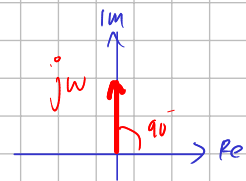
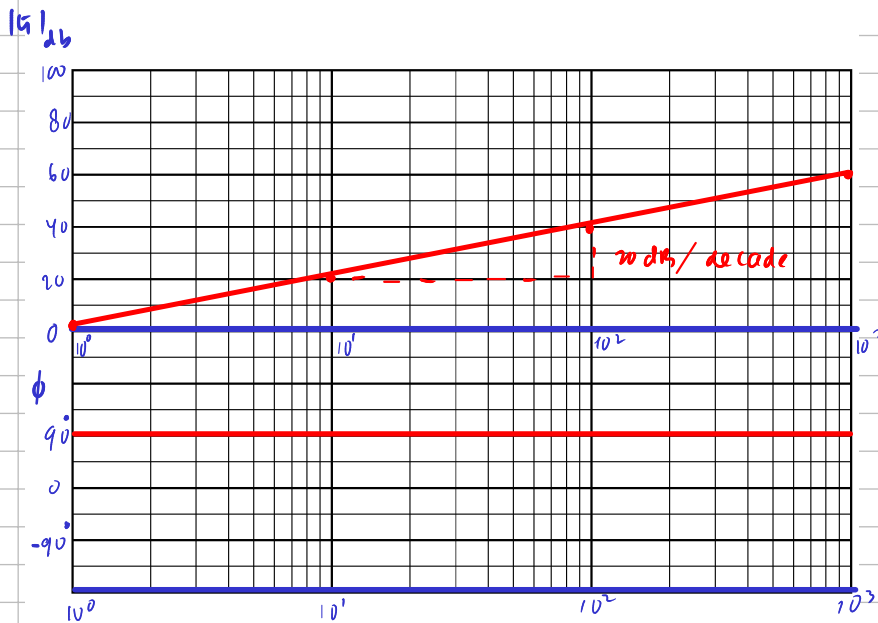


~ Asymptotic method ~ Approximation of the actual bode plot

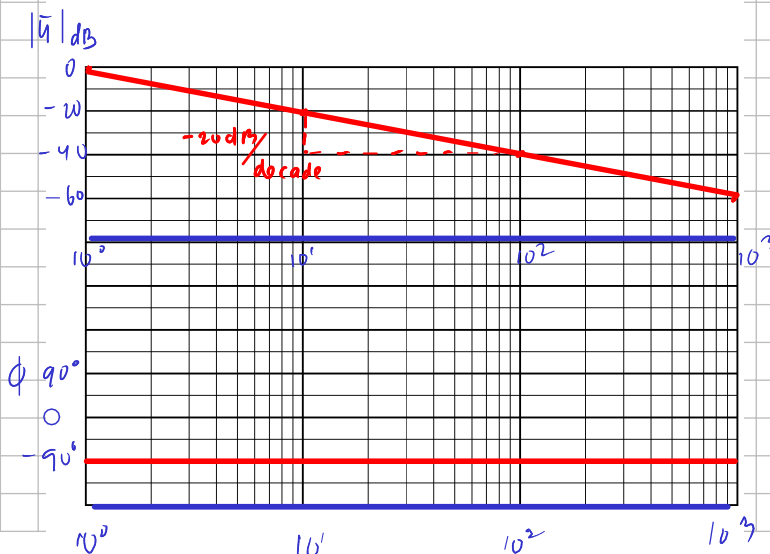
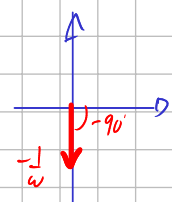
① $G(s) = s = j\omega$ $\begin{cases} |G| = \omega \\ \phi = 90^\circ \end{cases}$

s	$20 \log G \text{ dB}$	ϕ
1	$20 \log 1 = 0$	90
10	$20 \log 10 = 20$	90
100	$20 \log 100 = 40$	90
1000	$20 \log 1000 = 60$	90
\vdots	\vdots	\vdots



