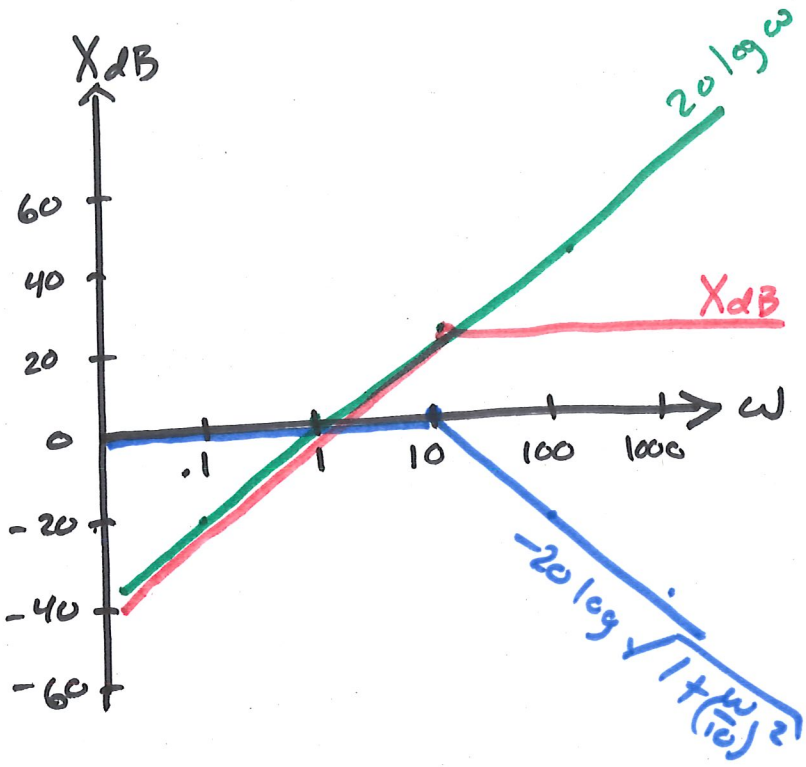
Bode Hw ①

$$X(s) = \frac{10s}{s+10} = \frac{s}{1+s/10}$$

$$X(\omega) = \frac{j\omega}{1+\frac{j\omega}{10}} = \left|\frac{j\omega}{1+j\frac{\omega}{10}}\right| \angle \frac{j}{\tan^{-1}(\omega/10)} \quad (j \leftarrow 90^\circ)$$

gain Bode

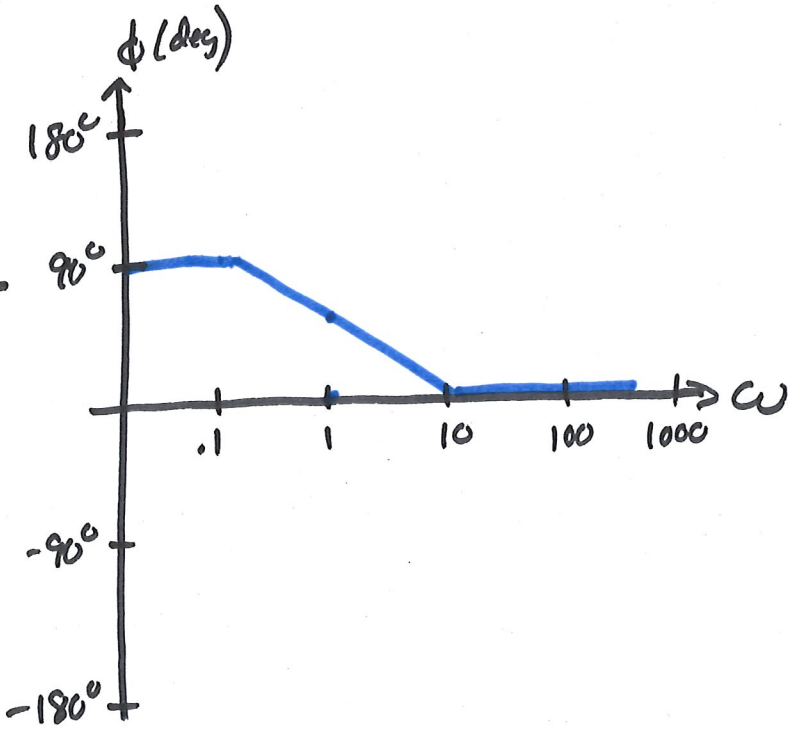
$$X_{dB} = 20\log\omega - 20\log\sqrt{1+\left(\frac{\omega}{10}\right)^2}$$



phase Bode

$$\phi = 90^\circ - \tan^{-1}\left(\frac{\omega}{10}\right)$$

ω	$\frac{\omega}{10}$	$\text{atand}\left(\frac{\omega}{10}\right)$	ϕ
.1	.01	~0°	90°
1	.1	5.7°	~90°
10	1	45°	45°
100	10	84.3°	~0°
1000	100	~90°	0°



