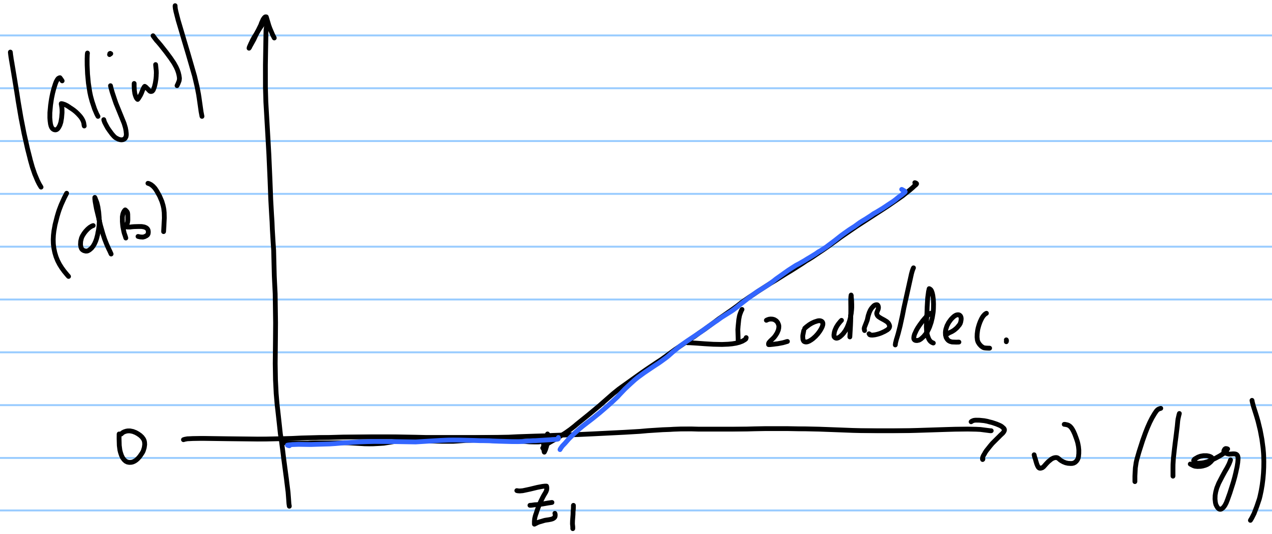
RHP zero

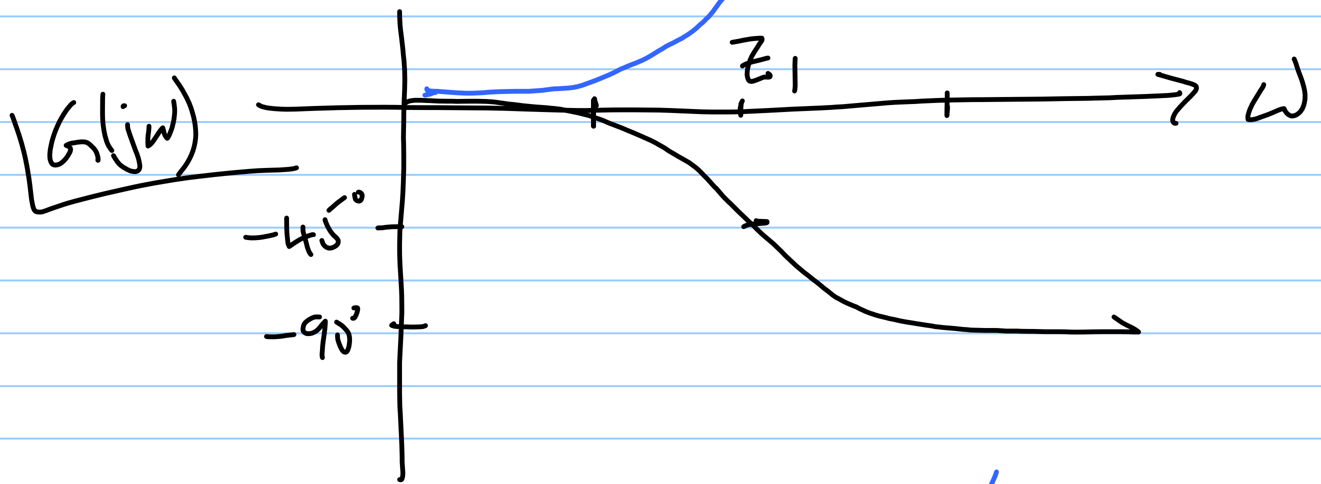
$$G(s) = \left(1 - \frac{s}{z_1}\right)$$

