

Ex. 1 $P(s) = ?$

initial 20 dB/dec slope

must have zero @ origin

$$P(s) = \frac{k s}{s + 40}$$

for $s > 40$ $|P(s)| = 26 \text{ dB}$
 $= 10^{26/20}$
 $= 20$

$$P(s) = \frac{k j\omega}{j\omega + 40} = 20, \quad k = 20$$

check phase plot

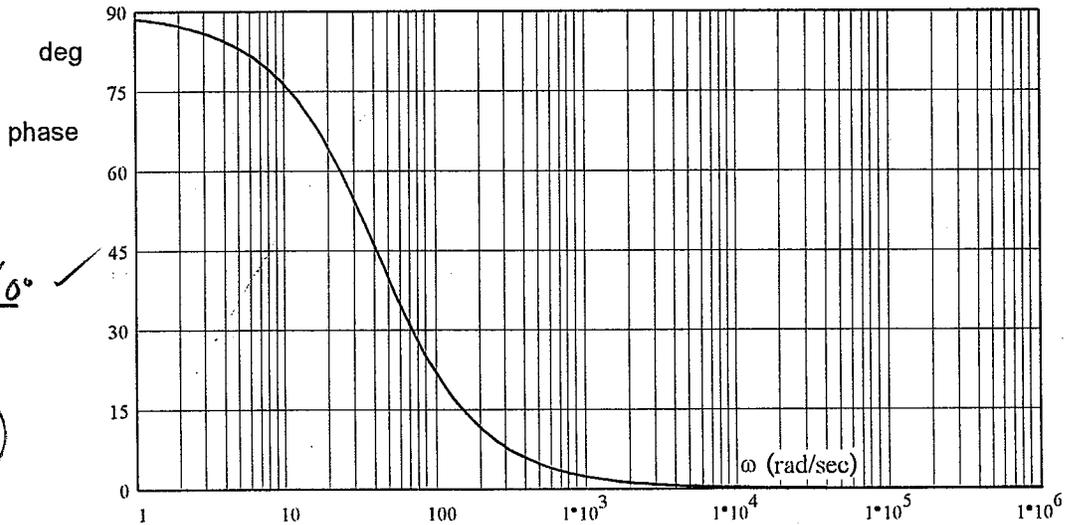
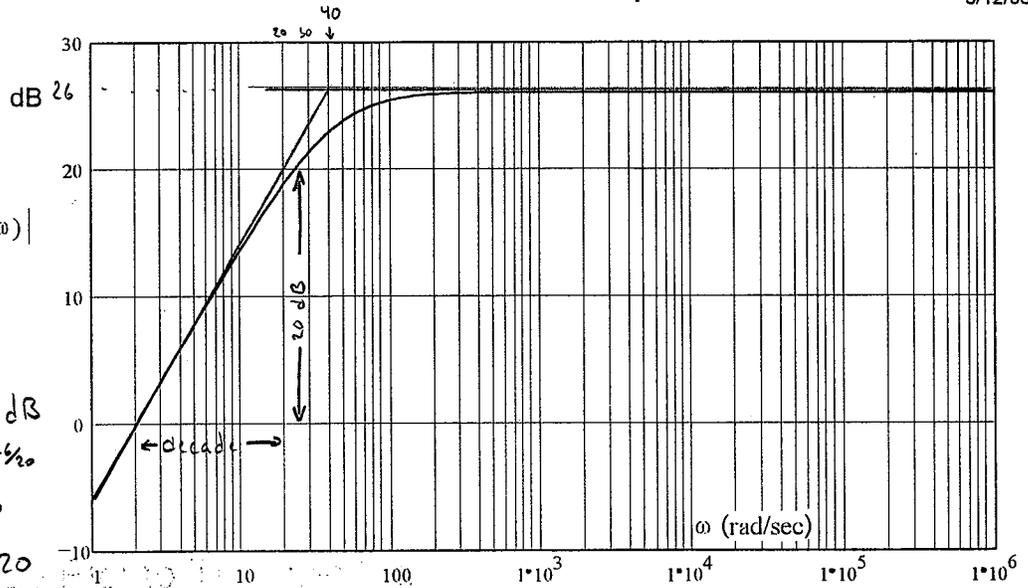
$$P(s) = \frac{k j\omega}{- + 40}$$