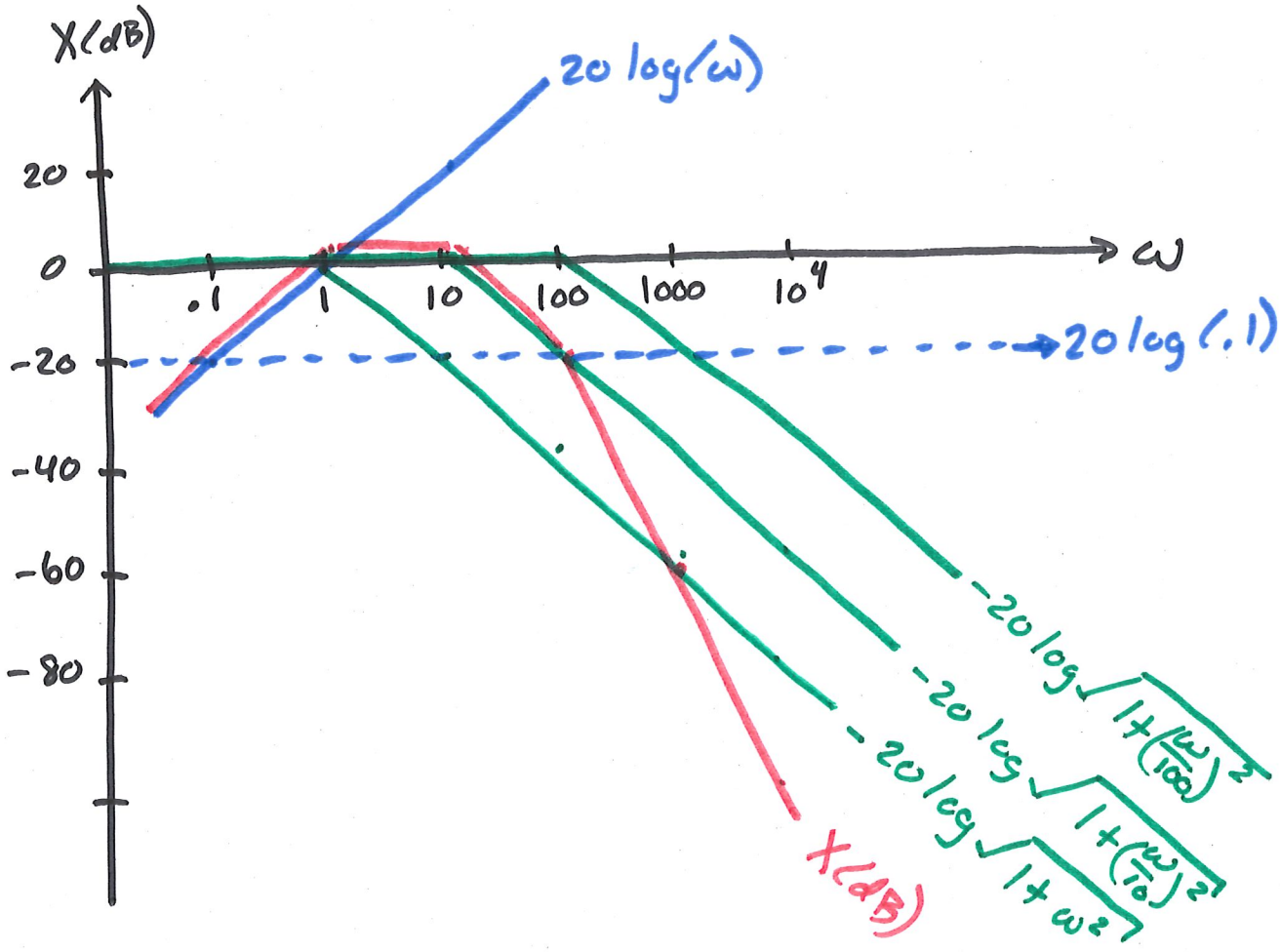
Bode HW (2)

$$X(s) = \frac{10s}{(s+1)(s+10)(s+100)} = \frac{10s/(10)(100)}{(1+s)(1+\frac{s}{10})(1+\frac{s}{100})}$$

