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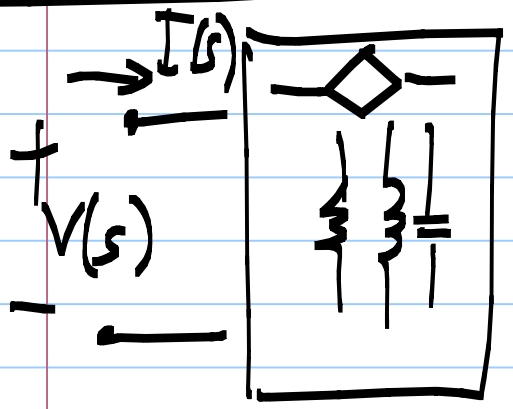
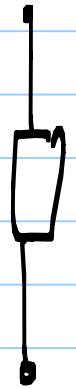
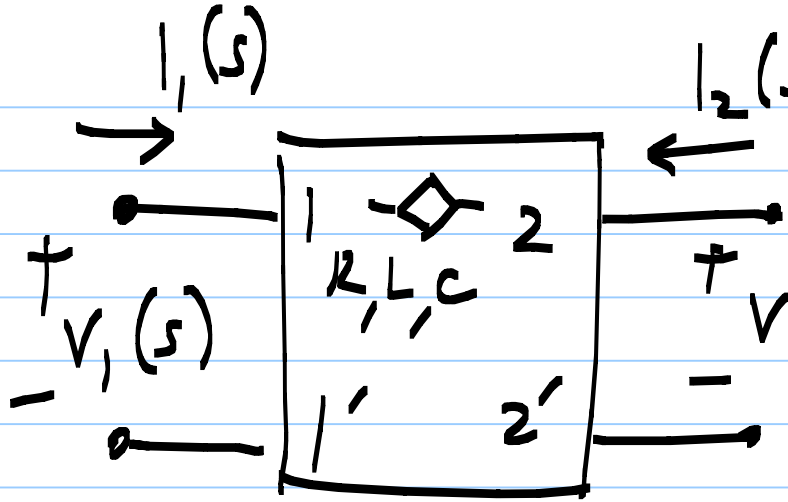