$\angle 90^\circ$ ✓

$$\frac{k j\omega}{j\omega + 40}$$

$\angle 0^\circ$ ✓

$$P(s) = \frac{20 s}{s + 40}$$



Ex. 2 What if the phase plot was:

$$P(s) = ? \stackrel{?}{=} \frac{\pm 20 j\omega}{(\pm \pm 40)}$$

initial angle = 90°

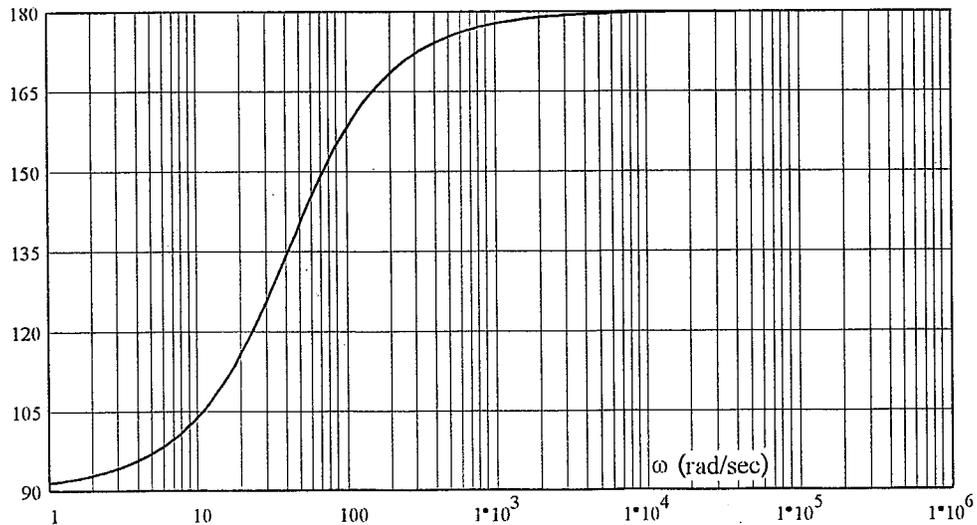
so

$$P(s) = \frac{+ 20 j\omega}{\pm - + 40}$$

no neg signs to start with

Phase angle does the "wrong" thing @ $s = 40j$

So $P(s) = \frac{20 s}{(-s + 40)}$ that s must have - sign



Bode Plot to Transfer Function Examples p.2

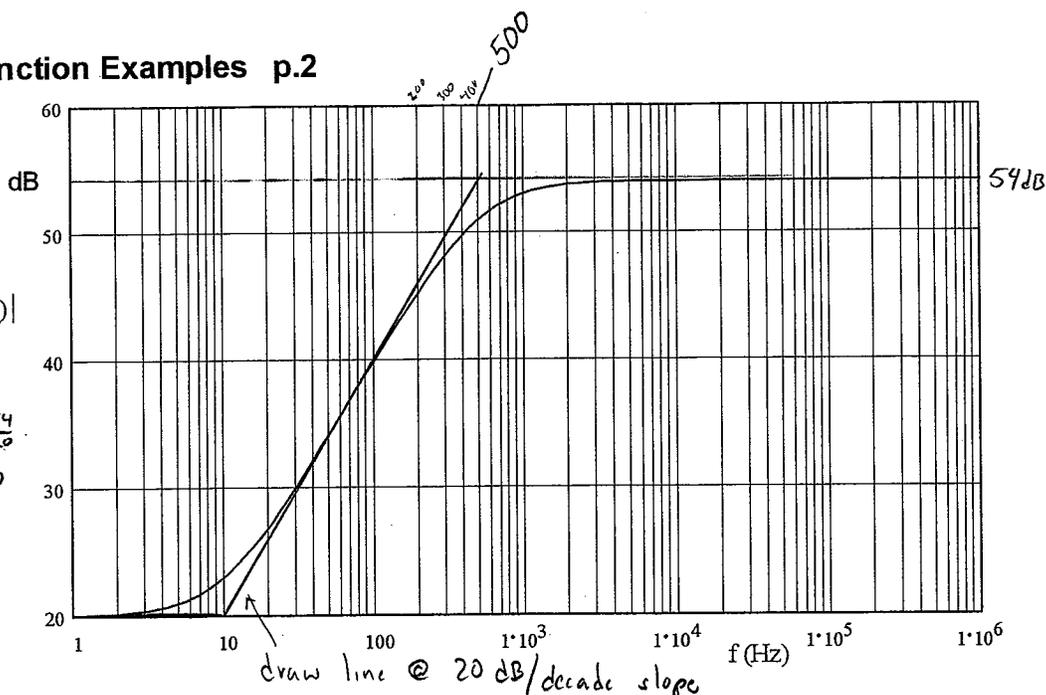
