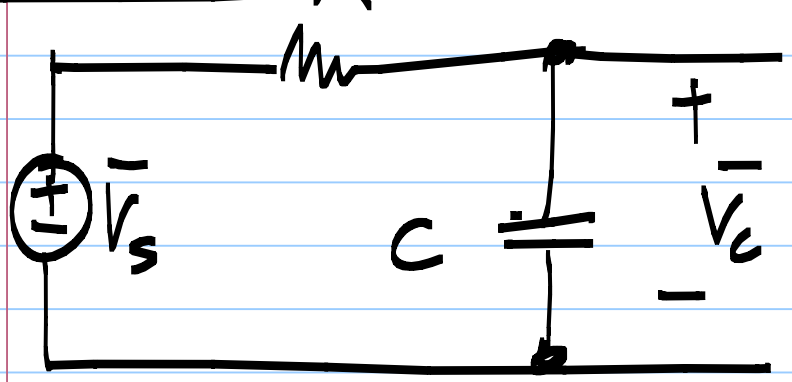
EE 2015 $\overline{V_R}$ $\left|\frac{\overline{V_R}}{\overline{V_s}}\right|$ 4/10/2017



$$H(j\omega) = \frac{\overline{V_c}}{\overline{V_s}} = \frac{1}{1+j\omega CR}$$

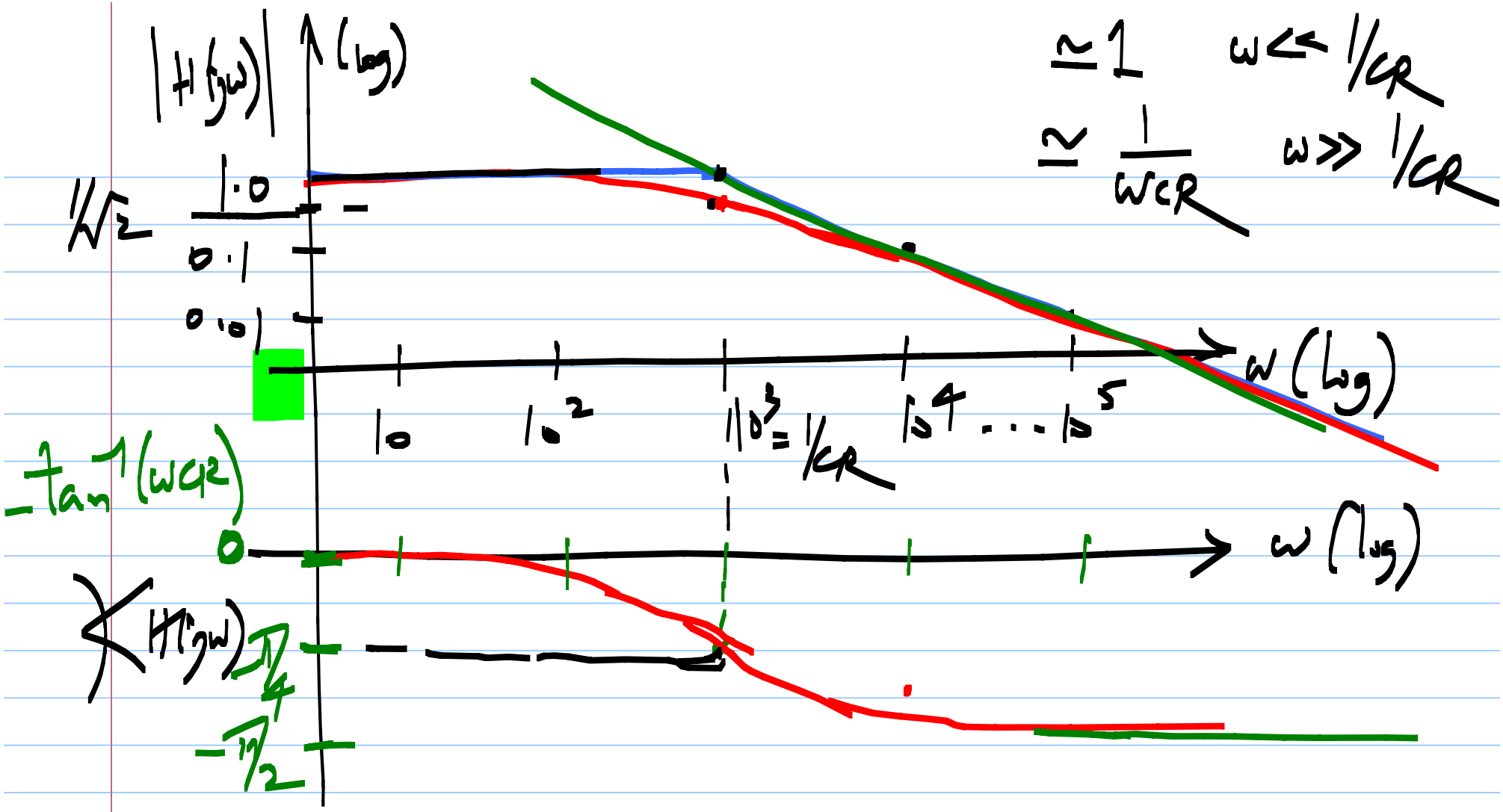
$C = 1\mu F$, $R = 1k\Omega$

$$|H(j\omega)| = \frac{1}{\sqrt{1+(\omega CR)^2}}$$

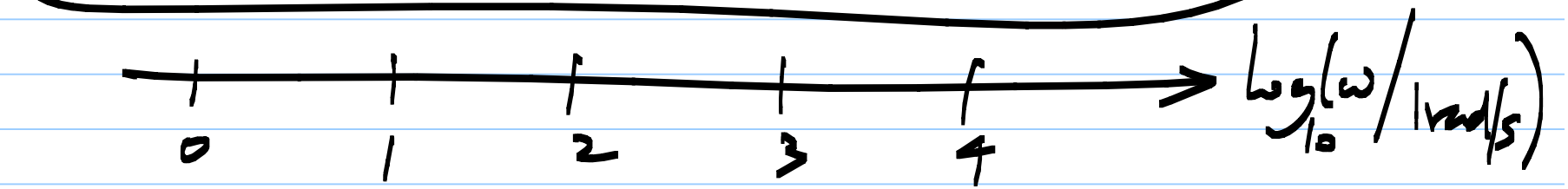
