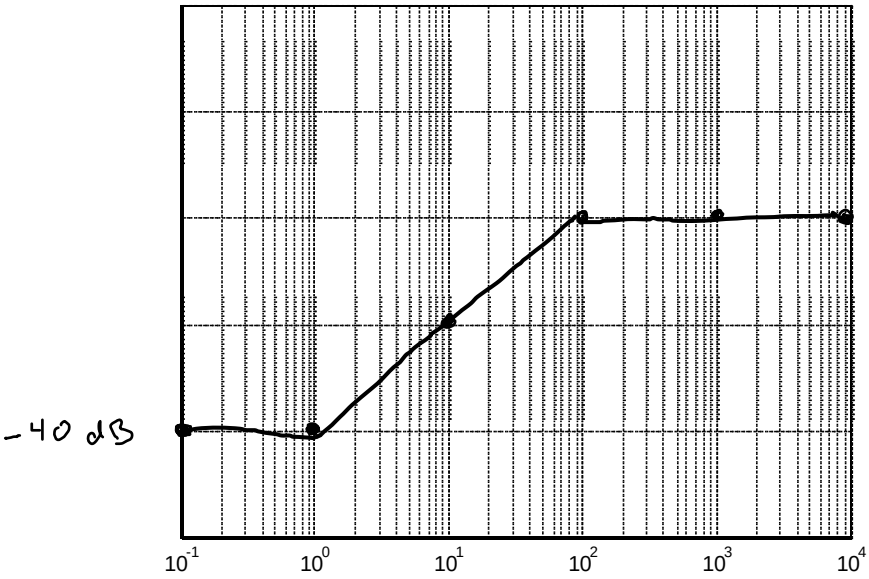
P1 Sketch the Bode plot between ω = 0.1 and 10k rad/s (magnitude only) of

$$H(s)=\frac{s+1}{s+100}$$

zeros: -1 ⇒ at ω = 1 causes increase of +20dB/dec

poles: -100 ⇒ at ω=100 causes decrease of -20dB/dec



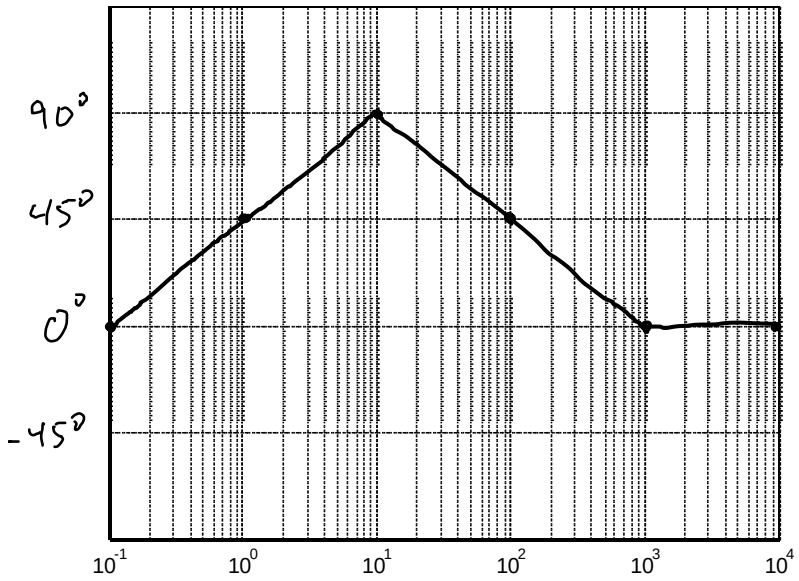
starts flat (no poles or zeros at 0)
at ω = 1 increases at +20dB/dec over previous flat = +20 dB/dec
at ω = 100 decreases at -20dB/dec over previous +20dB/dec = flat

find horizontal start point:
since starts flat use ω = 0
$H(0)=\frac{1}{100}$ = -40dB ∠0°

P2 Plot the above system's phase response.

zeros: -1 ⇒ at 0.1 starts increasing phase at +45°/dec
at 1 has +45° from this zero
at 10 stops affecting phase