$$|G(j\omega)| = \sqrt{1 + \frac{\omega^2}{z_1^2}}$$



|G(jω)| plot same as for RHP zero

$$\angle G(j\omega) = -\tan^{-1}\left(\frac{\omega}{z_1}\right)$$



LHP Zero: $$G(s) = \left(1 + \frac{s}{z_1}\right)$$

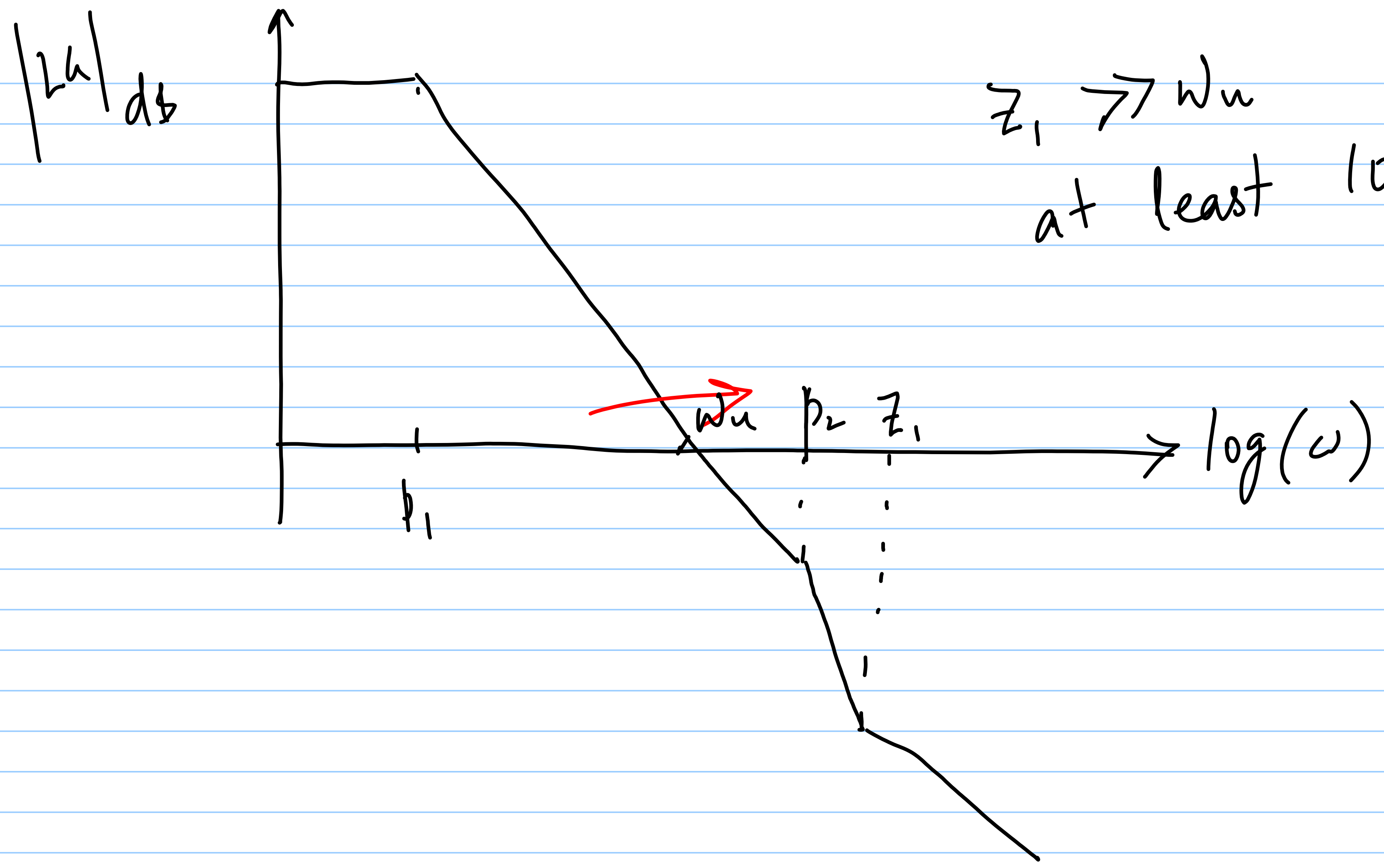
$$\angle G(j\omega) = \tan^{-1}\left(\frac{\omega}{z_1}\right)$$

