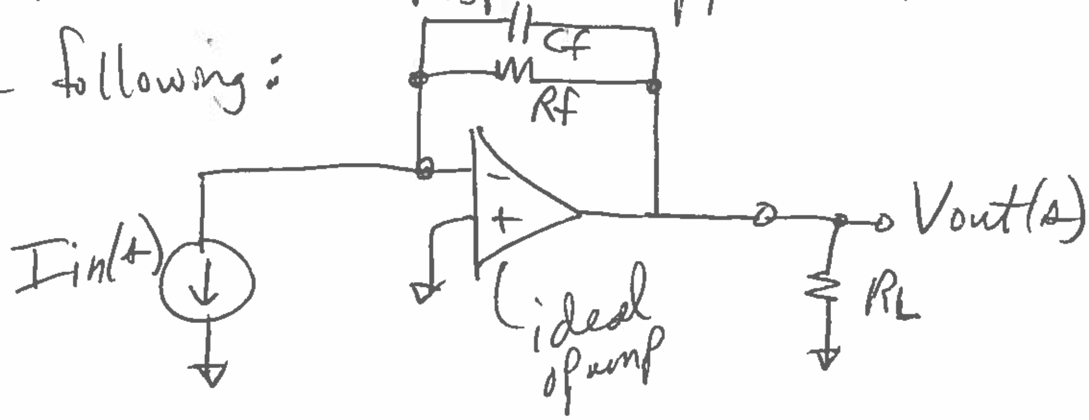
(Yet Another) Bode Example:

Sketch the Bode response approximation of the following:



→ Define transfer function $H(s)$ as ratio of output voltage $V_{out}(s)$ to input current $I_{in}(s)$:

$$H(s) = \frac{V_{out}(s)}{I_{in}(s)} \Rightarrow \text{Note that } V_{out}(s) = \underline{Z_f(s)\, I_{in}(s)}$$

So, $H(s) = Z_f(s) = R_f \,//\, (1/sC_f)$

$$= \frac{R_f\left(\frac{1}{sC_f}\right)}{R_f + \frac{1}{sC_f}} = \frac{R_f}{1 + sR_fC_f} = \frac{R_f}{\left(1 + s/\omega_{p1}\right)}$$

$$\Rightarrow H(s) = \frac{K}{\left(1 + s/\omega_{p1}\right)}, \quad K = R_f,\ \omega_{p1} = \frac{1}{R_fC_f}$$

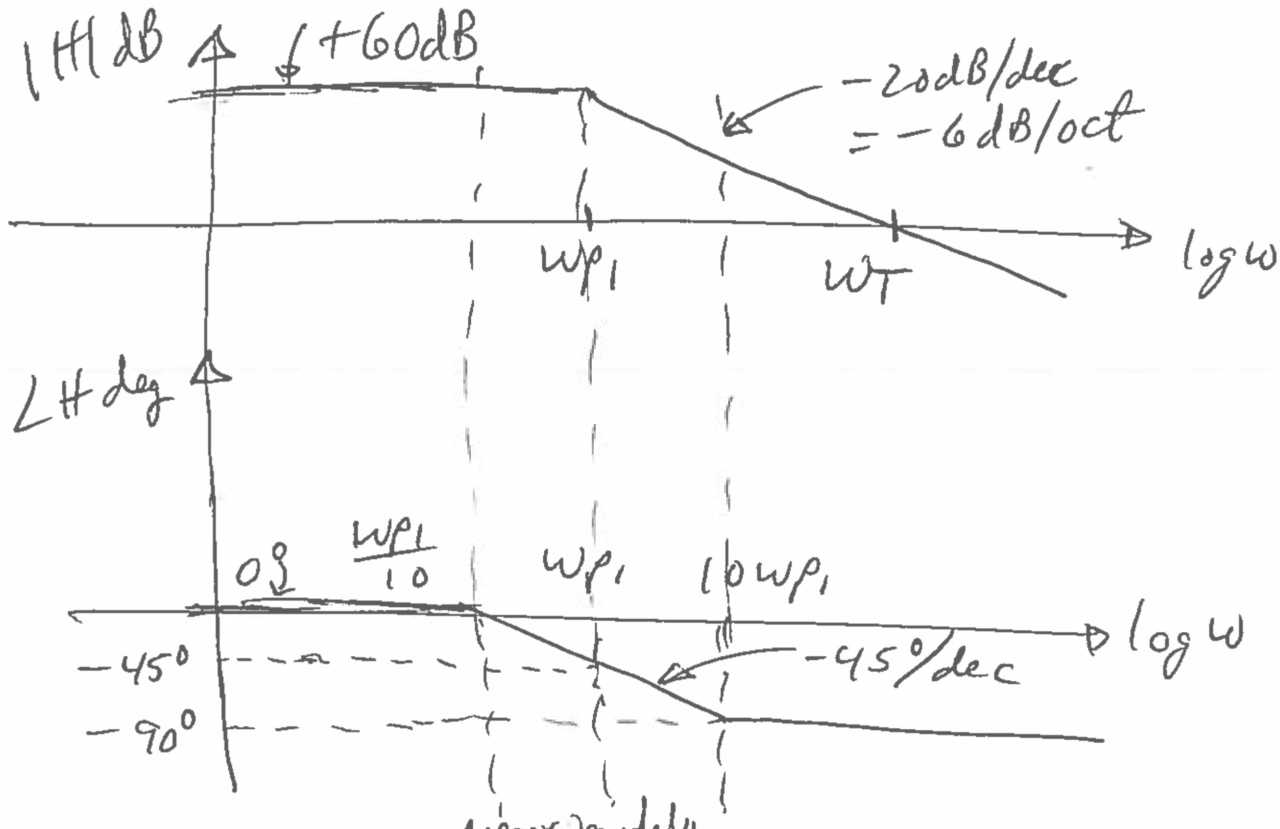
What does the Bode response approximation of this ckt look like? (cont'd)

→ Let $R_f = 1k\Omega$, $C_f = 10pF$. Then

$K = R_f = 1k\Omega \Rightarrow K_{dB} = 20\log_{10}(1k) = 60dB$, and

$$\omega_{p1} = \frac{1}{R_f C_f} = \frac{1}{(1k)(10p)} = 100\,Mrps \cong 2\pi(15.92MHz)$$

→ The Bode approximation looks like:



→ Additional question: Approximately, What is ω_T?

Here, ω_T is defined as the frequency at which $|H(j\omega)|$ falls to 0dB, approximately.

(Answer: $\omega_T \cong$ 3 decades higher than ω_{p1} $= 10^3 \omega_{p1} = 100\,Grps$)