Ex. 3 $P(s) = ?$

plot is in Hz!

$$P(s) = \frac{k(s + 10 \cdot 2\pi)}{(s + 500 \cdot 2\pi)} |H(f)|$$

for $s > 500 \cdot 2\pi$

$$P(s) \approx \frac{k}{s} = k = 10^{\frac{54}{20}} = 500$$



Check phase plot

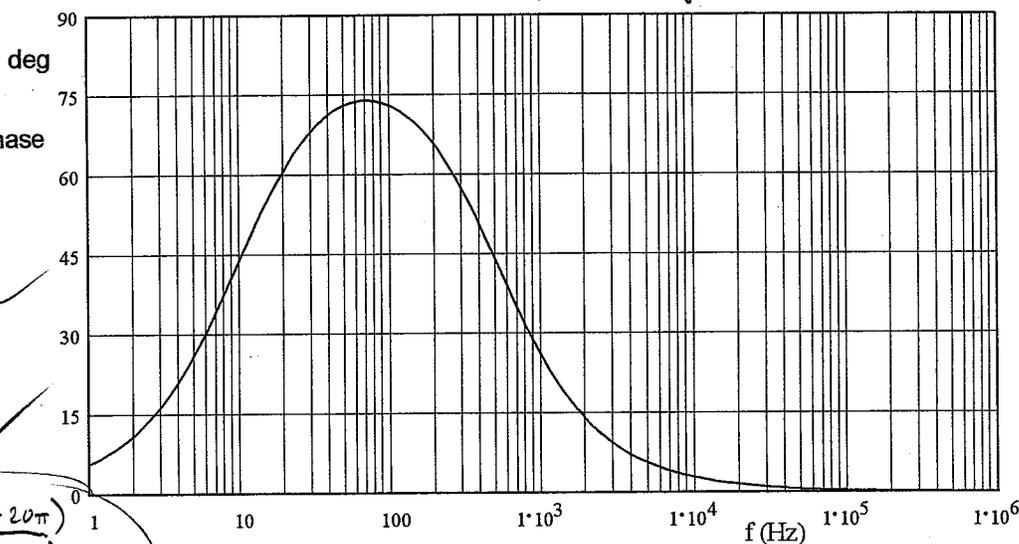
$$\frac{500(- + 20\pi)}{(- + 1000\pi)} \text{ phase}$$

init $\angle 0^\circ$ ✓

$$\frac{500(j\omega + 20\pi)}{- + 1000\pi} 90^\circ \checkmark$$

$$\frac{500 j\omega}{j\omega + \dots} \angle 0^\circ \checkmark$$

$$P(s) = \frac{500(s + 20\pi)}{(s + 2000\pi)}$$



Ex. 4 What if the phase plot was:

$P(s) = ?$

initials: $\angle 180^\circ$

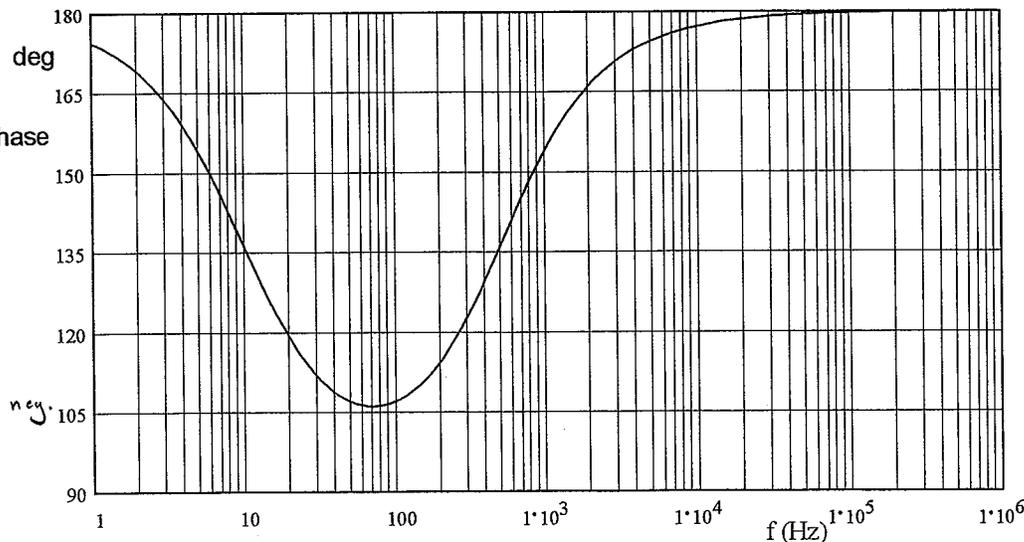
must have a -

$$\text{in } \frac{500(- + 20\pi)}{(- + 2000\pi)}$$

↑ phase does wrong thing @ $s = 2000\pi$, so this s is neg.

$$P(s) = \frac{500(s - 20\pi)}{(-s + 2000\pi)}$$

check this & it works.