② $H(s) = \frac{1}{s} \Rightarrow G(j\omega) = \frac{1}{j\omega} \times \frac{j}{j} = -\frac{j}{\omega} = 0 - j\frac{1}{\omega}$ $\begin{cases} |H| = \sqrt{\frac{1}{\omega^2}} = \frac{1}{\omega} \\ \phi = \arctan\left(\frac{-1/\omega}{0}\right) = -90^\circ \end{cases}$

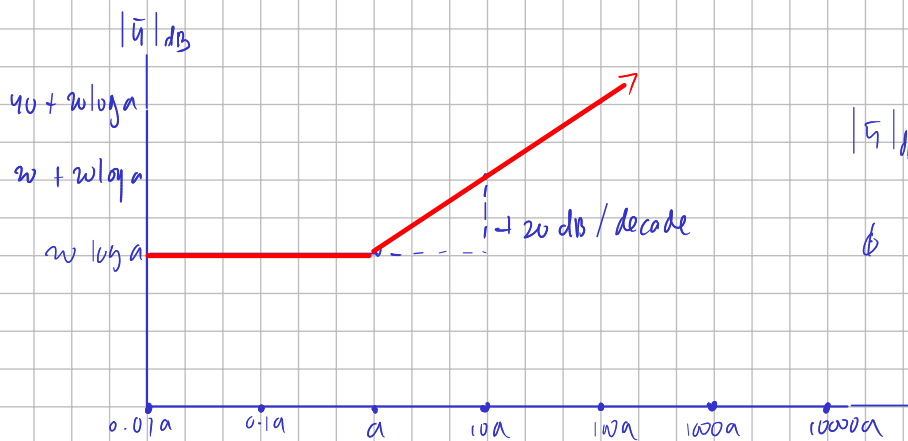
s	$20 \log H \text{ dB}$	ϕ
$j1$	$20 \log (1) = 0$	-90
$j10$	$20 \log (1/10) = -20$	-90
$j100$	$20 \log (1/100) = -40$	-90
\vdots	\vdots	\vdots



3

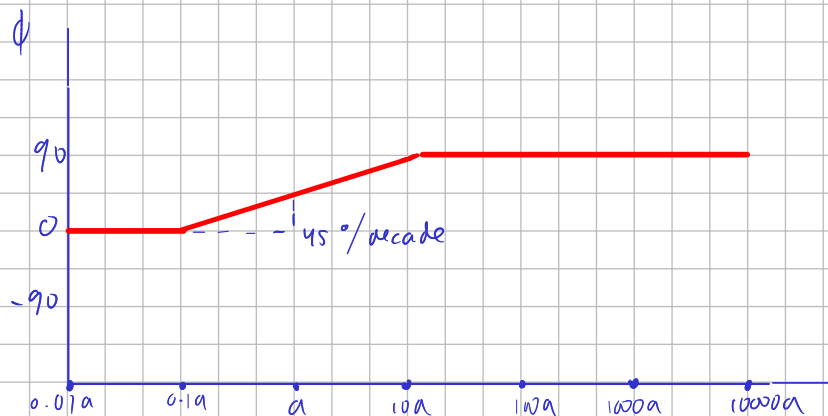
$$G(s) = s + a$$

when $\omega \gg a$ $G(s) = j\omega \rightarrow |G| = \omega \Rightarrow$ incrementing with 20dB/decade
 when $\omega \ll a$ $G(s) = a \rightarrow |G| = a \Rightarrow 20 \log a$



$$|G|_{dB} = \begin{cases} 20 \log \omega, & \omega \gg a \\ 0, & \omega \ll a \end{cases}$$