$$\frac{V}{I} = Z(s)$$



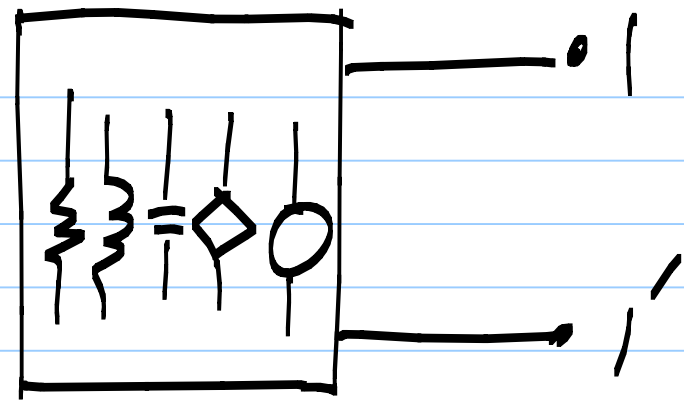


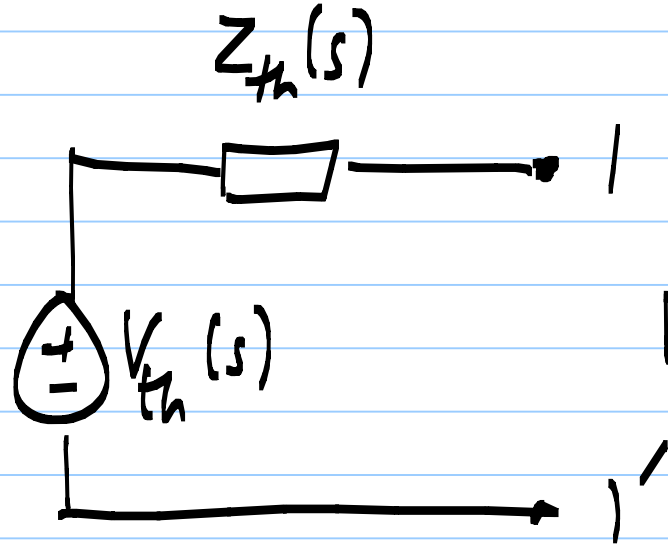
y-, z-, h-, g- parameters

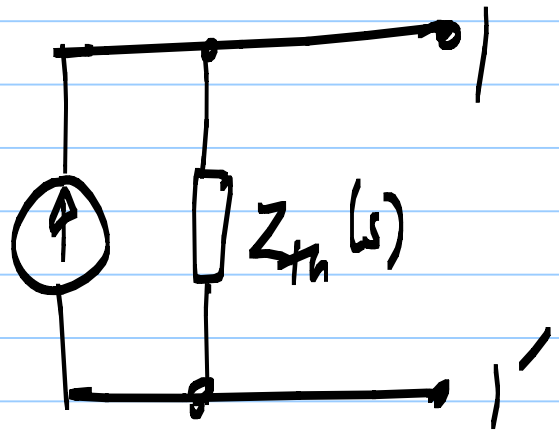
$$\begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix} = \begin{bmatrix} y_{11}(s) & y_{12}(s) \\ y_{21}(s) & y_{22}(s) \end{bmatrix} \begin{bmatrix} V_1(s) \\ V_2(s) \end{bmatrix}$$

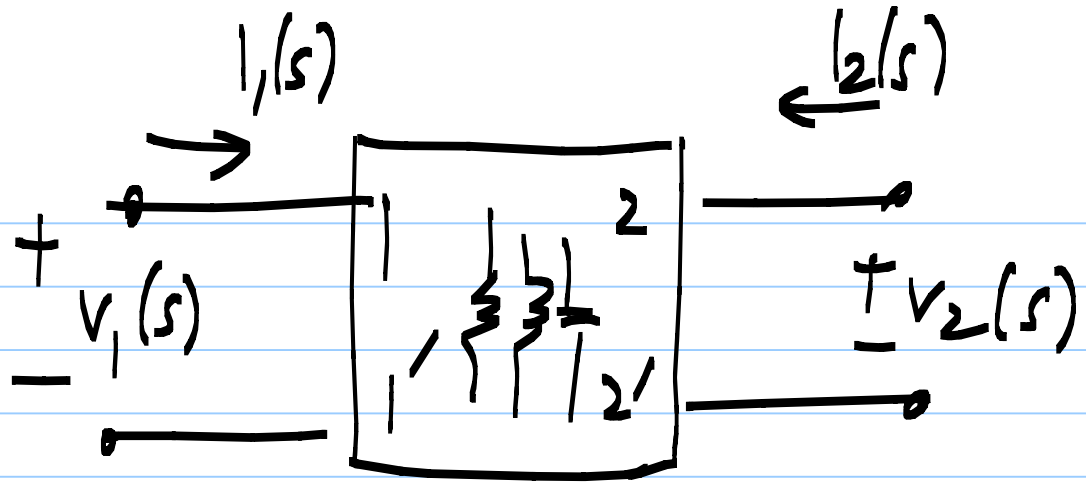
Substitution Theorem

Reciprocity.







