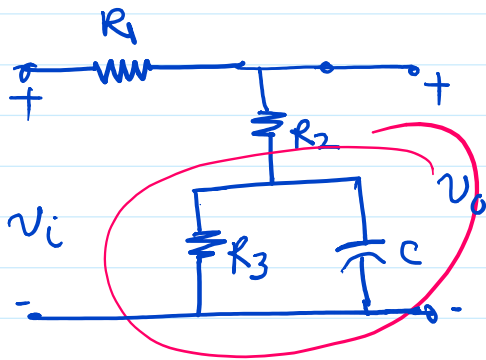


Quiz # 1

Wednesday, September 27, 2017 8:22 AM

Q.1



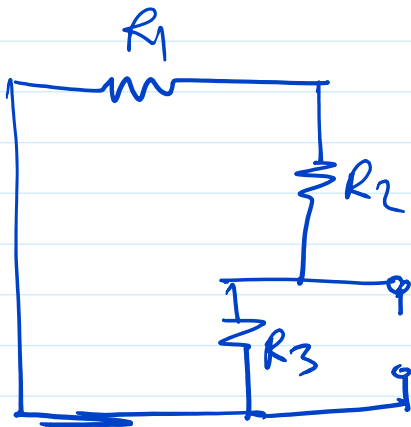
$$T(s) = \frac{v_o}{v_i} = ?$$

$$T(s) \Big|_{\max} = ? = \frac{R_2 + R_3}{R_1 + R_2 + R_3}$$

$$f_{\text{corner}}(s) = ?$$

Q2: Bode plot  $H(s) = \frac{10^6 (40+s)(2000+s)}{s}$

$\text{Mag} | H |_{\omega=1000 \text{ rad/s}}$   
 $\angle H_{\omega=1000 \text{ rad/sec}}$



$$Z = R_3 \parallel (R_1 + R_2) \times C$$

$$R_{eq} = R_3 \parallel (R_1 + R_2) \quad \frac{1}{2\pi RC} = f_c$$

$$R_3 \parallel \frac{1}{sC} = \frac{R_3 \times \frac{1}{sC}}{R_3 + \frac{1}{sC}} = \frac{R_3}{1 + sCR_3}$$

$$T(s) = \frac{Z_p}{Z_p + Z_s} = \frac{R_2 + \frac{R_3}{1 + sCR_3}}{(R_1 + R_2) + \frac{R_3}{1 + sCR_3}}$$

$$= \frac{R_2(1 + sCR_3) + R_3}{(R_1 + R_2)(1 + sCR_3) + R_3}$$

$$\Rightarrow \frac{(R_2 + R_3) + sCR_2R_3}{(R_1 + R_2 + R_3) + (R_1 + R_2)sCR_3}$$

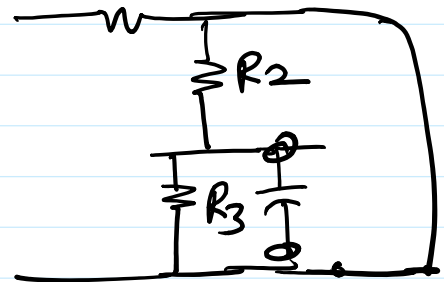
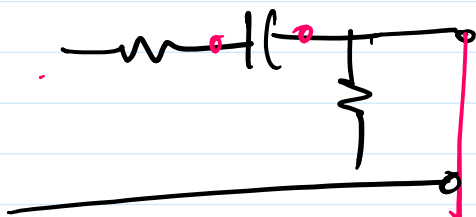
$$= \frac{(R_2 + R_3) \left[ 1 + \frac{sCR_2R_3}{R_2 + R_3} \right]}{\left[ R_1 + R_2 + R_3 \right] \left[ 1 + \frac{(R_1 + R_2)R_3sC}{(R_1 + R_2) + R_3} \right]}$$

