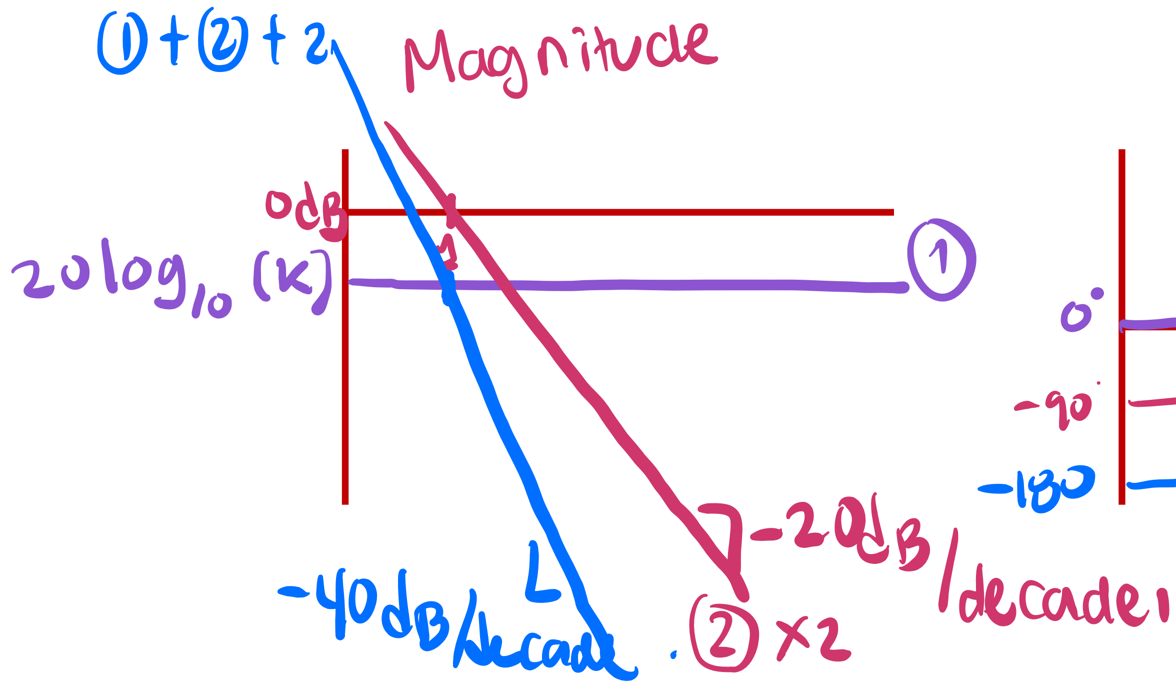
Last Class…

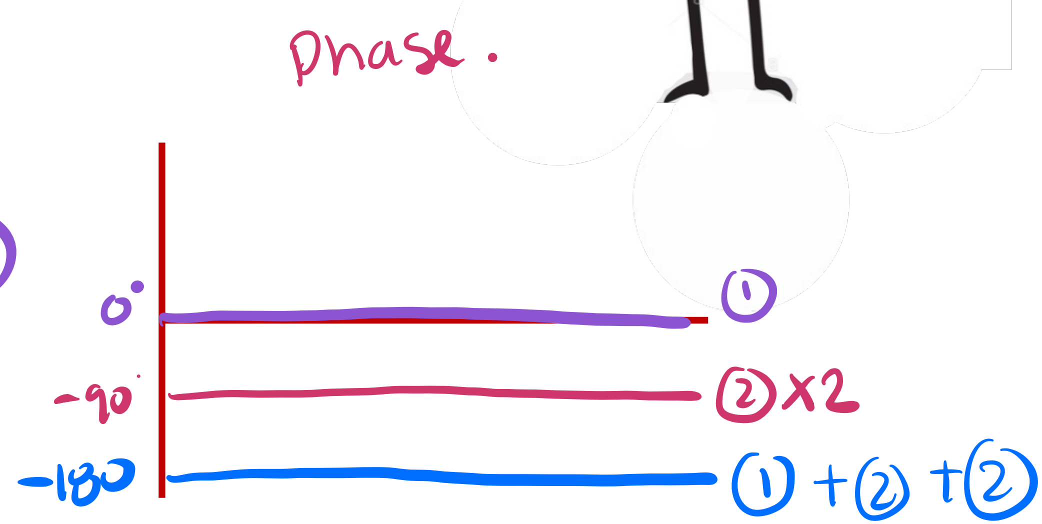
Pole @ the origin:

$$G(s) = \frac{K}{(j\omega)^2}$$

$$= K \cdot \frac{1}{j\omega} \cdot \frac{1}{j\omega}$$

① ② ②





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College of Engineering

Bode Plot (Part 2)

Modules 5-7

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This Lecture…

- Learning Objectives:
    - Generate magnitude frequency plots for high and low pass-filters.

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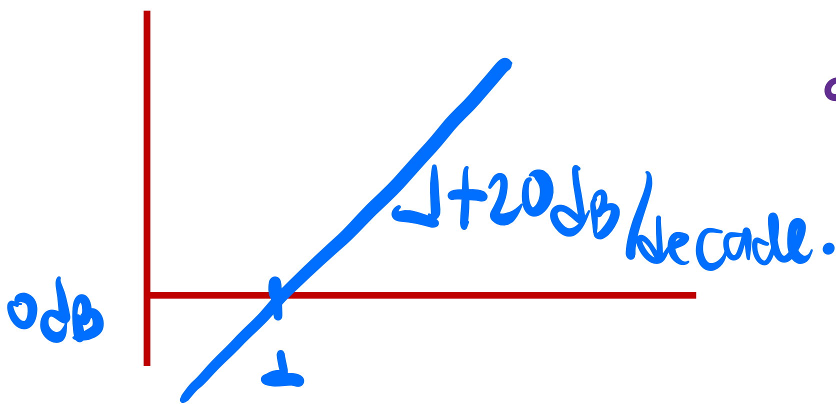
Sketch a Bode Plot

Zero @ the origin:

- $H(s) = j\omega = \dfrac{1}{1/jw}$ ← K

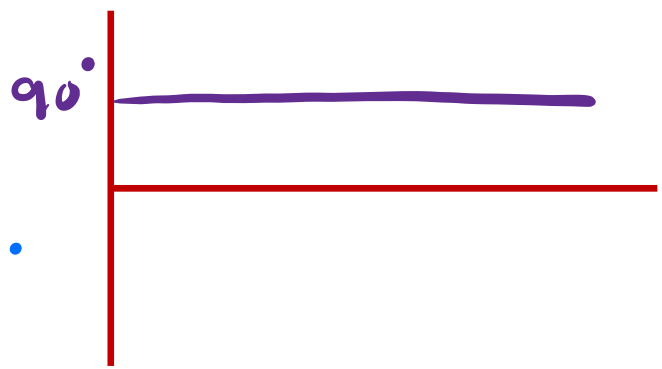
pole @ origin

Magnitude



Phase.

$0 - (-90^\circ)$



$$20\log_{10}\left(\frac{M_{num}}{M_{den}}\right) = \cancel{20\log_{10}(M_{num})}^{\,0} - 20\log_{10}(M_{den})$$

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Sketch a Bode Plot

Real Pole:

- $H(s) = \dfrac{1}{1 + \frac{j\omega}{\omega_0}}$

$\hookrightarrow$ W_0 = pole

poles: $1 + \dfrac{x}{W_0} = 0$

$\dfrac{x}{W_0} = -1$

$x = -W_0$

$\hookrightarrow$ critical Frequencies

LPF $\dfrac{1}{1 + jwCR}$

$1 + jw$

$W_0 = \dfrac{1}{} = \dfrac{1}{CR}$

pole

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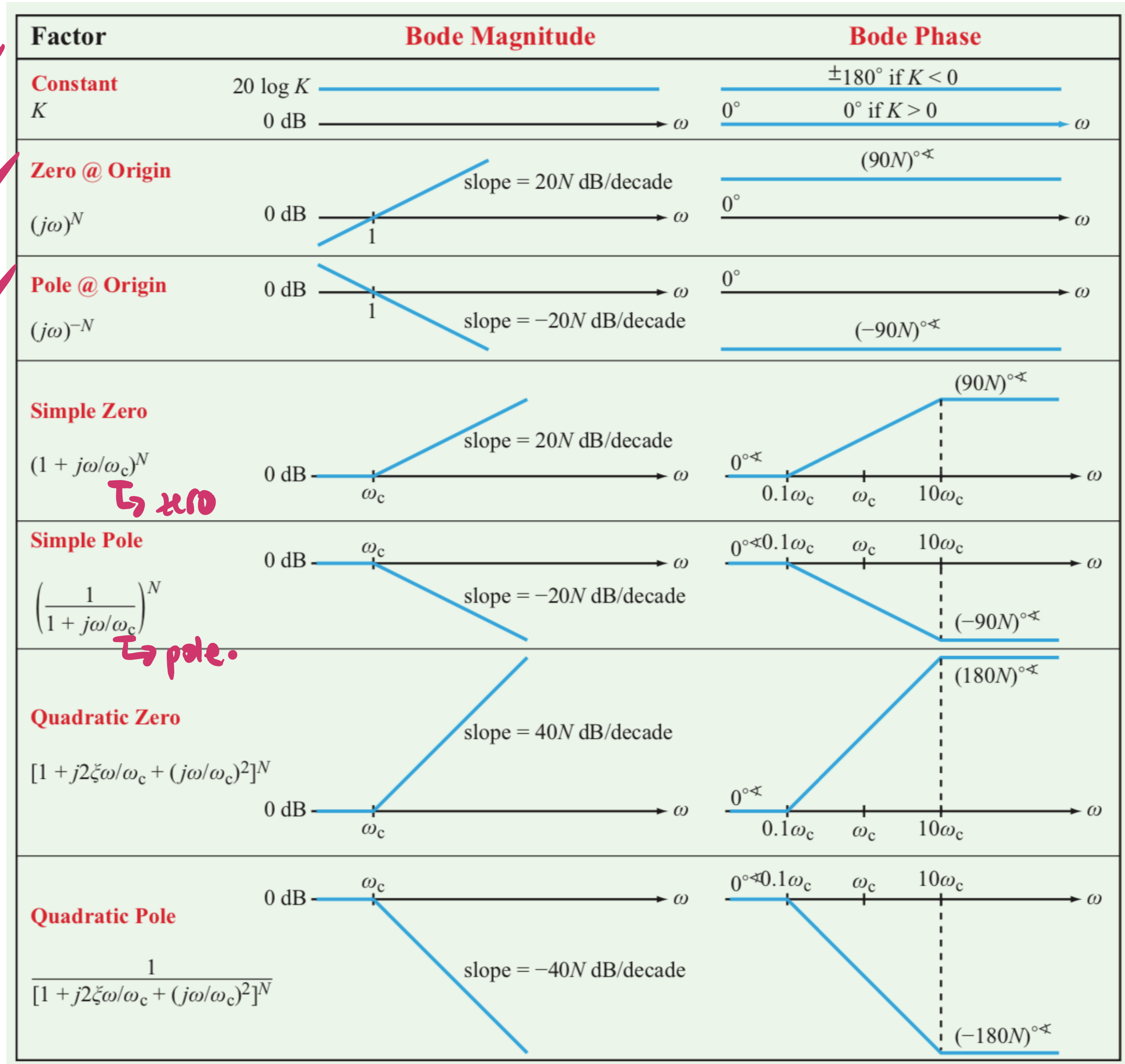
Sketch a Bode Plot



1 + jw

↳ zero

↳ pole.