Ex. 5 $P(s) = ?$

$$P(s) = \frac{ks}{(s + 80 \cdot 2\pi)(s + 10,000 \cdot 2\pi)}$$

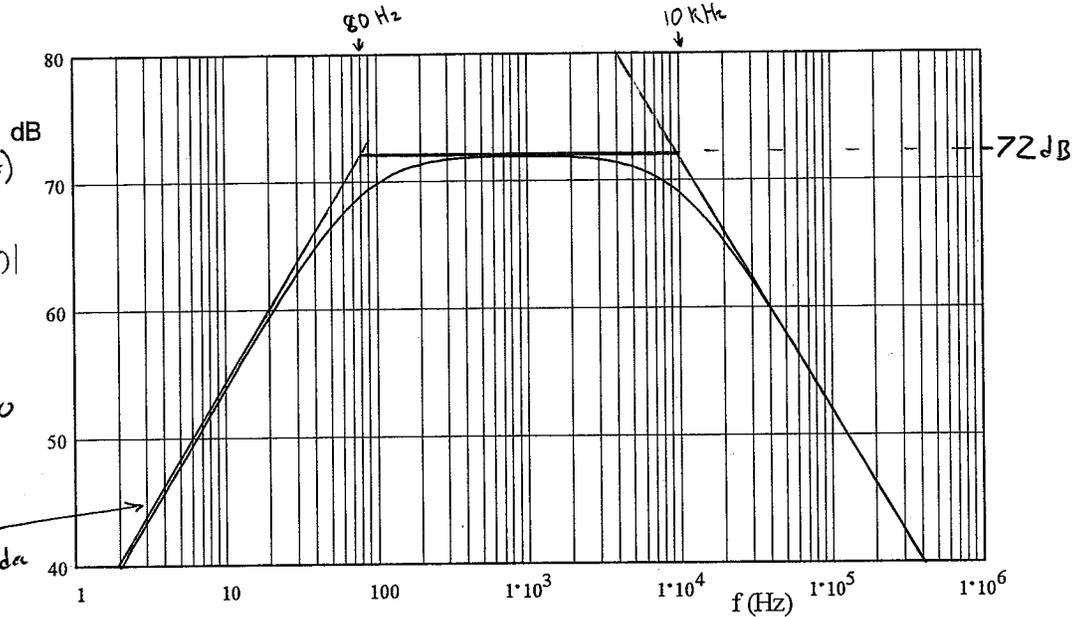
@ $s \approx 1000 \cdot 2\pi$

$$|P(s)| = 10^{\frac{22}{20}} \approx 4000$$

$$\frac{kj\omega}{j\omega(-+20000\pi)} = 4000$$

$$k = 8\pi \times 10^7$$

init
20dB/dec

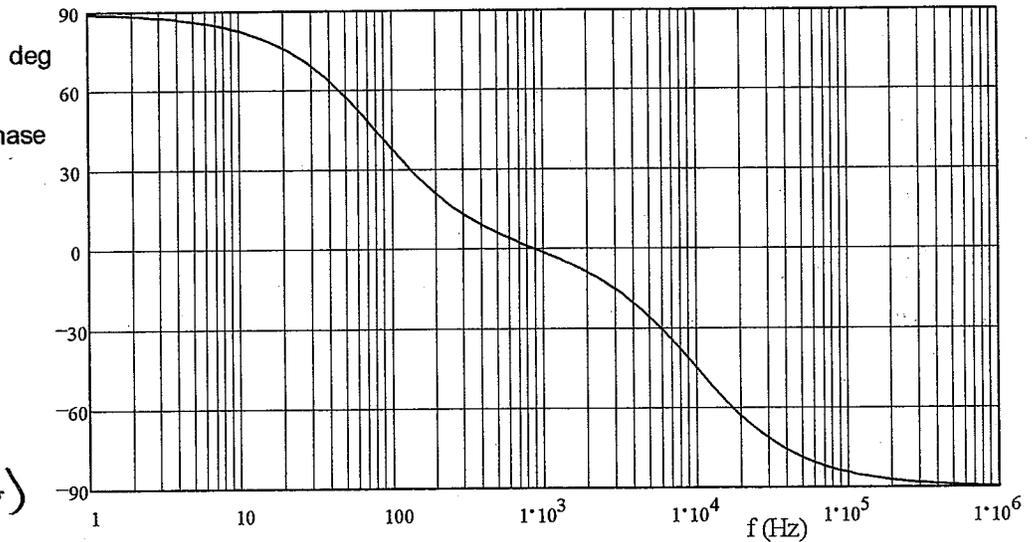


check phase plot

$$P(s) = \frac{8\pi \times 10^7 j\omega}{(-+160\pi)(-+20000\pi)}$$

init $90^\circ \checkmark$
 \downarrow
 $0^\circ \checkmark$
 \downarrow
 $-90^\circ \checkmark$

$$P(s) = \frac{8\pi \times 10^7 s}{(s + 160\pi)(s + 20000\pi)}$$



Ex. 6 What if the phase plot was:

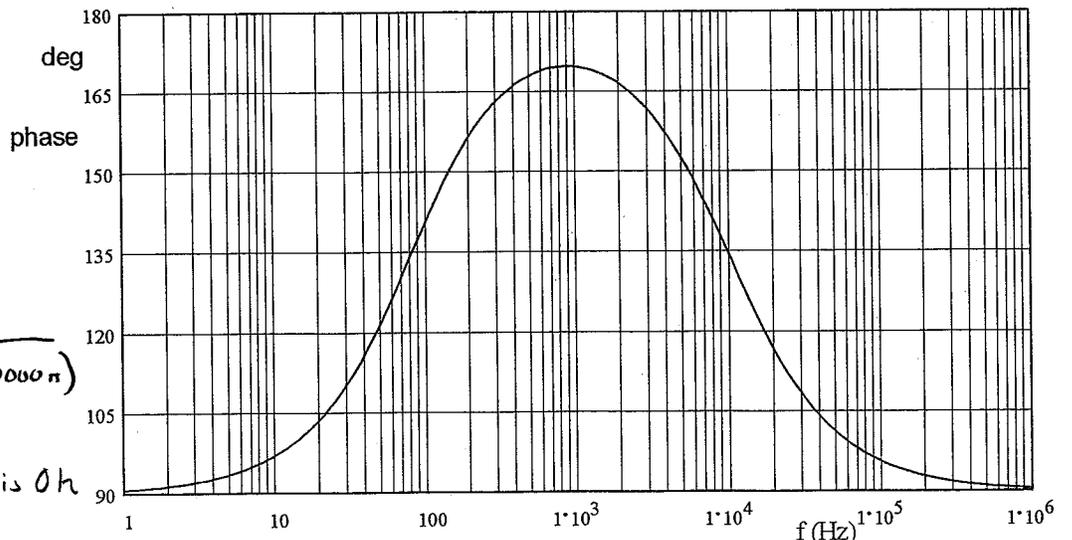
$$P(s) = ?$$

init phase 0H
 $s = 160\pi$ goes "wrong" way

so

$$P(s) = \frac{8\pi \times 10^7 s}{(-s + 160\pi)(s + 20000\pi)}$$

↑
last is 0H



Bode Plot to Transfer Function Examples p.4

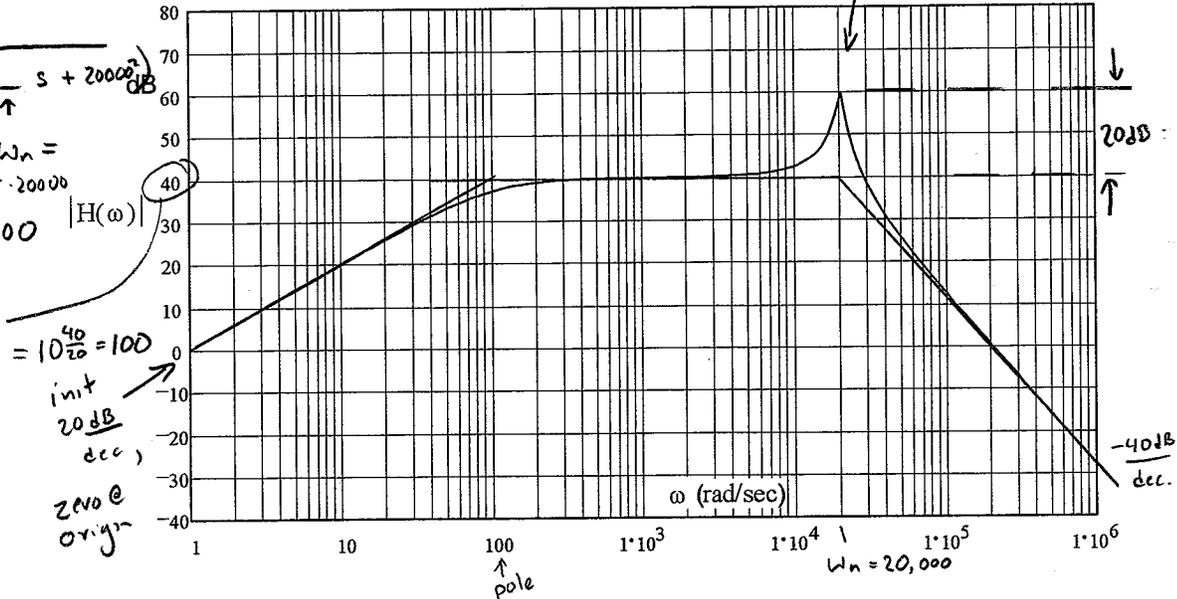
Ex. 7 $P(s) = ?$

$$P(s) = \frac{k s}{(s+100)(s^2 + \frac{s}{23} + 20000^2)}$$

$2\zeta\omega_n = 2 \cdot 0.05 \cdot 20000 = 2000$
 $\frac{1}{23} = 2000$
 $\zeta = 0.05$

$$\frac{k j\omega}{(j\omega+100)(20000^2)}$$

$$k = 100 \cdot 20000^2 = 4 \times 10^{10}$$



$$P(s) = \frac{4 \times 10^{10} s}{(s+100)(s^2 + 2000s + 20k^2)}$$

Check phase plot

$$\frac{4 \times 10^{10} j\omega}{(-j\omega+100)(-j\omega+20000)(-j\omega+20000)}$$

$90^\circ \checkmark$
 \downarrow
 $0^\circ \checkmark$
 \downarrow
 $-180^\circ \checkmark$

OK!

$$P(s) = \frac{4 \times 10^{10} s}{(s+100)(s^2 + 2000s + 4 \times 10^8)}$$