*Max Gain*

$$= \frac{R_2 + R_3}{R_1 + R_2 + R_3} \cdot \frac{1 + sZ_A}{1 + sZ_B}$$

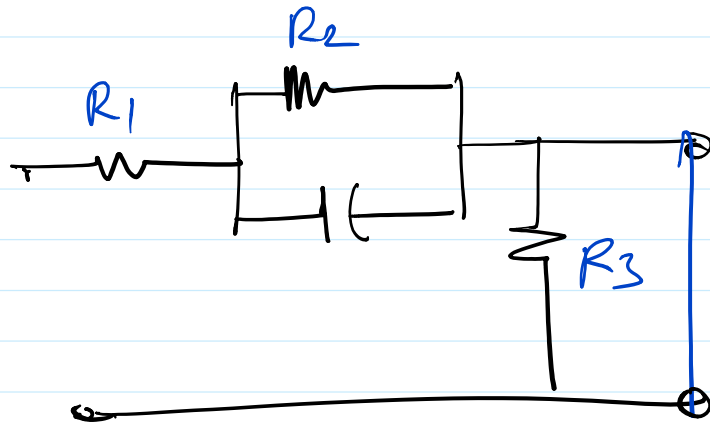
$$Z_B = \frac{(R_1 + R_2)R_3}{R_1 + R_2 + R_3} \quad C = \left( (R_1 + R_2) \parallel R_3 \right) C$$

$$Z_A = C (R_2 \parallel R_3)$$



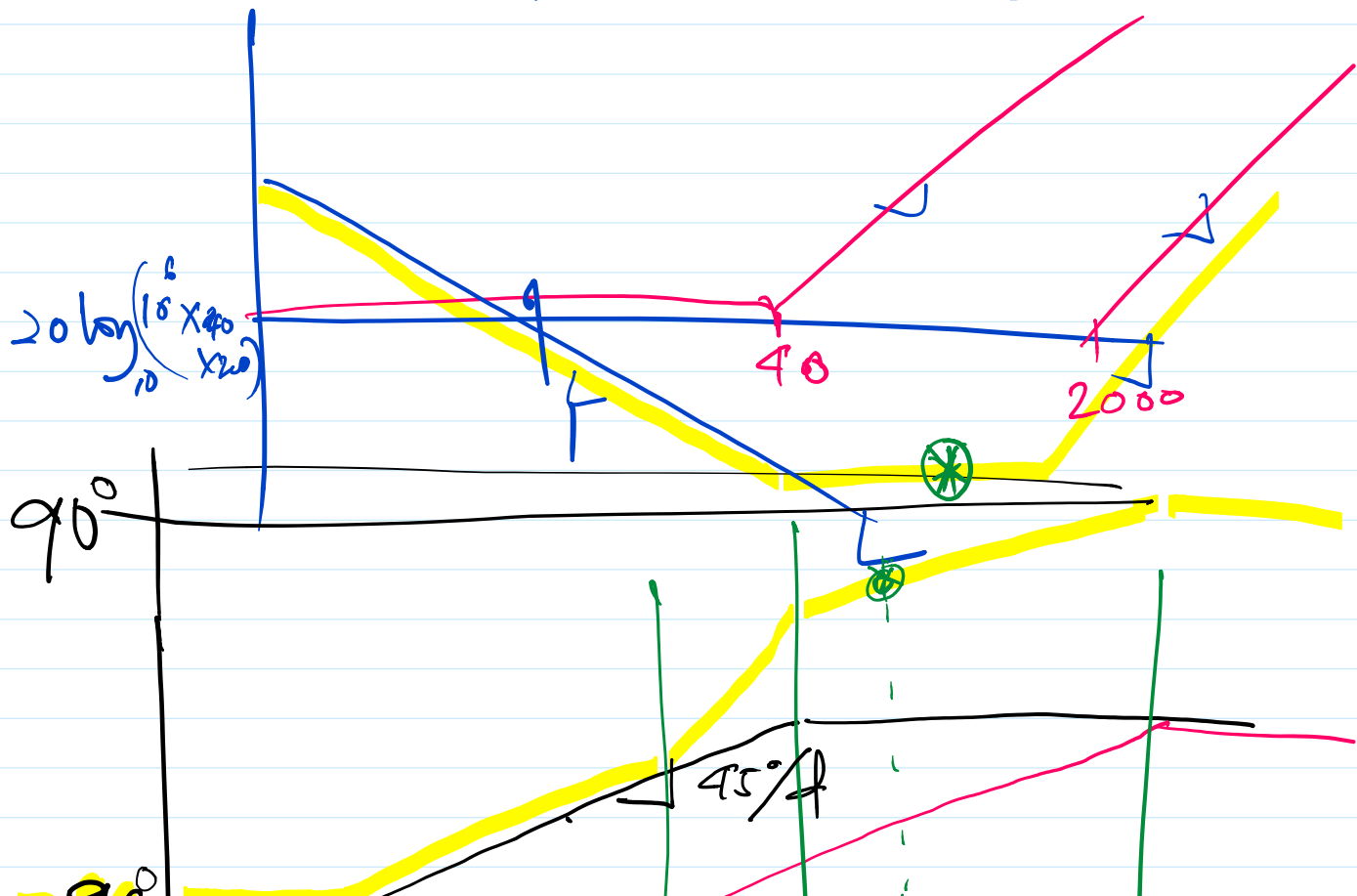
$$f_A = \frac{1}{2\pi Z_A} \text{ Hz} \quad f_B = \frac{1}{2\pi Z_B} \text{ Hz}$$

