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

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

Solution:

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

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

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

2. Find starting point: first pole/zero is at $10^3$, choose a freq. below that and evaluate starting mag/phase:

- Choose $\omega = 10^0 = 1$ for simplicity.

$$\mid H\mid \bigg|_{\omega=1} = \frac{10 \cdot 1 \cdot 1 \cdot 1}{1 \cdot 1 \cdot 1} = 10$$

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

3. Draw magnitude 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. Draw phase plot, again starting with $\angle H(j\omega) = 90^\circ$ at low freq. and adding/subtracting $90^\circ$ or $-90^\circ$ phase for each zero/pole encountered.