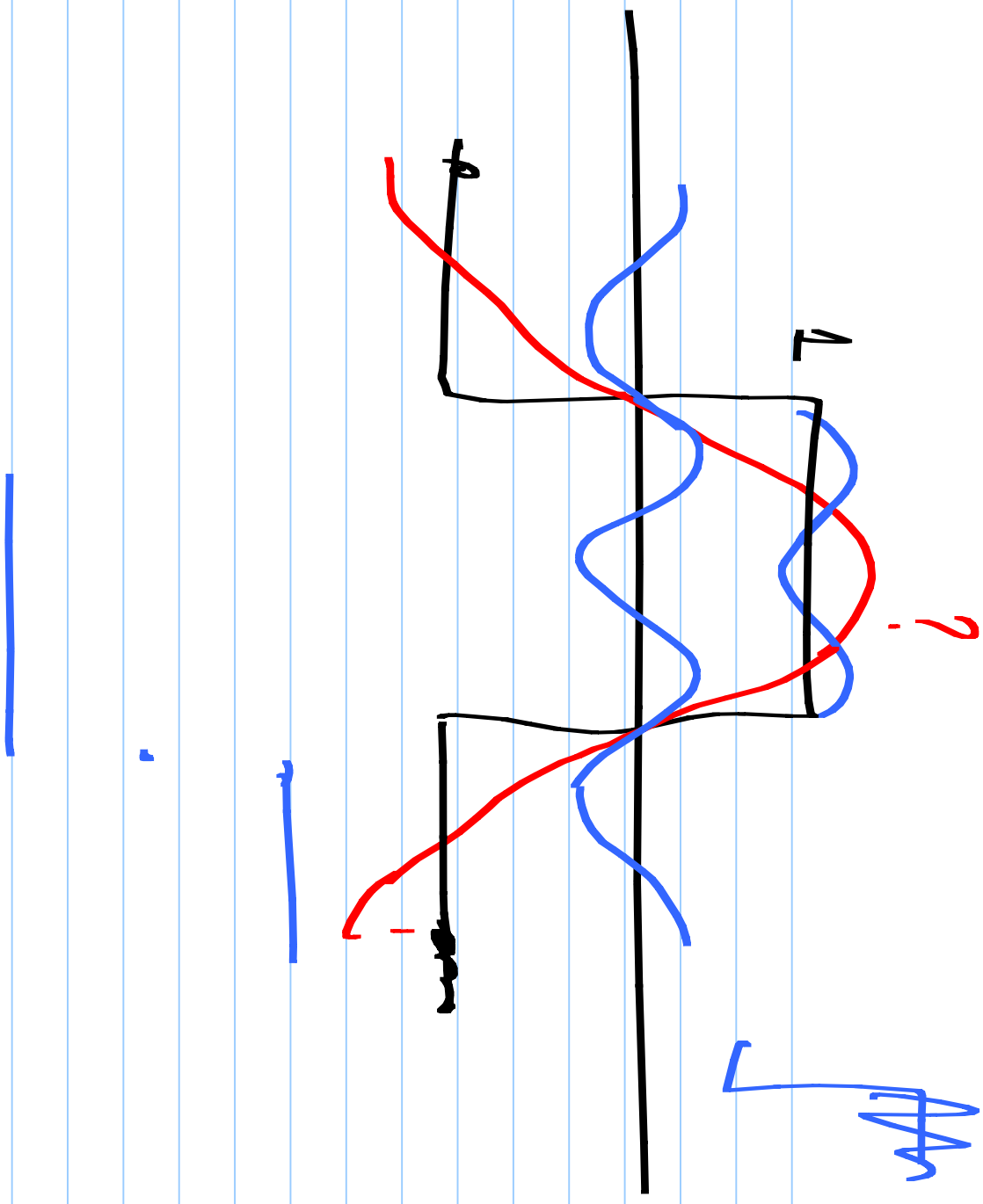


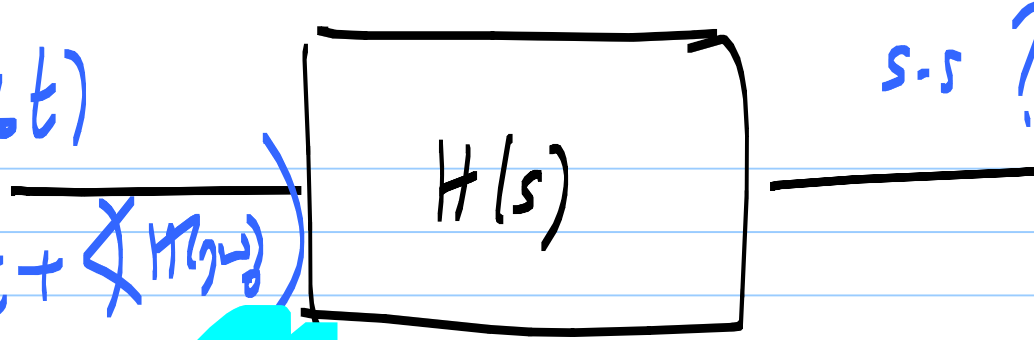
Reciprocity:

$$y_{12}(s) = y_{21}(s)$$

$$z_{12}(s) = z_{21}(s)$$

$$g_{12}(s) = -g_{21}(s) \; ; \; h_{12}(s) = -h_{21}(s)$$



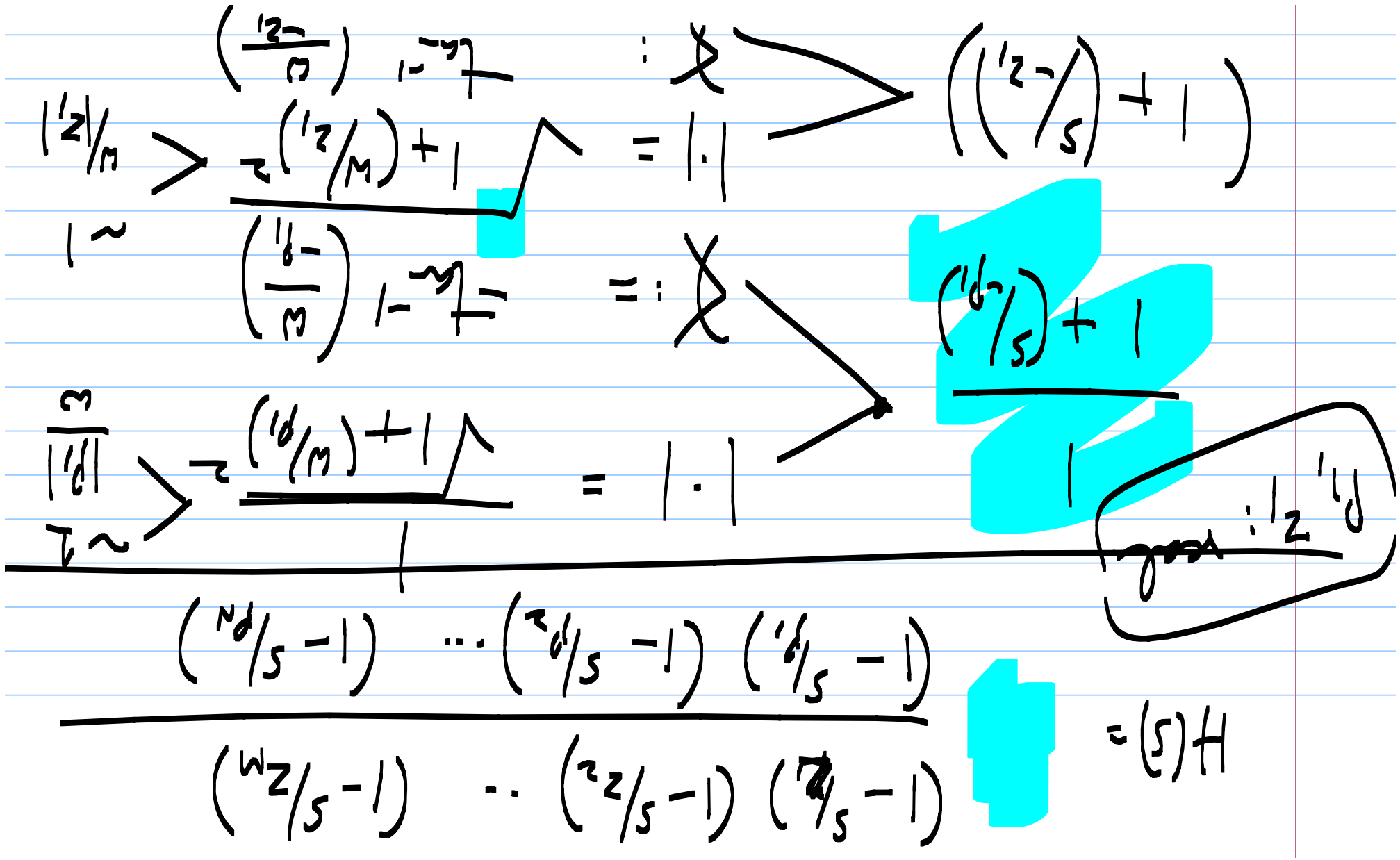
$\cos(\omega_0 t)$ →  → s.s ?