$$X(s) = \frac{1}{10}\,\frac{s}{(1+s)(1+\frac{s}{10})(1+\frac{s}{100})}$$

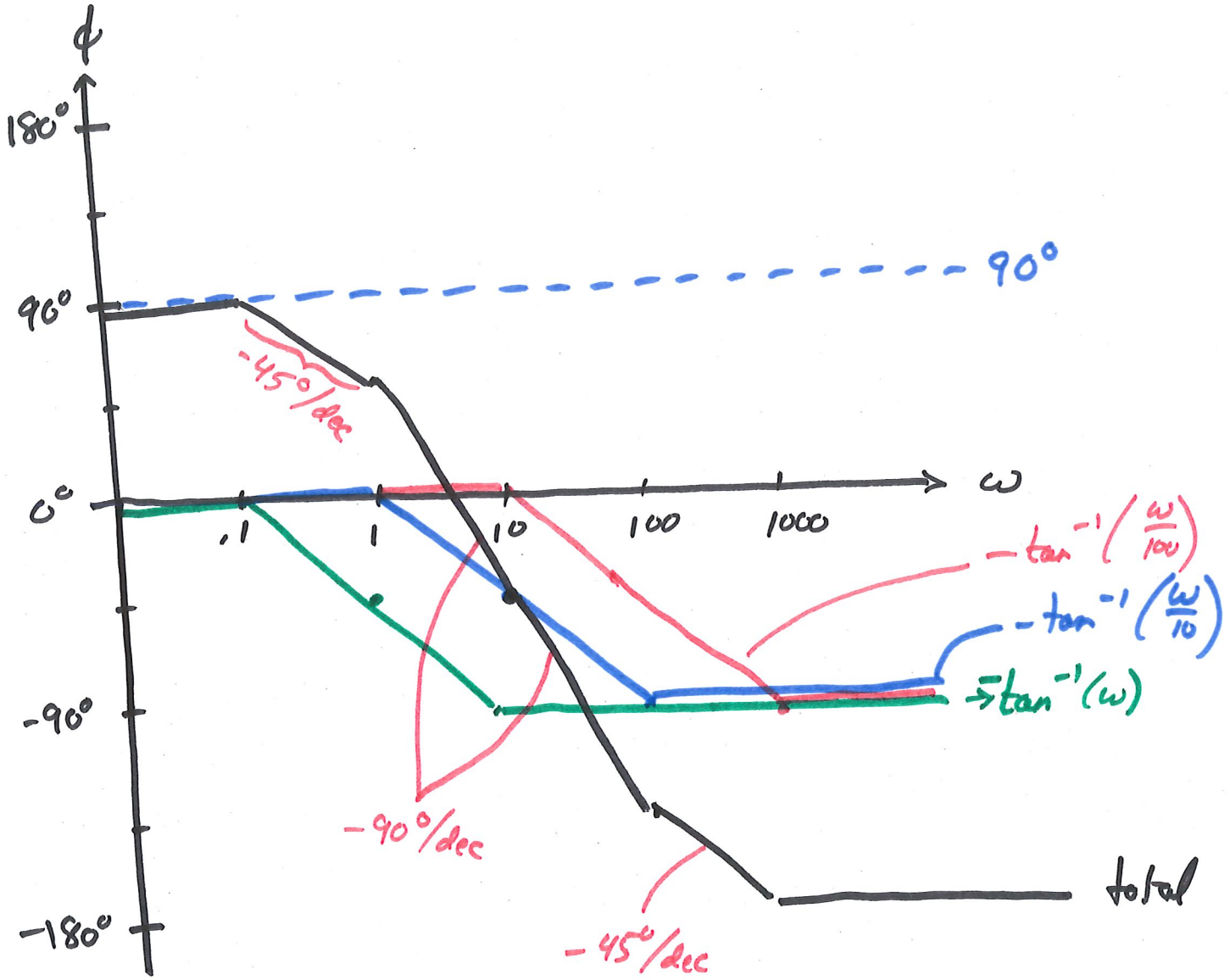
$(s \to j\omega)$

$$X(dB) = 20\log(.1) + 20\log(\omega) - 20\log\sqrt{1+\omega^2}$$
$$-20\log\sqrt{1+\left(\frac{\omega}{10}\right)^2} - 20\log\sqrt{1+\left(\frac{\omega}{100}\right)^2}$$