$\omega CR \ll 1 \quad \simeq 1$

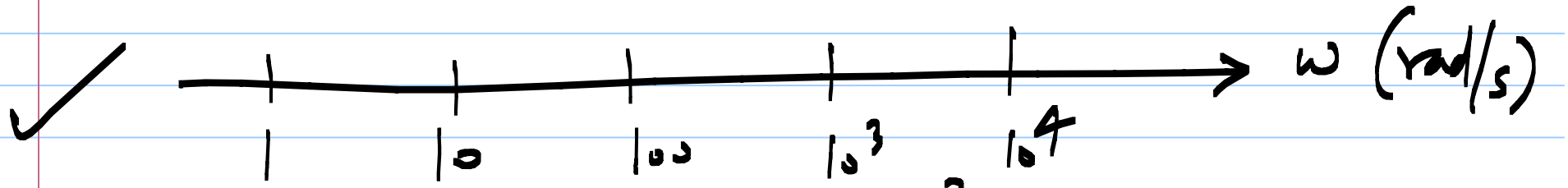
$\omega CR \gg 1 \quad \simeq 1/\omega CR$

$$\angle H(j\omega) = -\tan^{-1}(\omega CR)$$


$|H(j\omega)|$ (log)
$\simeq 1$ $\omega \ll 1/CR$
$\simeq \frac{1}{\omega CR}$ $\omega \gg 1/CR$
$1/\sqrt{2}$
1.0
0.1
0.01
10
10^2
$10^3 = 1/CR$
$10^4 \ldots 10^5$
ω (log)
$-\tan^{-1}(\omega CR)$
0
ω (log)
$\angle H(j\omega)$
$-\pi/4$
$-\pi/2$