$|H(j\omega_0)| \cos(\omega_0 t + \angle H(j\omega_0))$

$$H(s) = \frac{[illegible] + b_{M-1} s^{M-1} + \dots \quad b_1 s + [illegible]}{[illegible] + a_{N-1} s^{N-1} + \dots \quad + a_1 s + [illegible]}$$

$$= k \cdot \frac{([illegible])([illegible]) \quad (s - z_M)}{([illegible])([illegible]) \cdots (s - p_N)}$$

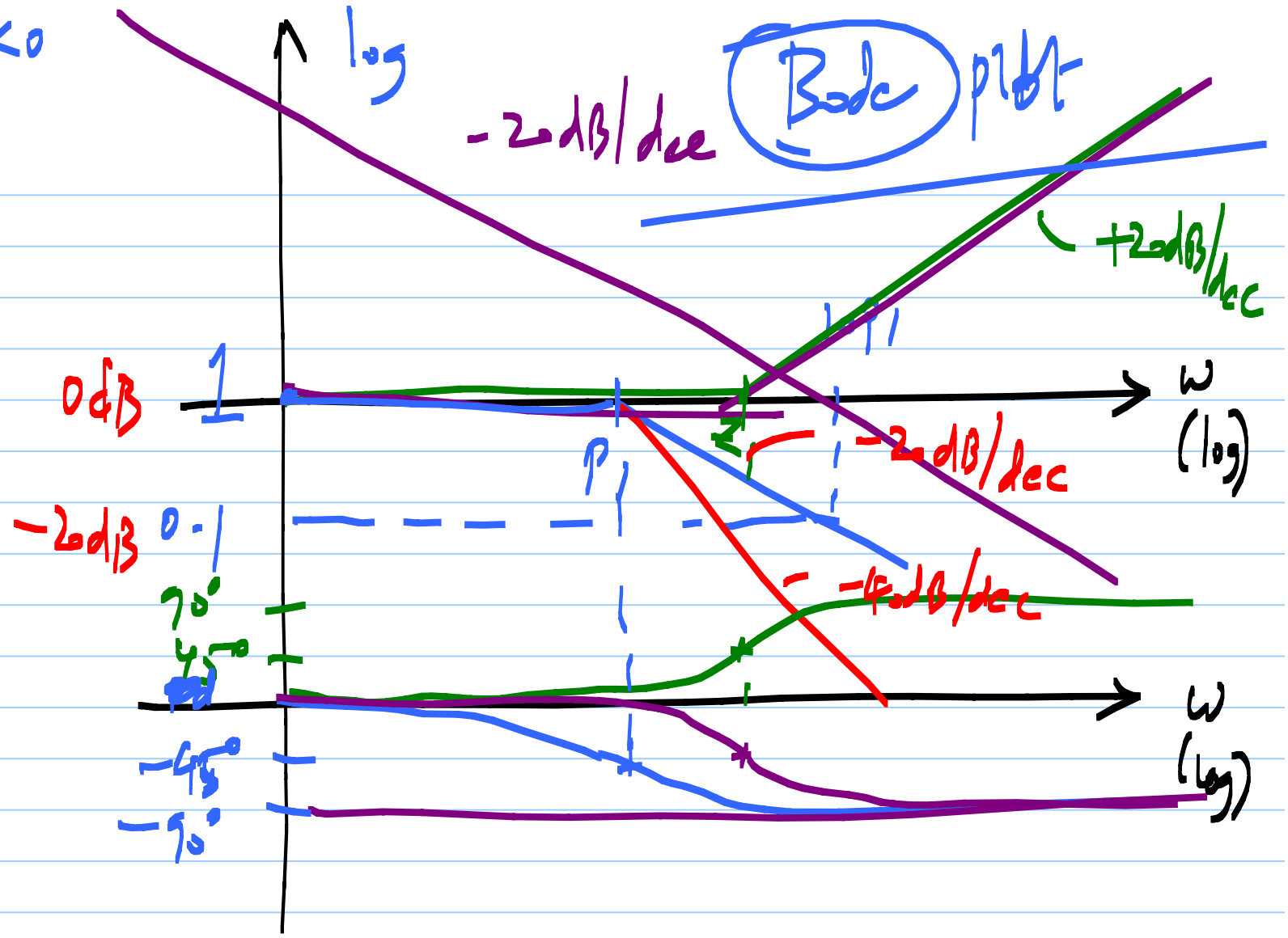
$$= \frac{r_1}{s - p_1} + \frac{r_2}{s - p_2} + \dots \quad + \frac{r_N}{s - p_N}$$



