Lecture 10

~~First~~ order:

Second

$$A(s) = \frac{A_0}{\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)}$$

$$A(s) = \frac{A_0/k}{\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)}$$

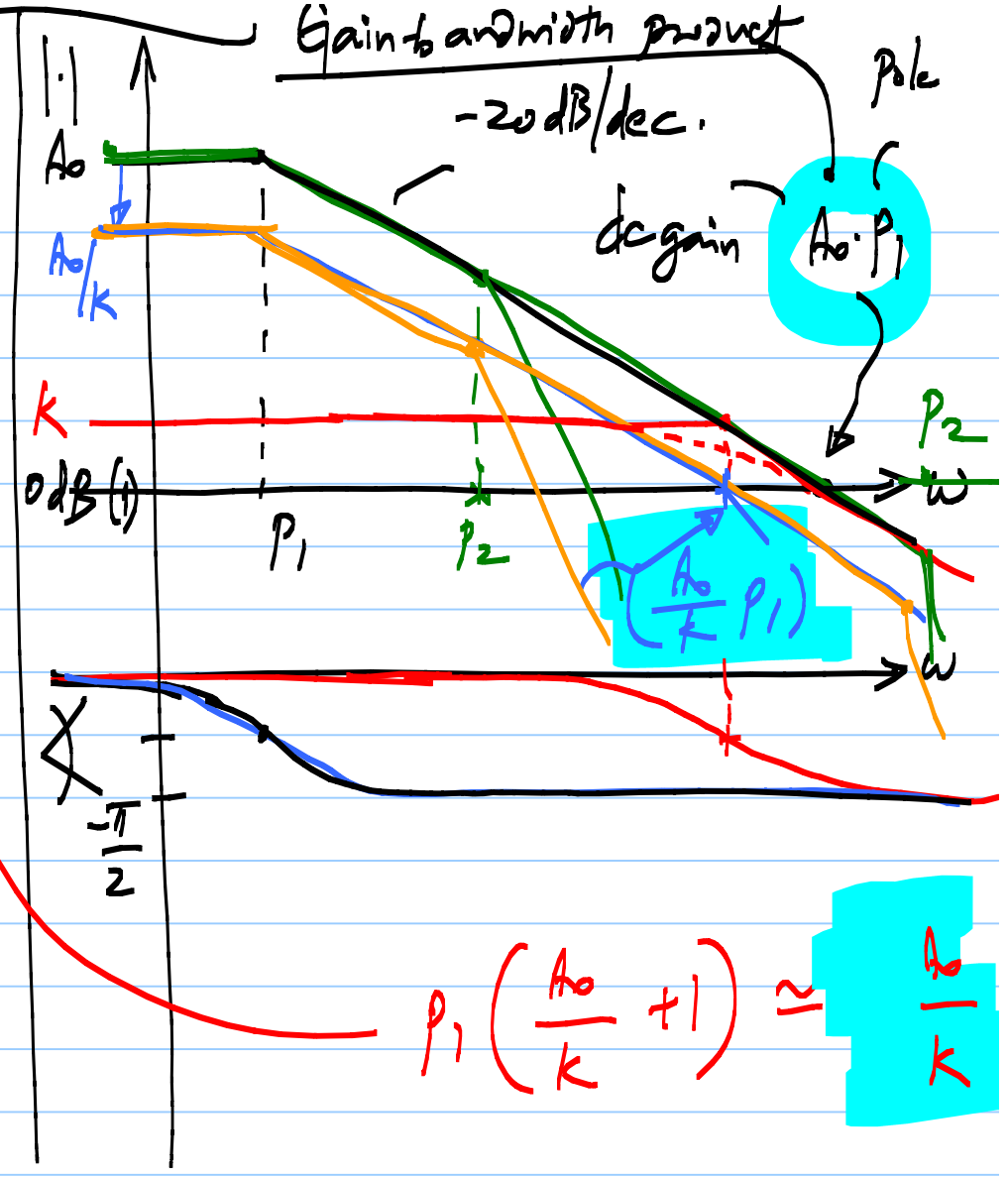
$$\zeta : \frac{1}{2}\sqrt{\frac{k}{A_0}}\left(\sqrt{\frac{p_1}{p_2}}+\sqrt{\frac{p_2}{p_1}}\right)$$

$$Q : \sqrt{\frac{A_0}{k}}\cdot\frac{1}{\sqrt{\frac{p_1}{p_2}}+\sqrt{\frac{p_2}{p_1}}}$$