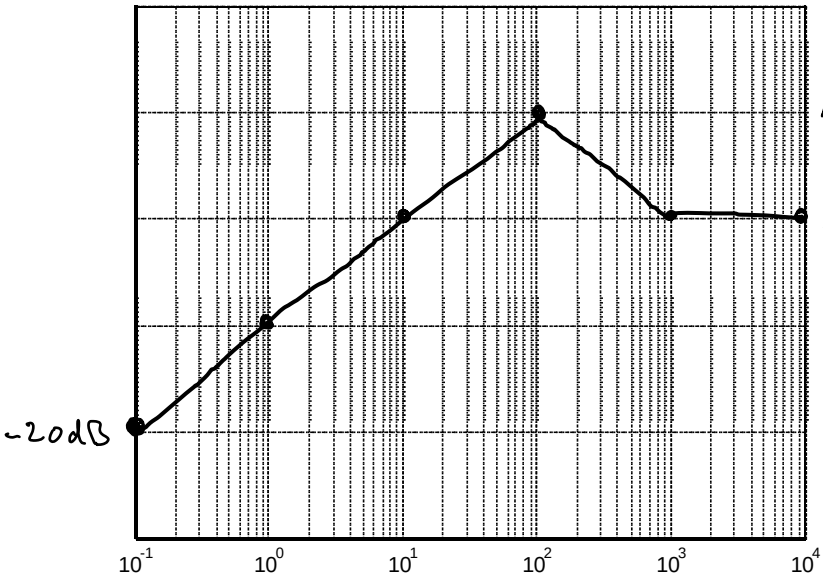
poles: -100 ⇒ at 10 starts decreasing phase at -45°/dec
at 100 has -45° from this pole
at 1000 stops affecting phase



starts flat at 0° (no poles or zeros at origin)
at 0.1 starts to rise by 45°/dec
at 1 is at 0° + 45° = 45°
at 10 is at 0° + 90° = 90° and starts to drop by 0° - 45° = -45°/dec
at 100 is at 0° + 90° - 45° = 45°
at 1000 levels out at 0° + 90° - 90° = 0°

P3 Sketch the Bode plot between ω = 0.1 and 10k rad/s (magnitude only) of

$$H(s) = \frac{10s(s+1000)}{(s+100)^2}$$



zeros: 0, -1000

poles: -100, -100

So starts increasing at +20dB/dec

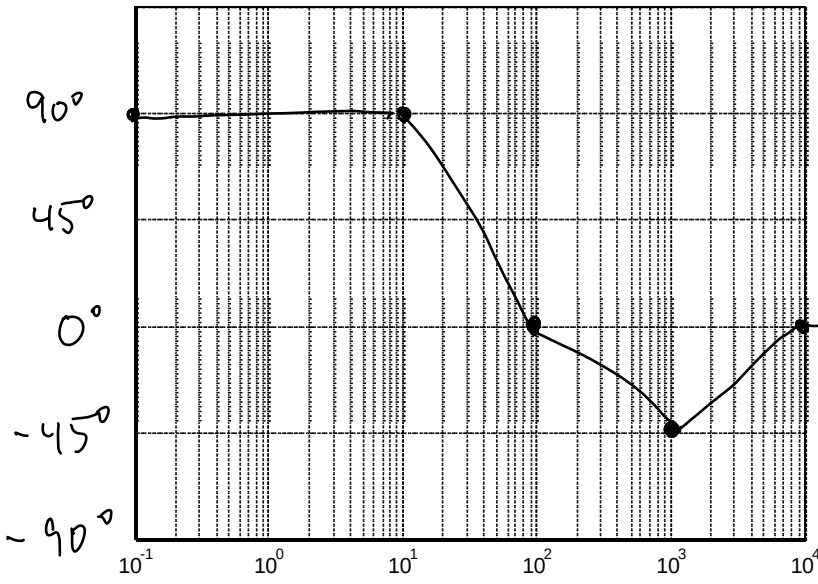
At 100 decreases by -20dB/dec x2 from +20dB/dec = -20 dB/dec

At 1000 increases by +20 dB/dec from -20dB/dec = flat

To start at, $H(\omega = 0.1) = \frac{10(j0.1)(j0.1+1000)}{(j0.1+100)^2}$

$\approx \frac{j(1000)}{(100)^2} = \frac{j}{10} = -20\text{dB}/90^\circ$

P4 Plot the above system's phase response.



Starts at +90°

At 10 starts decreasing by 45°/dec x 2 = -90°/dec

By 100 dropped by 45° x 2 from +90° = 0°

At 100 starts rising by 45°/dec in addition to -90°/dec for a total of -45°dec

At 1000 the zeros have influenced it by +90°+45° and poles by -90° x 2 total of -45°. Rising by 45°/dec

At 10k flat, total of -90° x 2 +90° x 2 = 0°.