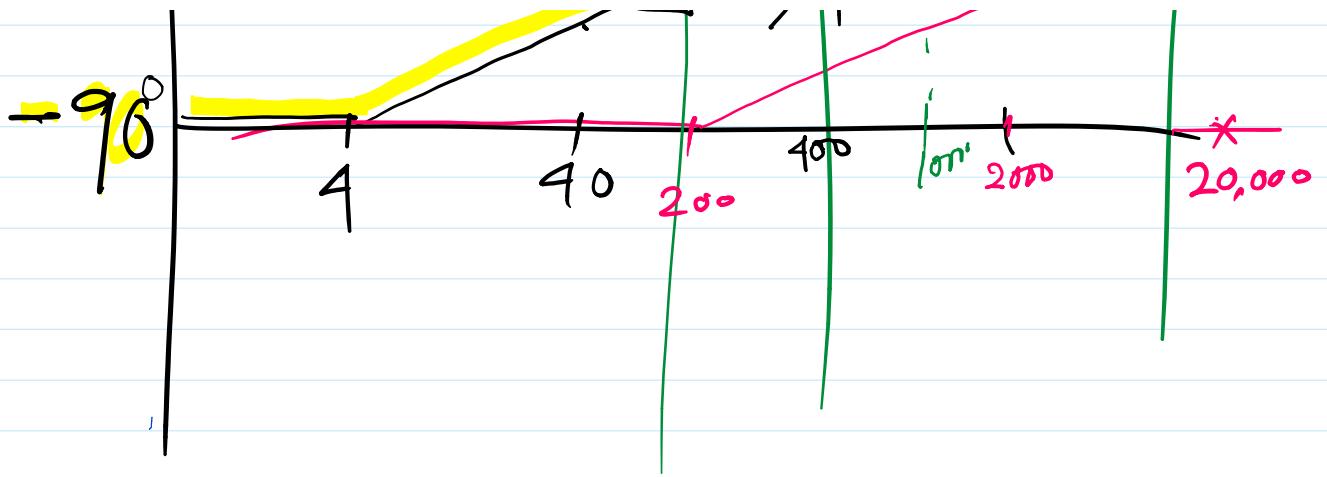
$$f_A = \frac{1}{2\pi R_A C_A} \approx 10^6 \text{ Hz}$$



$$T(s) = 10^6 \frac{(40 + s)(2000 + s)}{s}$$

$$= 10^6 \times 40 \times 2000 \frac{(1 + \frac{s}{40})(1 + \frac{s}{2000})}{s}$$





$$\theta = -90^\circ + \tan^{-1} \frac{1000}{40} + \tan^{-1} \frac{1000}{2000}$$

$\omega = 1000$

$$T_{dB} = 20 \log_{10} 10^6 \times 40 \times 2000 - 20 \log_{10} (40)$$

$\omega = 1000$

$$T(s)_{\omega=1000} = 2000 \times 40 \times 10^6 \times \frac{1}{s}$$