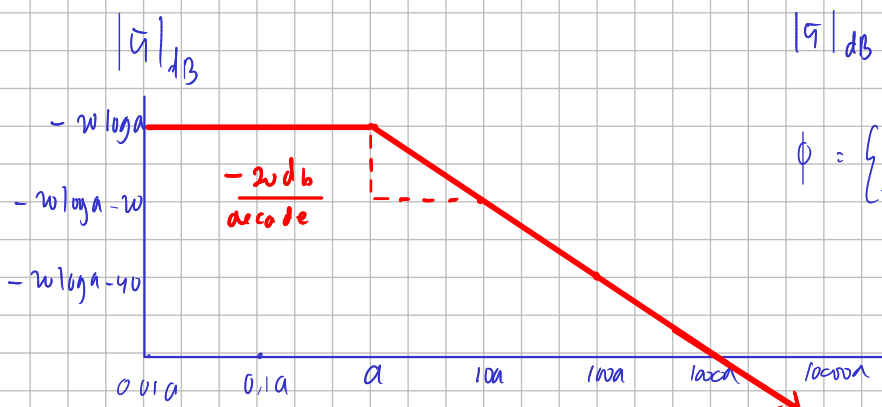
$$\phi = \begin{cases} 0, & \omega \ll a \\ 90, & \omega \gg a \end{cases}$$



4

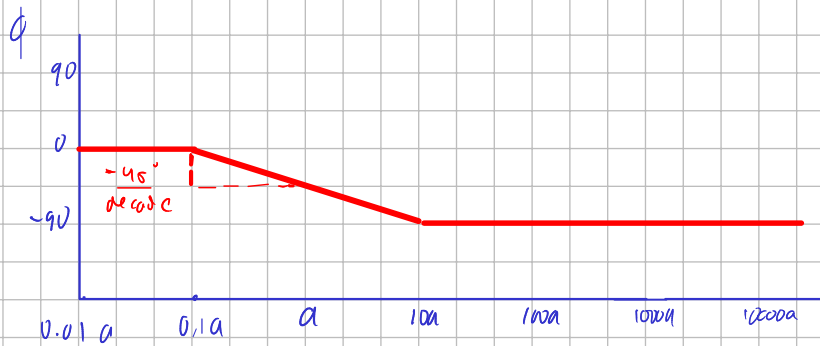
$$G(s) = \frac{1}{s + a}$$

when $\omega \gg a$ $G(s) = \frac{1}{j\omega} = -\frac{j}{\omega} \Rightarrow |G| = \frac{1}{\omega}$ decaying with a gradient of -20 dB/decade
 when $\omega \ll a$ $G(s) = \frac{1}{a} \Rightarrow |G| = \frac{1}{a} \Rightarrow 20 \log \frac{1}{a} = -20 \log a$



$$|G|_{dB} = \begin{cases} -20 \log a, & \omega \ll a \\ -20 \log \omega, & \omega \gg a \end{cases}$$

$$\phi = \begin{cases} 0, & \omega \ll a \\ -90, & \omega \gg a \end{cases}$$



⑤ $G = K \Leftarrow$ constant value

$$G(s) = K$$

$$|G| = |K|$$

$$\phi = \begin{cases} 0, & K > 0 \\ -180, & K < 0 \end{cases}$$

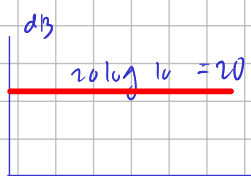


Contoh :

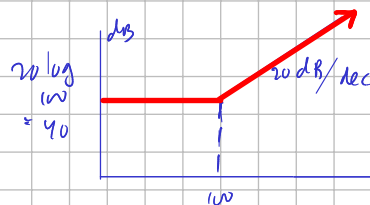
$$\bar{G}(s) = \frac{10(s+10)}{(s+1)}$$

Magnitude

$$\bar{G}_1(s) = 10$$



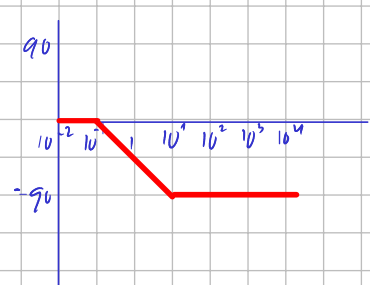
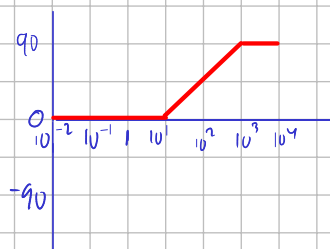
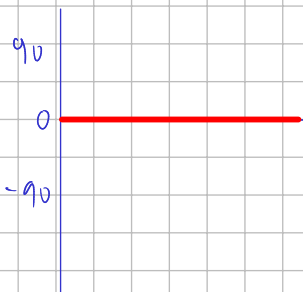
$$\bar{G}_2(s) = s+10$$