$$-\tan^{-1}(x) + \tan^{-1}\left(\frac{1}{x}\right) = \pi/2$$

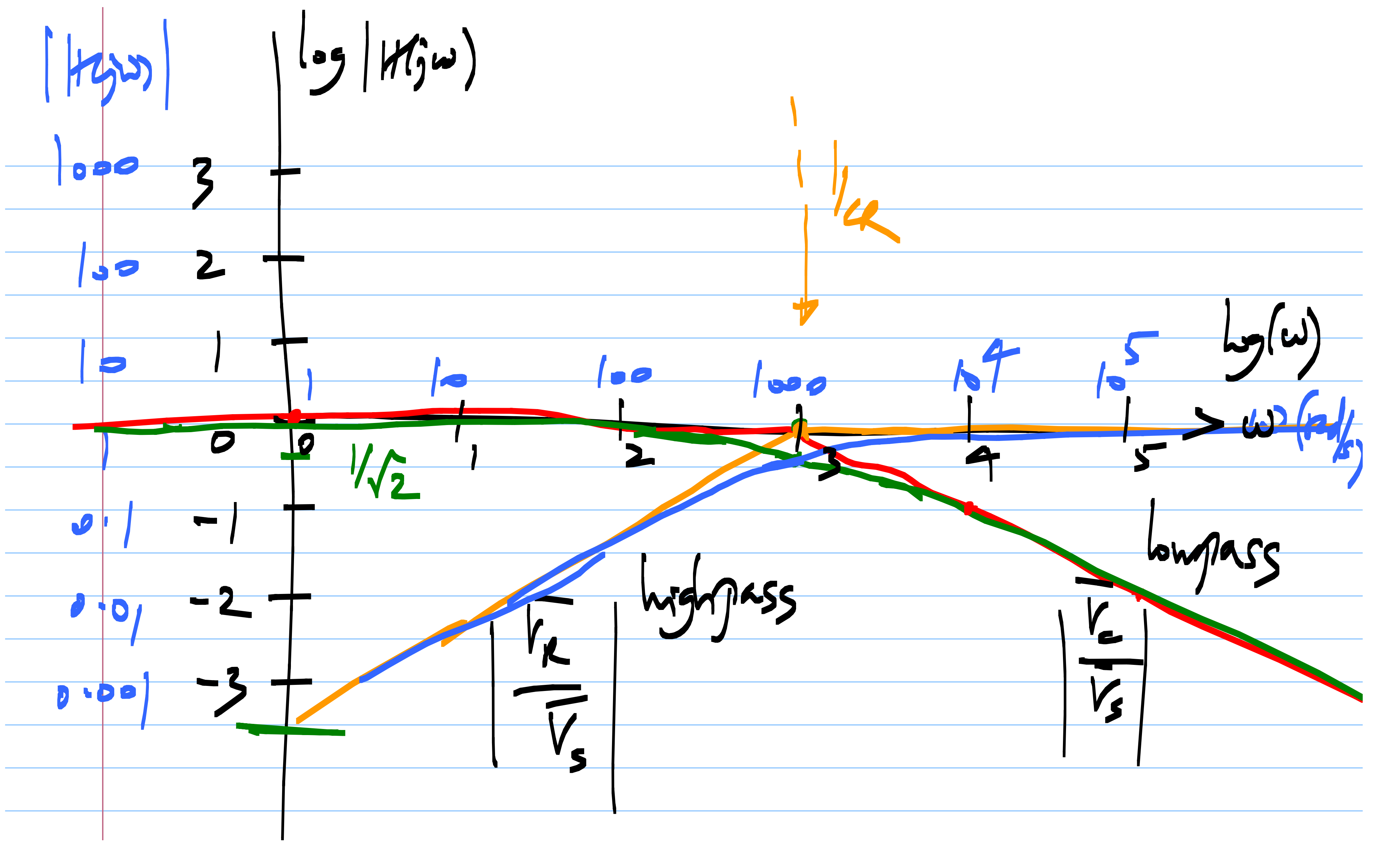




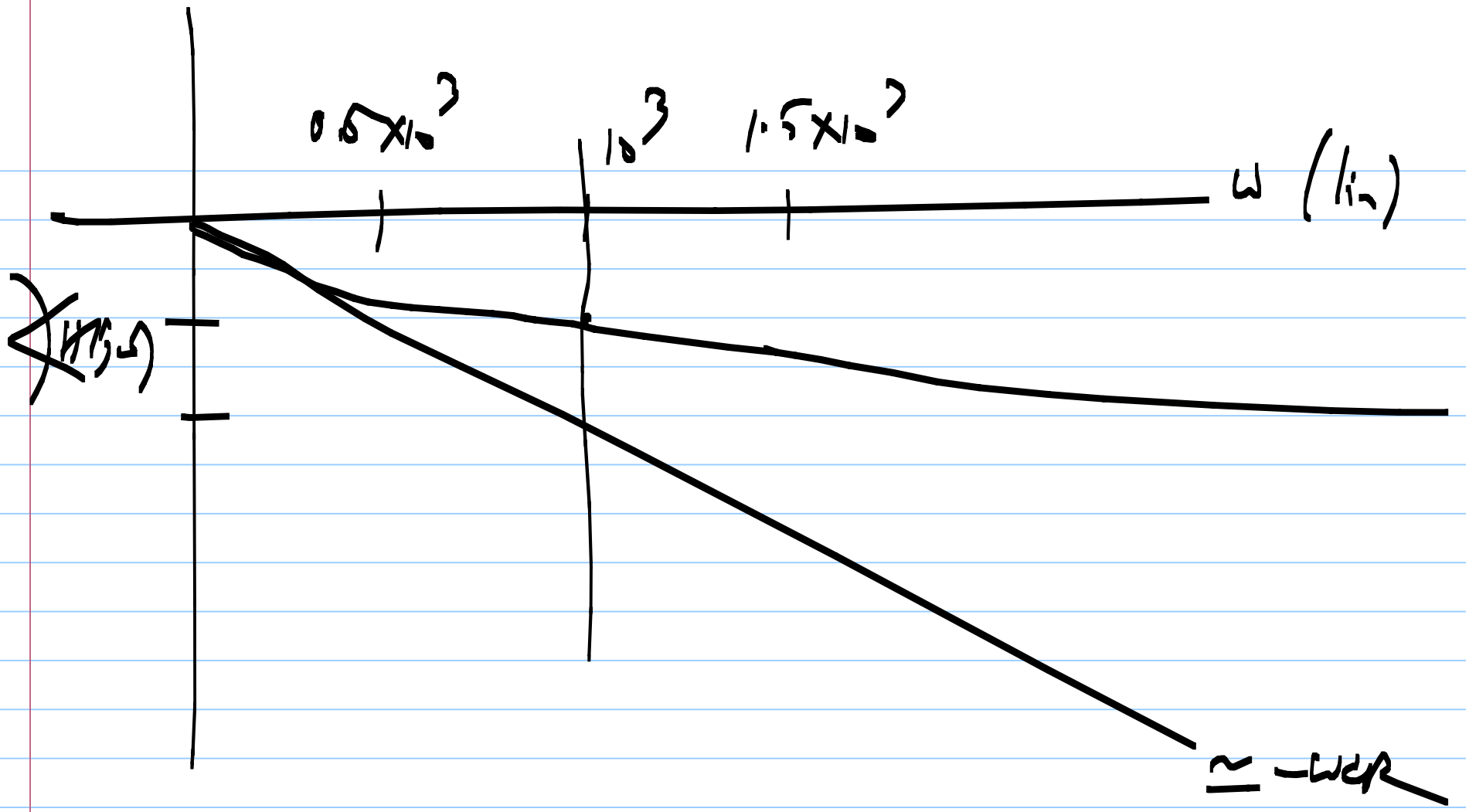
$\omega = 10/\mathrm{rad}$ $\quad$ $\omega = 10^3\ 0.1/\mathrm{rad}$

$$\tan^{-1}(10) + \tan^{-1}\left(\frac{1}{10}\right) = \pi/2$$

$$\tan^{-1}(3) + \tan^{-1}\left(\frac{1}{3}\right) = \pi/2$$



|H(jω)|
log |H(jω)|
1000
100
10
1
0.1
0.01
0.001
3
2
1
0
-1
-2
-3
1/√2
10
100
1000
10^4
10^5
log(ω)
ω (rad/s)
1/ω
highpass
lowpass
$|V_R / V_s|$
$|V_c / V_s|$

