{223{,}87}{46{,}546} = 4{,}8087$

⇒ $\frac{g_{m6}}{g_{o6}} = 4{,}8087 = 4{,}88426$ ⇒ lowest value pickable

↳ adds buffer ↓ $L = 60n$

⇒ $g_{o6} = \frac{g_{m6}}{4{,}88426} = 2{,}0042 \cdot 10^{-7}$

$I_{D1} = \frac{g_{m1}}{22{,}2450} = 6{,}0021 \cdot 10^{-9}$

$I_{D6} = \frac{g_{m6}}{11{,}3299} = 1{,}4141 \cdot 10^{-7}$

All current from M_1 flows into M_4 at DC

All current from M_2 flows into M_3

current through $M_7 = I_{DS1} + I_{D2} = 2 \cdot I_{DS1}$

All current through M_6 goes through M_5 at DC

current through M7 comes from current mirror M8

⇒ choose $I_{D8} = I_{D6} = 1{,}4141 \cdot 10^{-7}$

⇒ then $I_{BIAS} = 1{,}4141 \cdot 10^{-7}$

⇒ good current sources are long transistors

→ choose $L = 500nm$ for M8 and M5

⇒ then is L of M7 equal to $\frac{L8}{\frac{Ids7}{Ids8}} = 5{,}8802 \cdot 10^{-6}$

⇒ NOTE Width of M7 is equal to width of M8 and is equal to 100 · L8

Next: sizing M3 and M4

⇒ again current mirror

→ $L = 500\ nm$

⇒ $\frac{gm4}{Ids4} = 27{,}5157$

⇒ $\frac{gm4}{go4} = 27{,}6 \Rightarrow go4 = \frac{gm4}{27{,}6}$

⇒ After iteration ⇒ gain and bandwith not big enough

⇒ to do:

→ calculate Vcm, Vout and Pdiss ⇒ get from Vin and Iin.

→ calculate gds of M5,8 and M7 (for, gds plot)

→ calculate Vds,sat

→ new iteration with higher gain and GBW

→ figure out how to use RH in calculations