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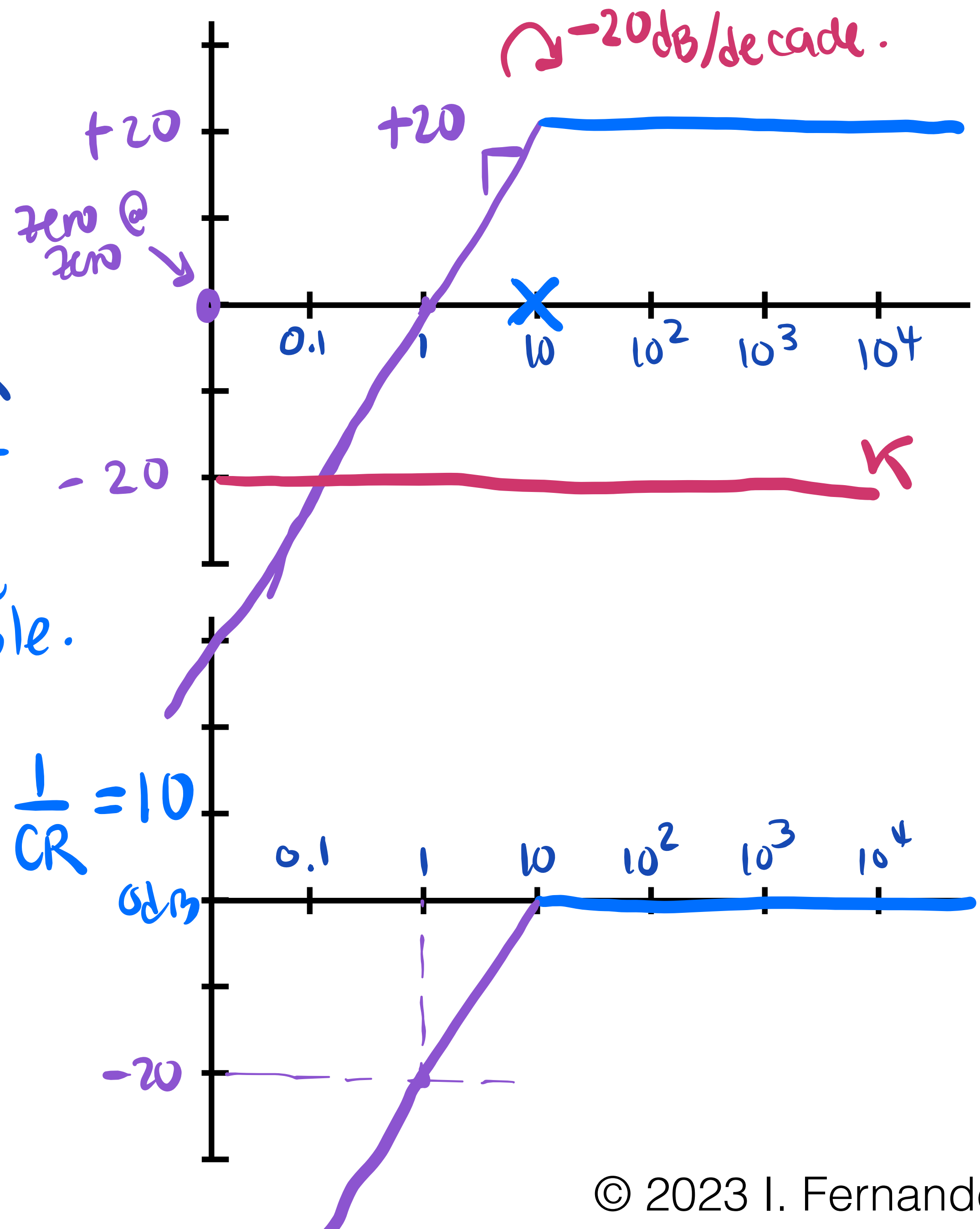
Example 1