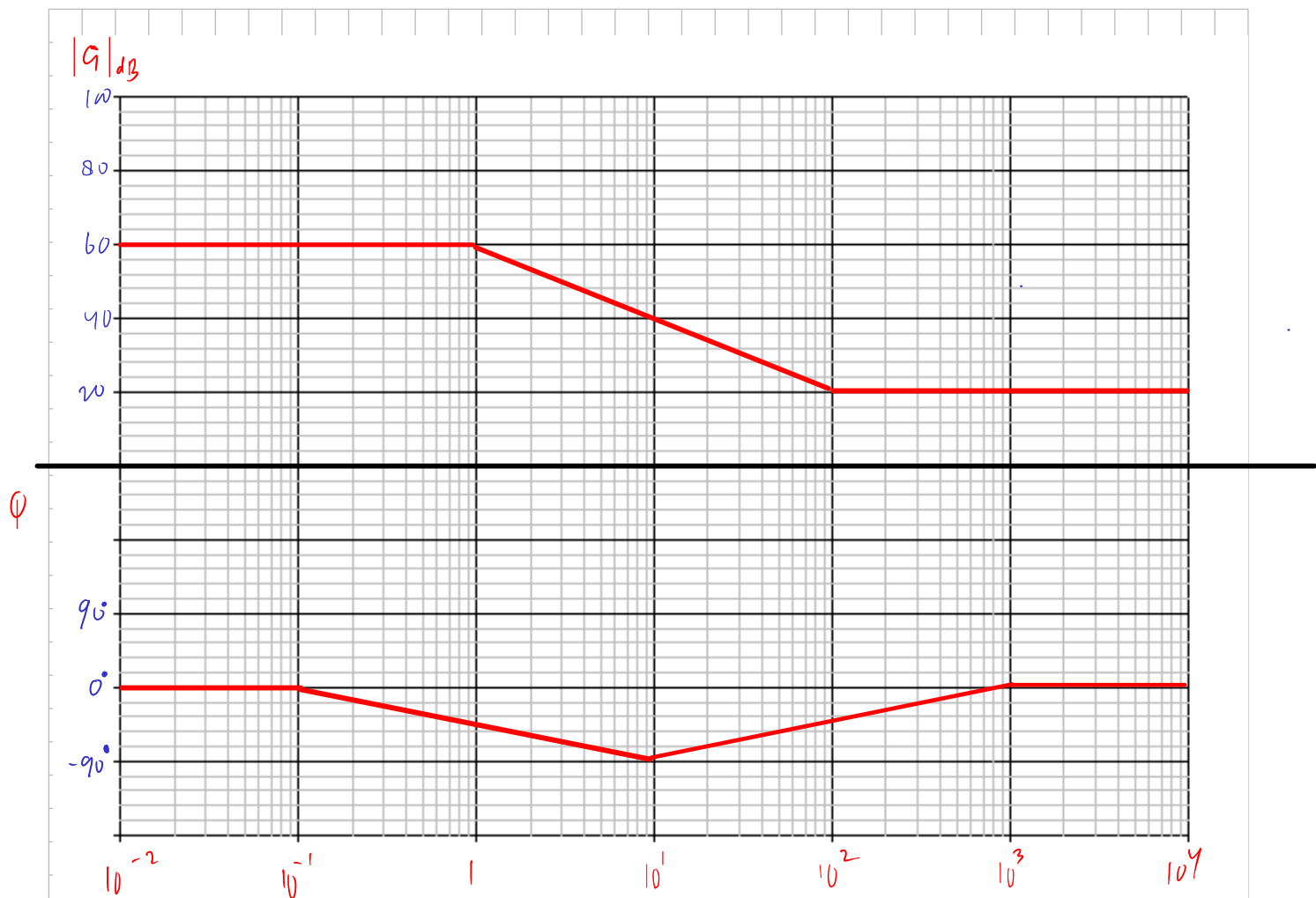


$$\bar{G}_3(s) = \frac{1}{s+1}$$



Phase





using MATLAB:

bodeas(100, 1, 0)