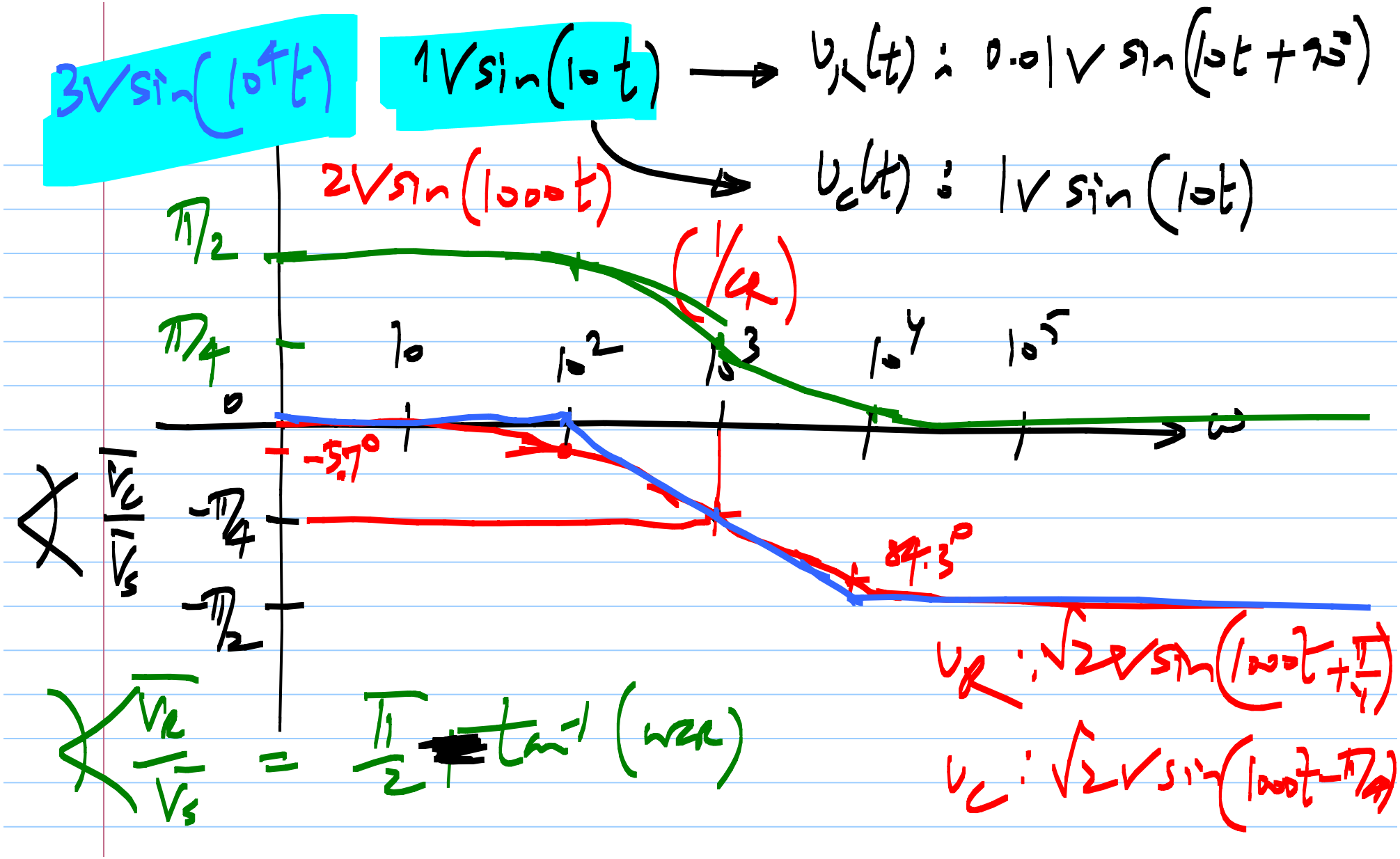

0.5×10^3
10^3
1.5×10^3
ω (rad/s)
χ(ω)
~ -1/ω

$$\frac{\bar{V}_R}{\bar{V}_s} = \frac{j\omega CR}{1 + j\omega CR}$$

$$\left|\frac{\bar{V}_R}{\bar{V}_s}\right| = \frac{\omega CR}{\sqrt{1 + (\omega CR)^2}}$$

$\omega \ll 1/CR$

$\omega \gg 1/CR$ 1


3V sin(10⁴t)
1V sin(10t)
$v_R(t)$: 0.01V sin(10t + 25°)
$v_C(t)$: 1V sin(10t)
2V sin(1000t)
π/2
π/4
0
10
10²
10³
10⁴
10⁵
ω
1/CR
-57°
-π/4
-π/2
84.3°
$\angle \frac{V_R}{V_S}$
$\frac{|V_C|}{|V_S|}$
$\angle \frac{V_R}{V_S} = \frac{\pi}{2} - \tan^{-1}(\omega CR)$
v_R : $\sqrt{2}V \sin(1000t + \frac{\pi}{4})$
v_C : $\sqrt{2}V \sin(1000t - \pi/4)$