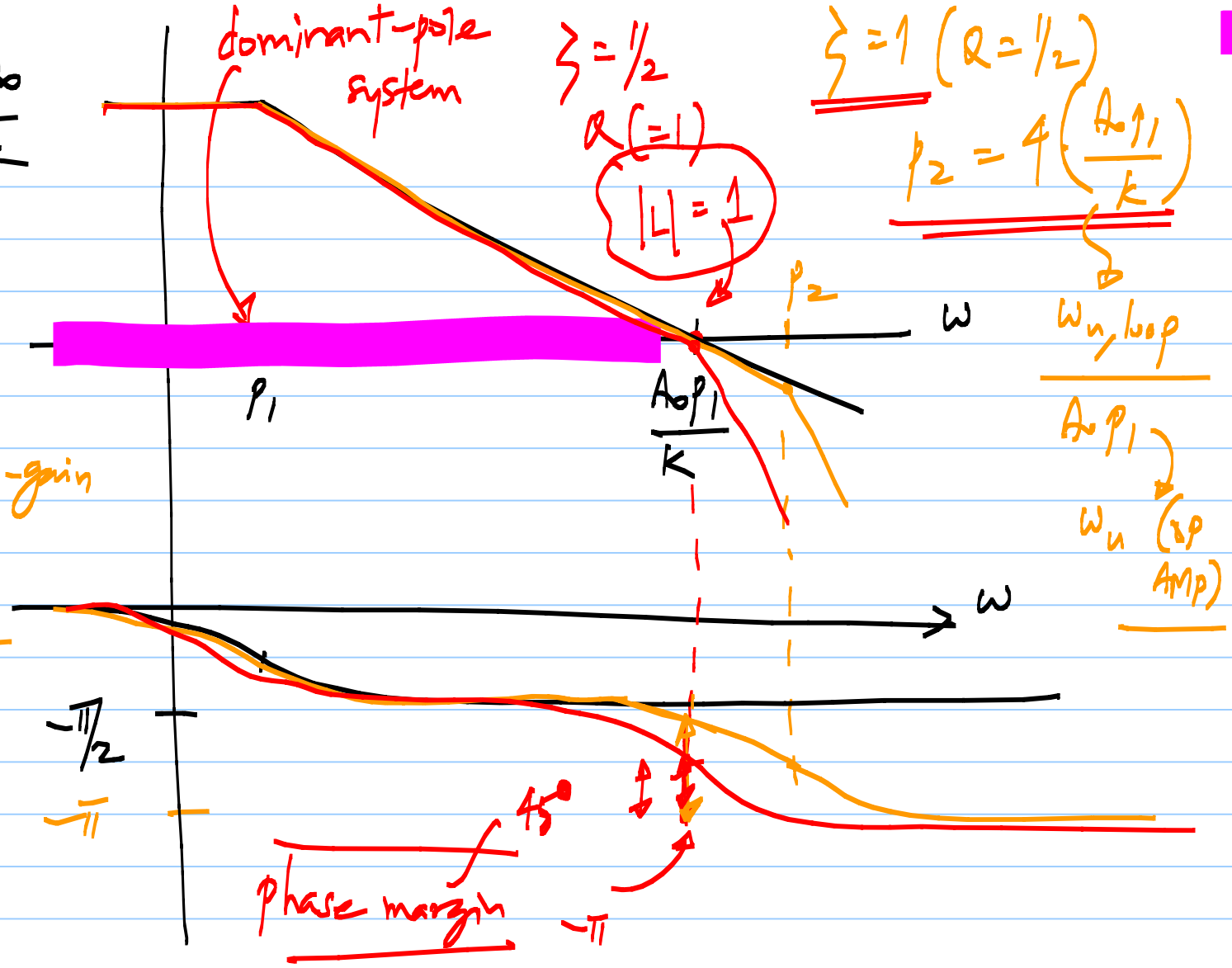
(closed loop)

