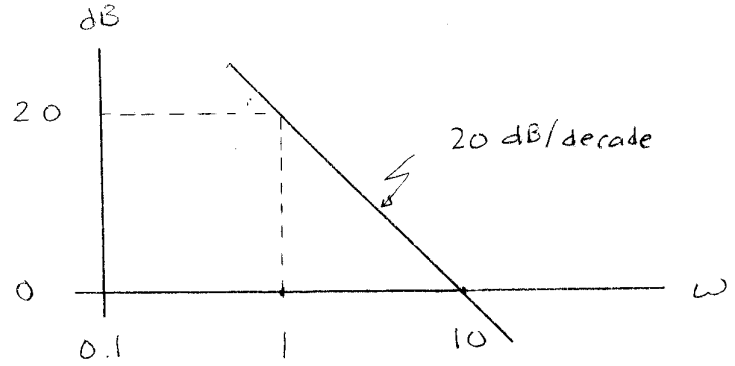
Spring Quarter 2004, Final Exam. Prob #2

(a) $|G(\omega)| = \frac{10}{\omega} \Rightarrow dB = 20\log_{10}\left(\frac{10}{\omega}\right) = 20\left[1 - \log_{10}\omega\right]$



(b) $i(t) = 2\sin 10t + \cos\left(20t + \frac{\pi}{4}\right)$

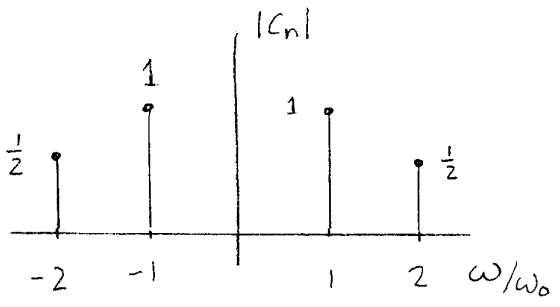
$= \frac{2}{2j}\left(e^{j10t} - e^{-j10t}\right) + \frac{1}{2}\left[e^{j(20t+\frac{\pi}{4})} + e^{-j(20t+\frac{\pi}{4})}\right]$

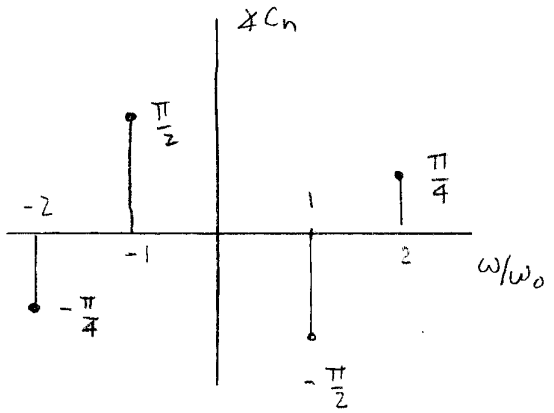
$= -j\,e^{j10t} + \left(\frac{1}{2}e^{j\pi/4}\right)e^{j20t}$ + Complex conjugate

Hence $\omega_0 = 10$.

$C_1 = -j \Rightarrow |C_1| = 1, \ \angle C_1 = -\pi/2$

$C_2 = \frac{1}{2}e^{j\pi/4} \Rightarrow |C_2| = \frac{1}{2}, \ \angle C_2 = \pi/4$





(c) $\omega = 10$, $G = \frac{10}{10j} = -j$, $|G| = 1$, $\angle G = -\frac{\pi}{2}$

Response $= 2 \times 1 \sin(10t - \frac{\pi}{2}) = -2\cos 10t$

$\omega = 20$, $G = \frac{10}{20j} = -\frac{j}{2}$, $|G| = \frac{1}{2}$, $\angle G = -\frac{\pi}{2}$

Response $= 1 \times \frac{1}{2} \cos(20t + \frac{\pi}{4} - \frac{\pi}{2}) = \frac{1}{2}\cos(20t - \frac{\pi}{4})$

$\Theta(t) = -2\cos 10t + \frac{1}{2}\cos(20t - \frac{\pi}{4})$

(d) NO. $G(\omega)$ does not resemble a constant in the frequency domain.