

Bode Plot Example: draw the bode plot for the following transfer function:

$$H(s) = \frac{s \cdot 10^{18} (s + 10^6)}{(s + 10^2)(s + 10^5)(s + 10^8)^2}$$

Solution:

① Factor $H(s)$ to get in standard pole/zero format:

$$\begin{aligned} H(s) &= \frac{s \cdot 10^{18} \cdot 10^6 (1 + s/10^6)}{10^2 (1 + s/10^2) \cdot 10^5 (1 + s/10^5) \cdot 10^8 \cdot 10^8 (1 + s/10^8)^2} \\ &= \frac{10 \cdot s \cdot (1 + s/10^6)}{(1 + s/10^2)(1 + s/10^5)(1 + s/10^8)^2} \end{aligned}$$

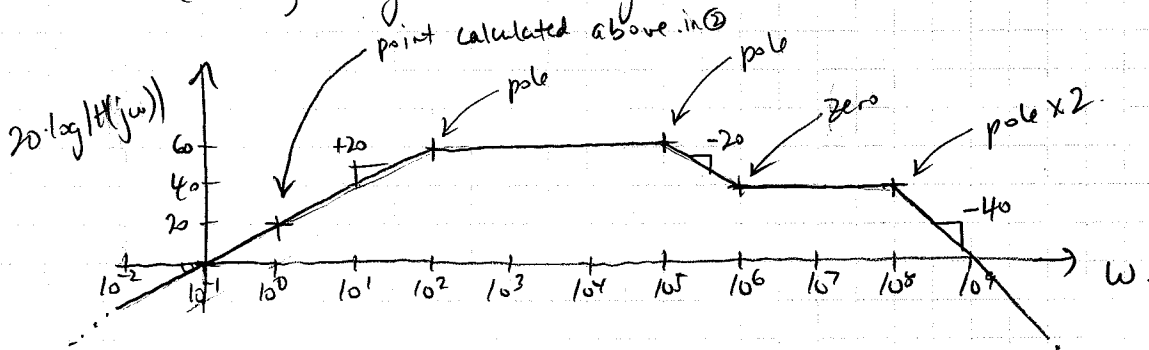
② Find starting point: first pole/zero is at 10^2 , choose a freq. below that and evaluate starting mag./phase.

→ choose $\omega = 10^0 = 1$ for simplicity.

$$|H(1j)| = \left| \frac{10 \cdot 1 \cdot j \cdot (1)}{(1) \cdot (1) \cdot (1)} \right| = 10$$

$$\angle H(1j) = \angle \frac{10 \cdot 1 \cdot j \cdot (1)}{(1) \cdot (1) \cdot (1)} = 90^\circ$$

③ Draw mag. bode plot, working up from $\omega = 1$ and reducing mag. by 20 dB/dec. for each pole and increasing by 20 dB/dec. for each zero. (initially mag. is increasing at 20 dB/dec. due to zero at $\omega = 0$).



④ Now draw phase plot, again starting with $\angle H(j\omega) = 90^\circ$ at low freq. and adding/subtracting 90° of phase for each zero/pole encountered.