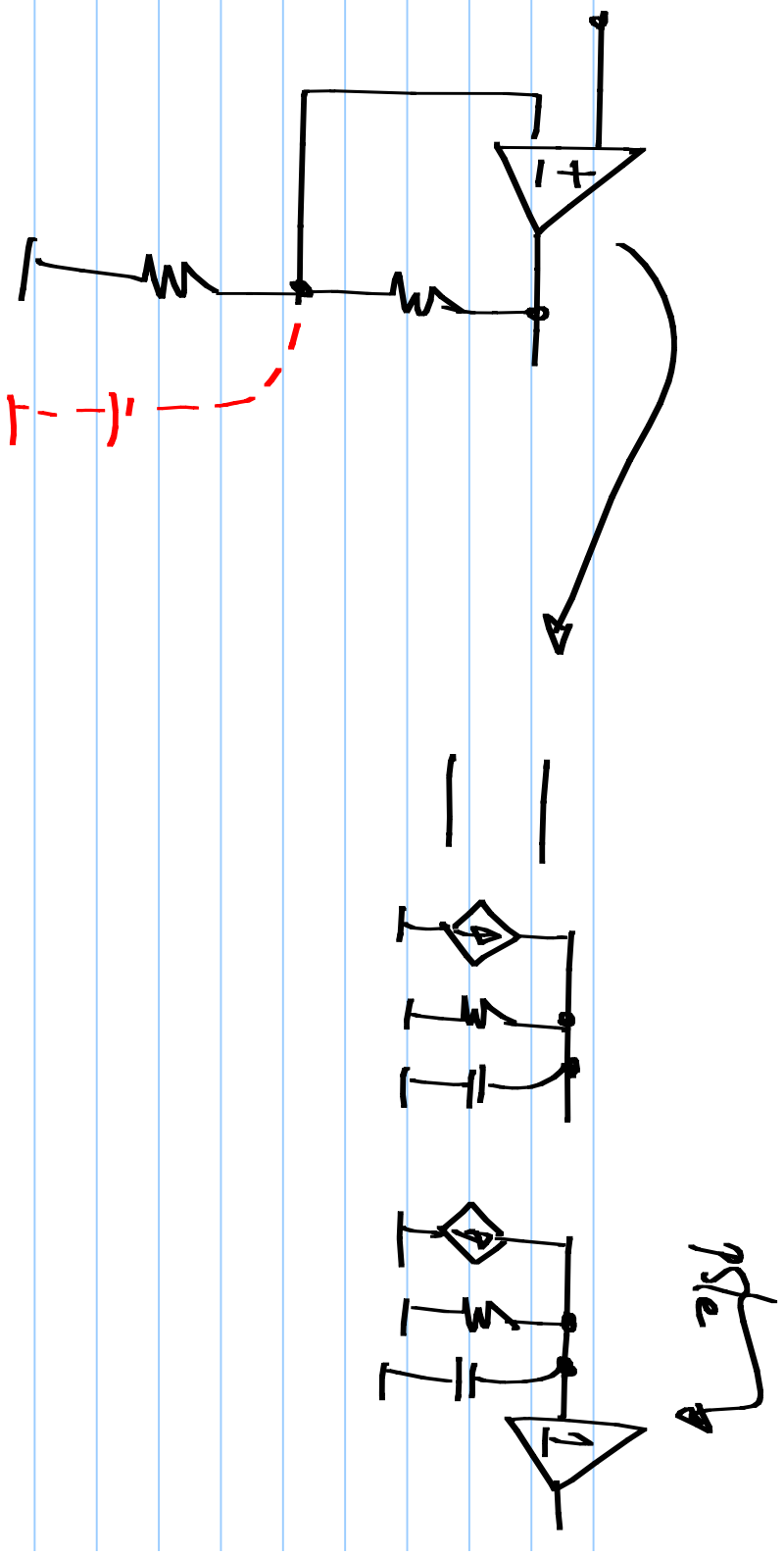
Unity gain frequency

Gain bandwidth product



p_2: (additional pole) has to be beyond the unity