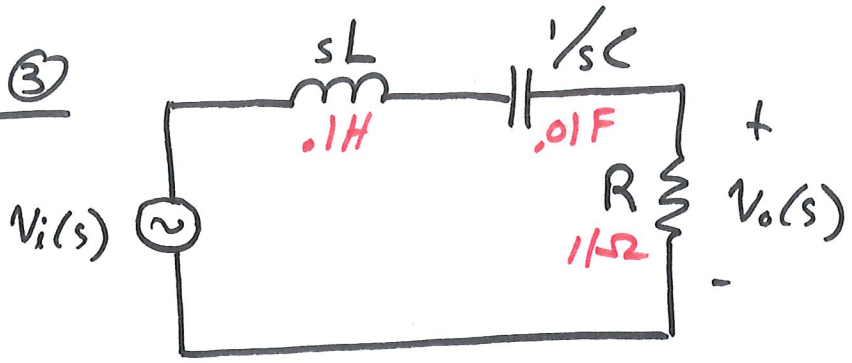


Bode HW2 → phase

$$\phi = 90^\circ - \tan^{-1}(\omega) - \tan^{-1}\left(\frac{\omega}{10}\right) - \tan^{-1}\left(\frac{\omega}{100}\right)$$



Bode HW ③



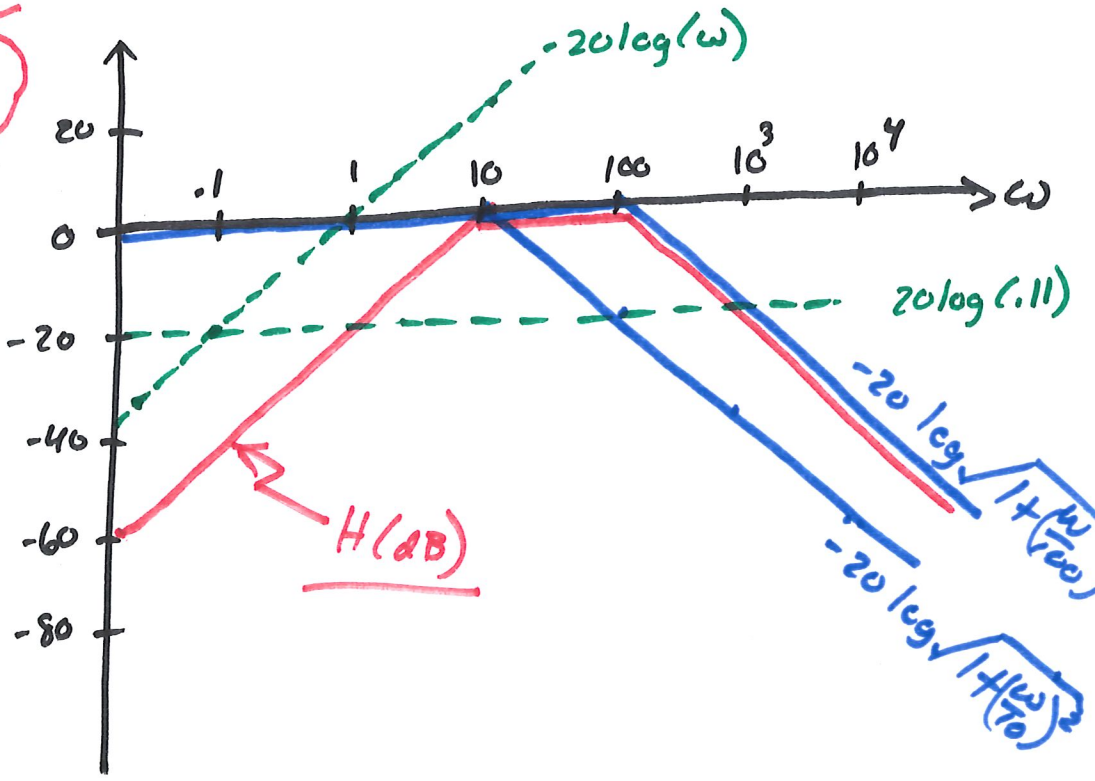
$$H(s) = \frac{V_o(s)}{V_i(s)} = \frac{R}{sL + R + \frac{1}{sC}} = \frac{sRC}{s^2LC + sRC + 1} = \frac{.11s}{.001s^2 + .11s + 1}$$

$$H(s) = \frac{110s}{s^2 + 110s + 1000} = \frac{110s}{(s+10)(s+100)} = \frac{.11s}{\left(1+\frac{s}{10}\right)\left(1+\frac{s}{100}\right)}$$

$$H(\omega) = \frac{.11(j\omega)}{\left(1+\frac{j\omega}{10}\right)\left(1+\frac{j\omega}{100}\right)}$$

$$H(dB) = 20\log(.11) + 20\log(\omega) - 20\log\sqrt{1+\left(\frac{\omega}{10}\right)^2} - 20\log\sqrt{1+\left(\frac{\omega}{100}\right)^2}$$

$= -19.17\ dB$
$\approx -20\ dB$



Bode HW③ – phase

$$\phi = 90^\circ - \tan^{-1}\left(\frac{\omega}{10}\right) - \tan^{-1}\left(\frac{\omega}{100}\right)$$