HPF $\dfrac{j\omega CR}{1+j\omega CR}$

$$CR \cdot j\omega \cdot \frac{1}{1+j\omega CR}$$

①	②	③
constant K	zero @ zero	simple pole.
$CR = 0.1$	$\downarrow$	$\downarrow$
$\Downarrow$	$w_1 = 0$	$w_2 = \dfrac{1}{CR} = 10$
$K = 0.1$	O	X

$$20\log_{10}(0.1) = -20\,dB$$



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Example 3

$$H(s) = \frac{5 + jw}{1 + jw10}$$

$$= \frac{5(1 + jw0.2)}{1 + jw10}$$

$$= \underbrace{5}_{①} \cdot \underbrace{(1 + jw0.2)}_{②} \cdot \underbrace{\frac{1}{1 + jw10}}_{③}$$

① K

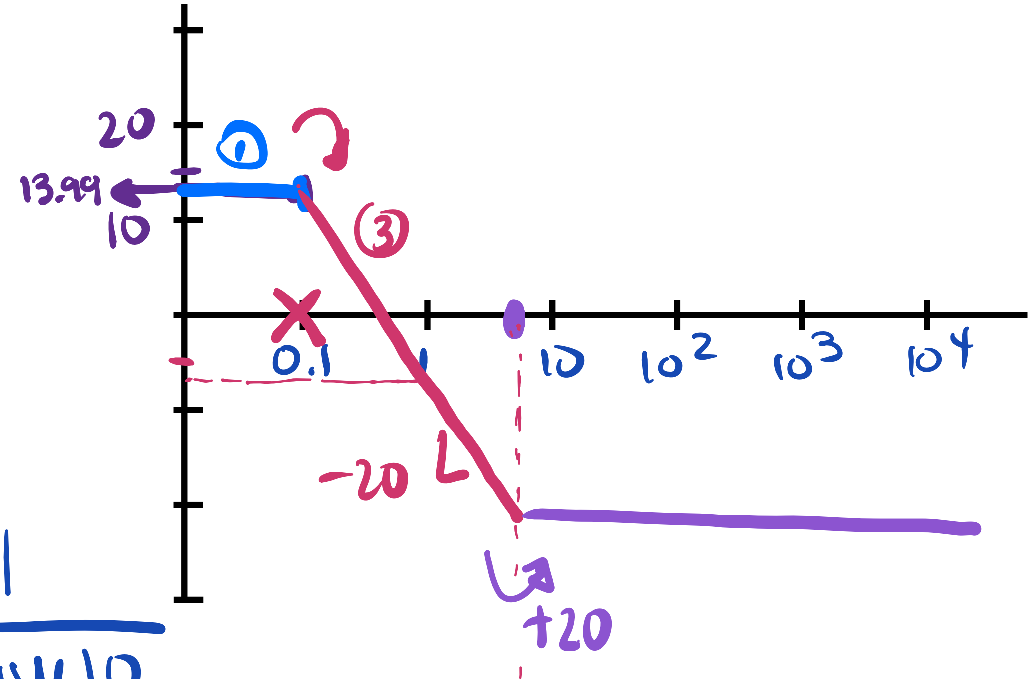
② simple zero

③ simple pole.