$p_1 < 0$

$$\frac{1}{\left(1 + \frac{s}{-p_1}\right)^2}$$

$$\frac{1}{\sqrt{1 + \left(\frac{\omega}{p_1}\right)^2}}$$



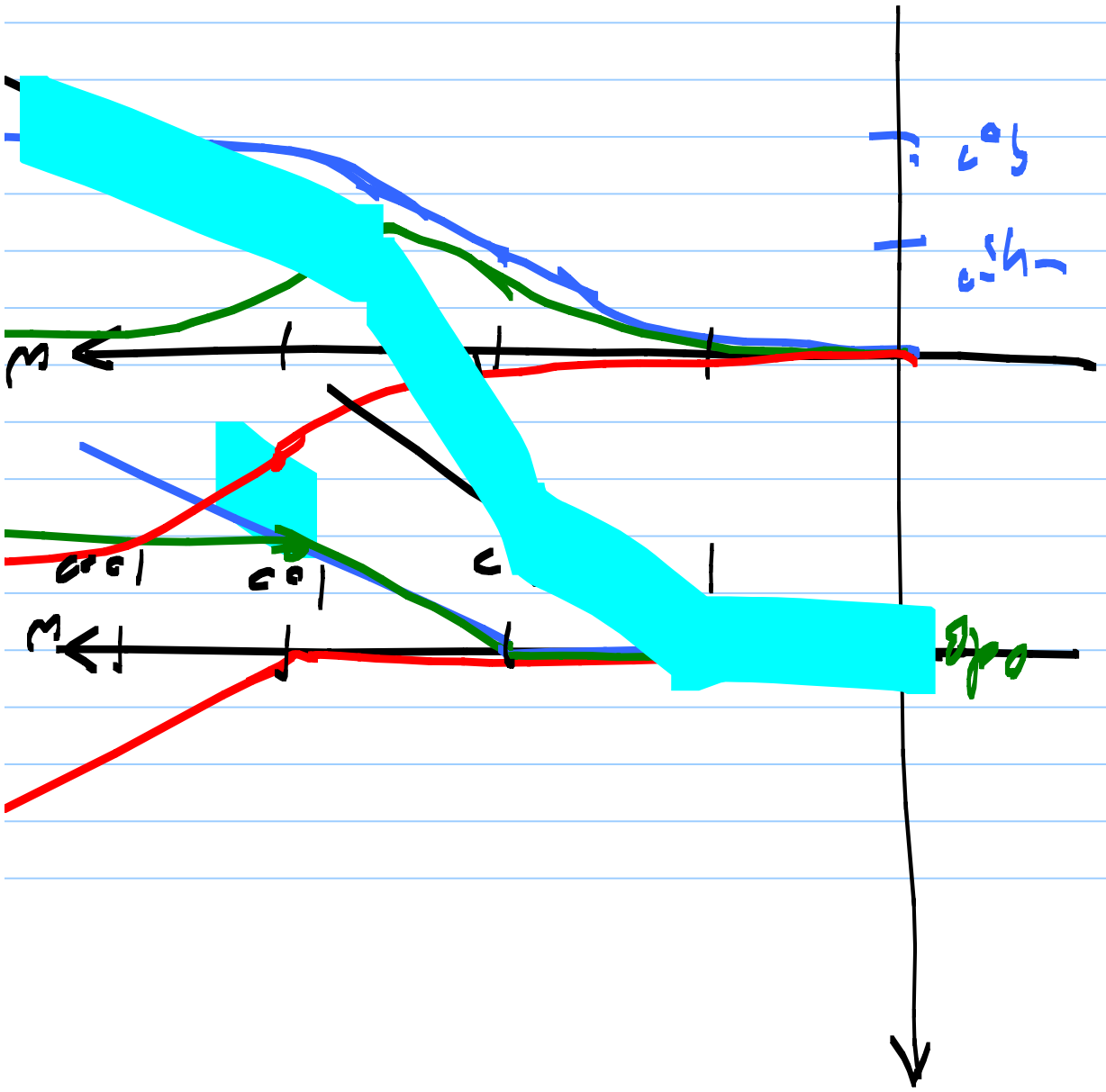
decibel:

$$H(s) = \frac{1}{s}$$

$|\cdot|$: $\frac{1}{\omega}$

$\angle$:

$$\frac{1}{\frac{s^2}{\omega_n^2} + \frac{s}{Q\omega_n} + 1}$$



$$\frac{\left(\omega_1/s+1\right)}{\left(\omega_2/s+1\right)}\,\frac{\omega_1/s+1}{1}$$