loop-gain frequency





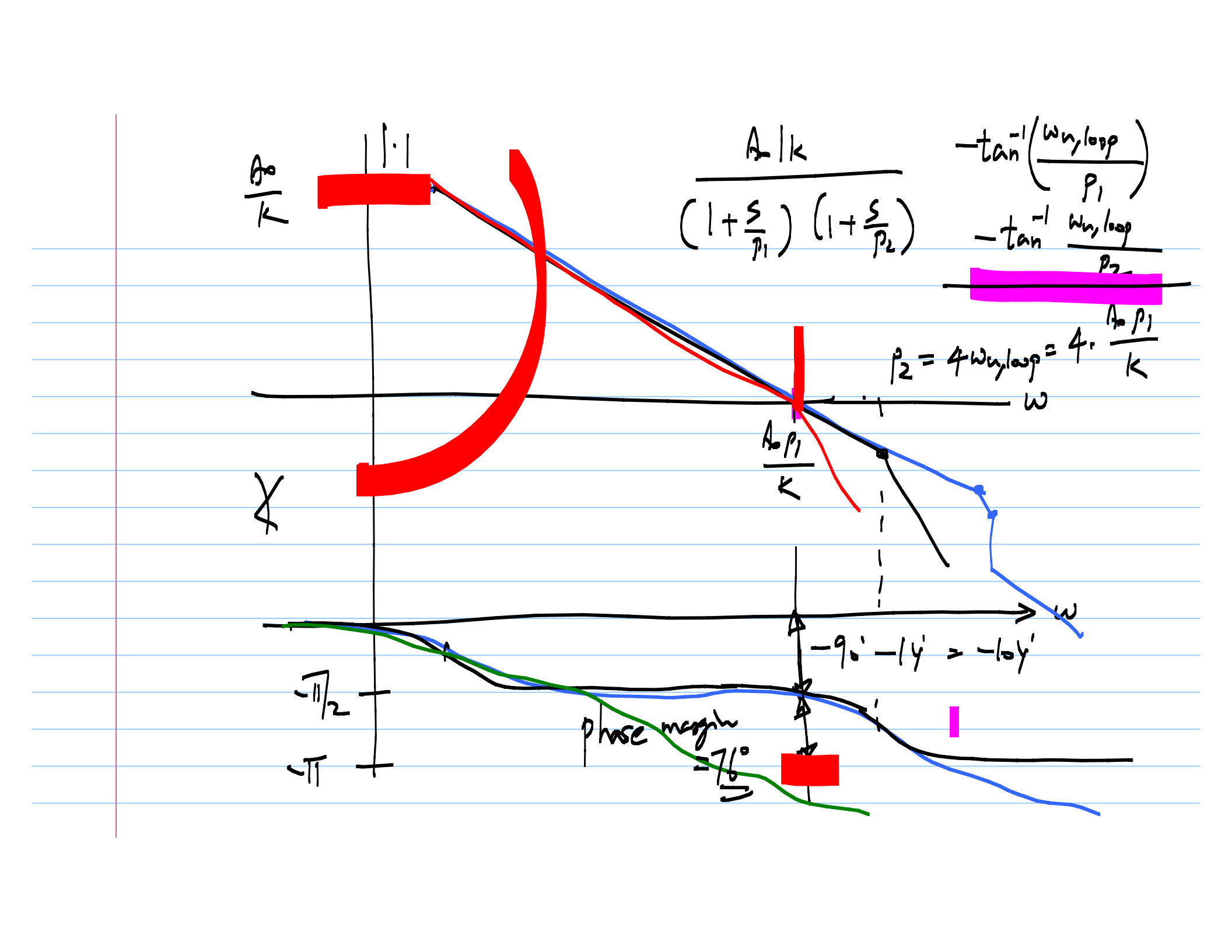
$$H(s) = \frac{G}{1 + GH} = \frac{1}{H} \cdot \frac{1}{1 + \frac{1}{GH}}$$