$$p_1 \approx \frac{G_{o1}}{C_c \cdot \left(\frac{G_{m2}}{G_{o2}}\right)}$$

$$A_o = \frac{G_{m1} \, G_{m2}}{G_{o1} \, G_{o2}}$$

$$\omega_u = A_o \cdot p_1 = \frac{G_{m1}}{C_c}$$

$$z_1 = \frac{G_{m2}}{C_c}$$



$z_1 >> \omega_u$

at least 10X

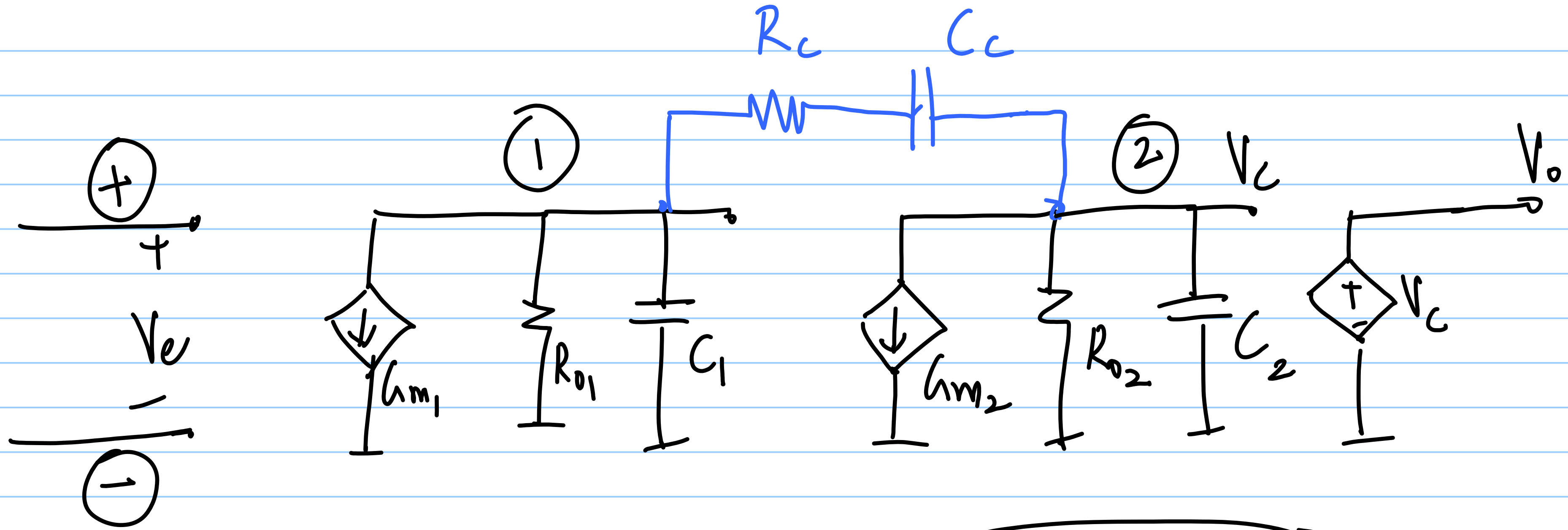
$$z_1 \gg \omega_u$$

$$\frac{G_{m_2}}{C_c} \gg \frac{G_{m_1}}{C_c}$$

$$\boxed{G_{m_2} \gg G_{m_1}}$$

$$PM \simeq 180^\circ - 90^\circ - \tan^{-1}\left(\frac{\omega_u}{p_2}\right)$$

$$= 90^\circ - \tan^{-1}\left(\frac{\omega_u}{p_2}\right)$$



3 poles

1 zero

Analysis − HW