$$20 \log_{10}(5) = 13.99$$

$$w_1 = \frac{1}{0.2} = 5$$

$$w_2 = \frac{1}{10} = 0.1$$



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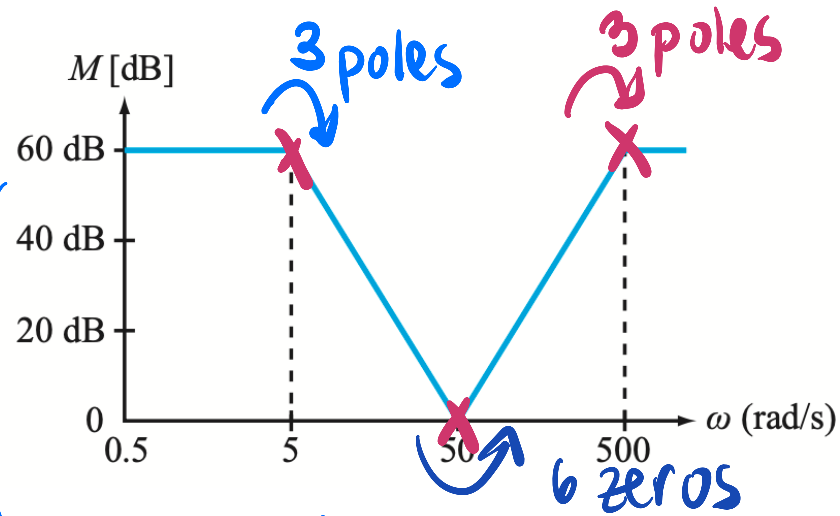
Example 3

Determine the voltage transfer function H(ω) corresponding to the Bode magnitude plot shown



$$60 = 20\log_{10}(K)$$

$$3 = \log_{10}(K)$$

$$10^3 = K$$

$$H(jw) = ???$$

$$= \frac{10^3\,(1 + jw/50)^6}{(1 + jw/5)^3\,(1 + jw/500)^3}$$

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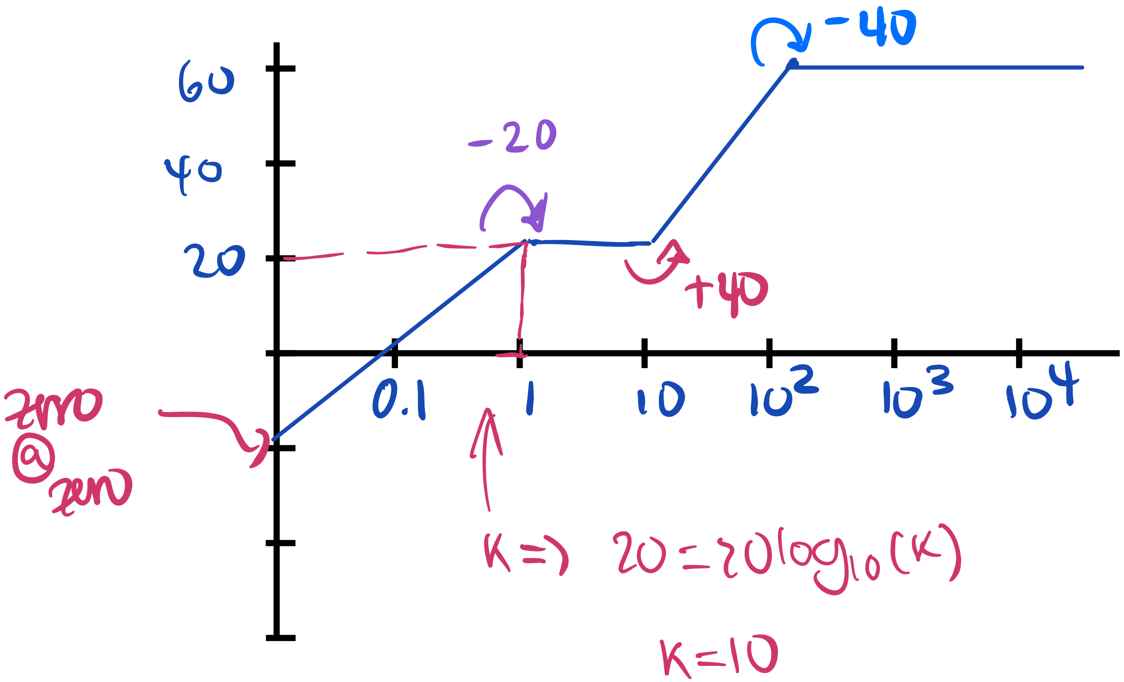
Example 4

$$H(j\omega) = ???$$

$$= \frac{10 j\omega \left(1 + j\omega/10\right)^2}{\left(1 + j\omega\right)\left(1 + j\omega/100\right)^2}$$



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