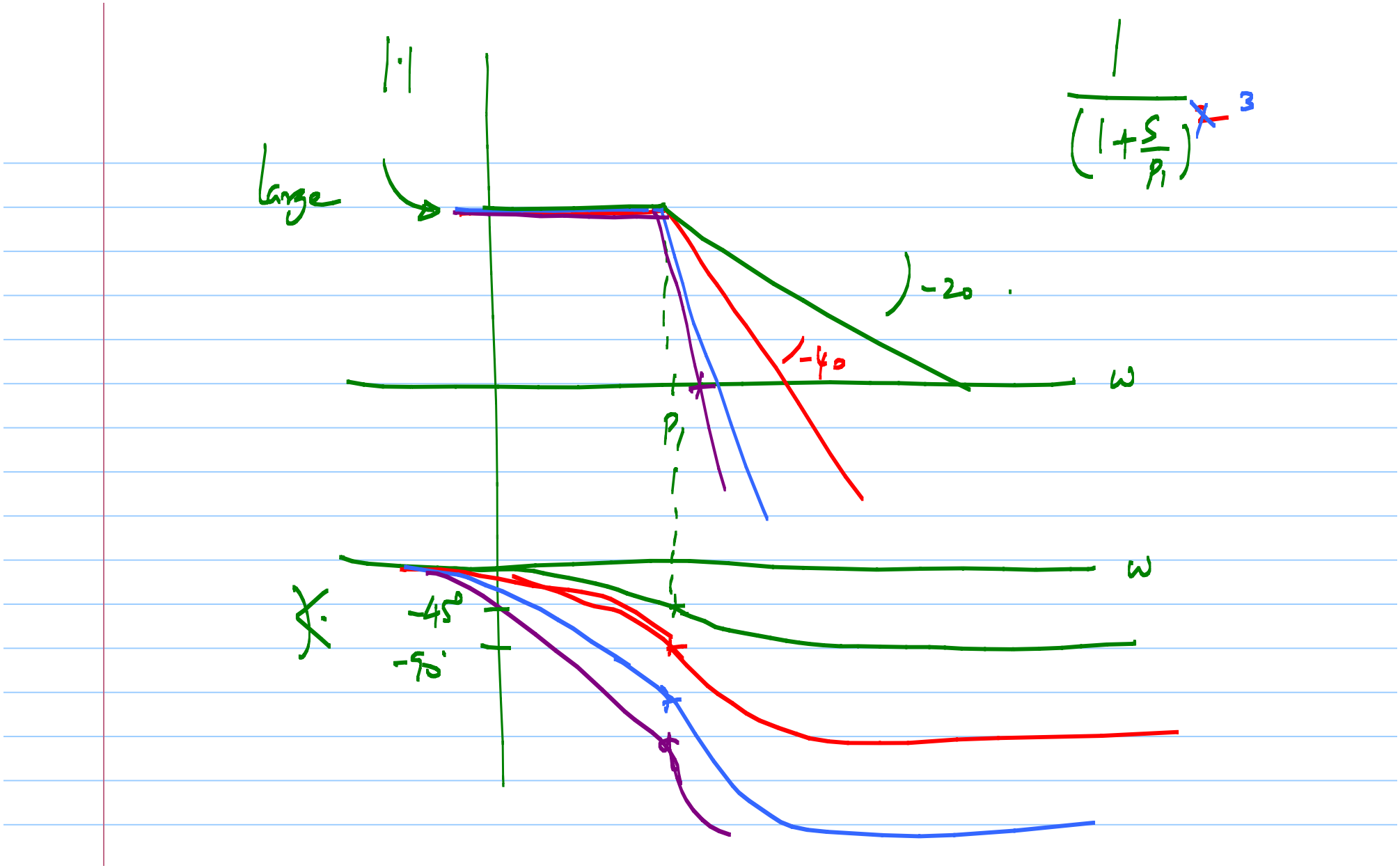
GH → L

$\frac{1}{GH}$ → Loop gain.

$$\frac{V_o}{V_i} = \frac{k}{1 + \frac{k}{A(s)}}$$

$\frac{k}{A(s)}$ → $\frac{1}{L}$


$\frac{A_0}{k}$
$|\cdot|$
$\frac{A_0 |k}{(1+\frac{s}{p_1})(1+\frac{s}{p_2})}$
$-\tan^{-1}\left(\frac{\omega_{n,loop}}{p_1}\right)$
$-\tan^{-1}\frac{\omega_{n,loop}}{p_2}$
$p_2 = 4\omega_{n,loop} = 4\cdot\frac{A_0 p_1}{k}$
ω
$\frac{A_0 p_1}{k}$
$\angle$
ω
$-90^\circ - 14^\circ = -104^\circ$
$-\pi/2$
$-\pi$
phase margin
$= 76^\circ$


$\frac{1}{\left(1+\frac{s}{p_1}\right)^3}$
|·|
large
-20
-40
p_1
ω
ω
∠·
-45°
-90°