$$p_1 \approx \frac{G_{o1}}{C_c\left(\frac{G_{m2}}{G_{o2}}\right)} \quad ; \quad p_2 \approx \frac{G_{m_2} \frac{C}{C+C_1}}{C_2 + \frac{C_c C_1}{C_c + C_1}}$$

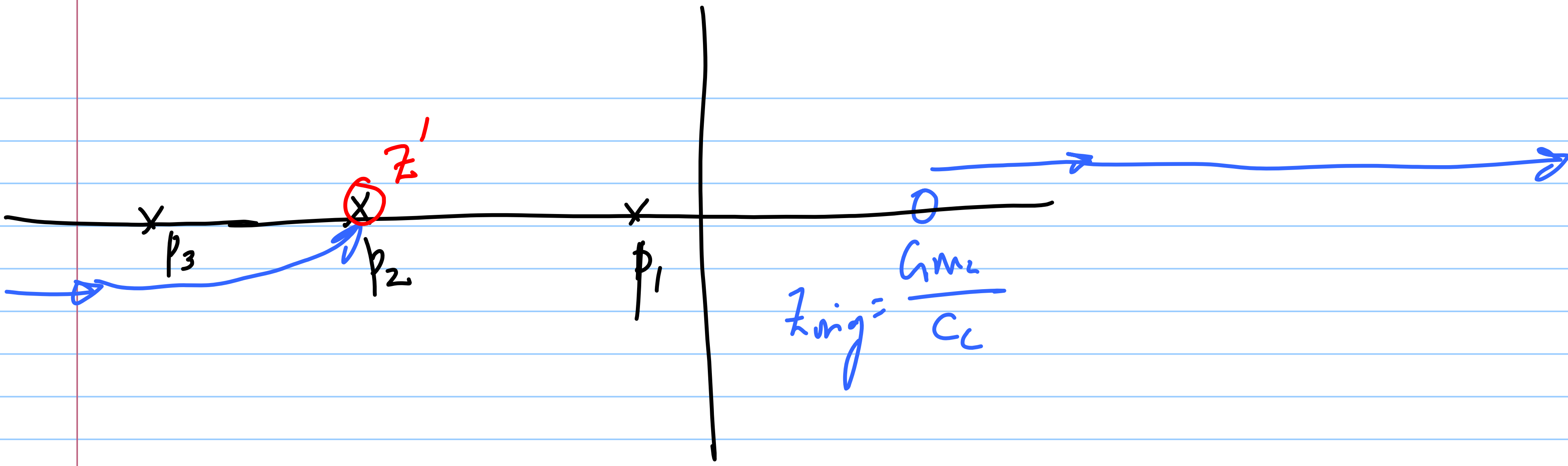
$$Z = \frac{-G_{m2}}{C_c\left[G_{m2}R_c - 1\right]} = \frac{G_{m2}}{C_c\left[1 - G_{m2}R_c\right]}$$

$$p_3 = HW$$

$$R_c = 0 \Rightarrow Z = \frac{G_{m2}}{C_c}$$

$0 < G_{m2}R_c < 1 \Rightarrow$ RHP zero moves to higher freq.

$G_{m2}R_c = 1 \Rightarrow$ zero moves to $+\infty$



$G_{m2} R_c > 1$

choose R_c so that $z = p_2$ in LHP

$\Rightarrow$ pole - zero cancellation

ensure that P_3 limits PM $\{ \omega_u$ can be larger $\}$