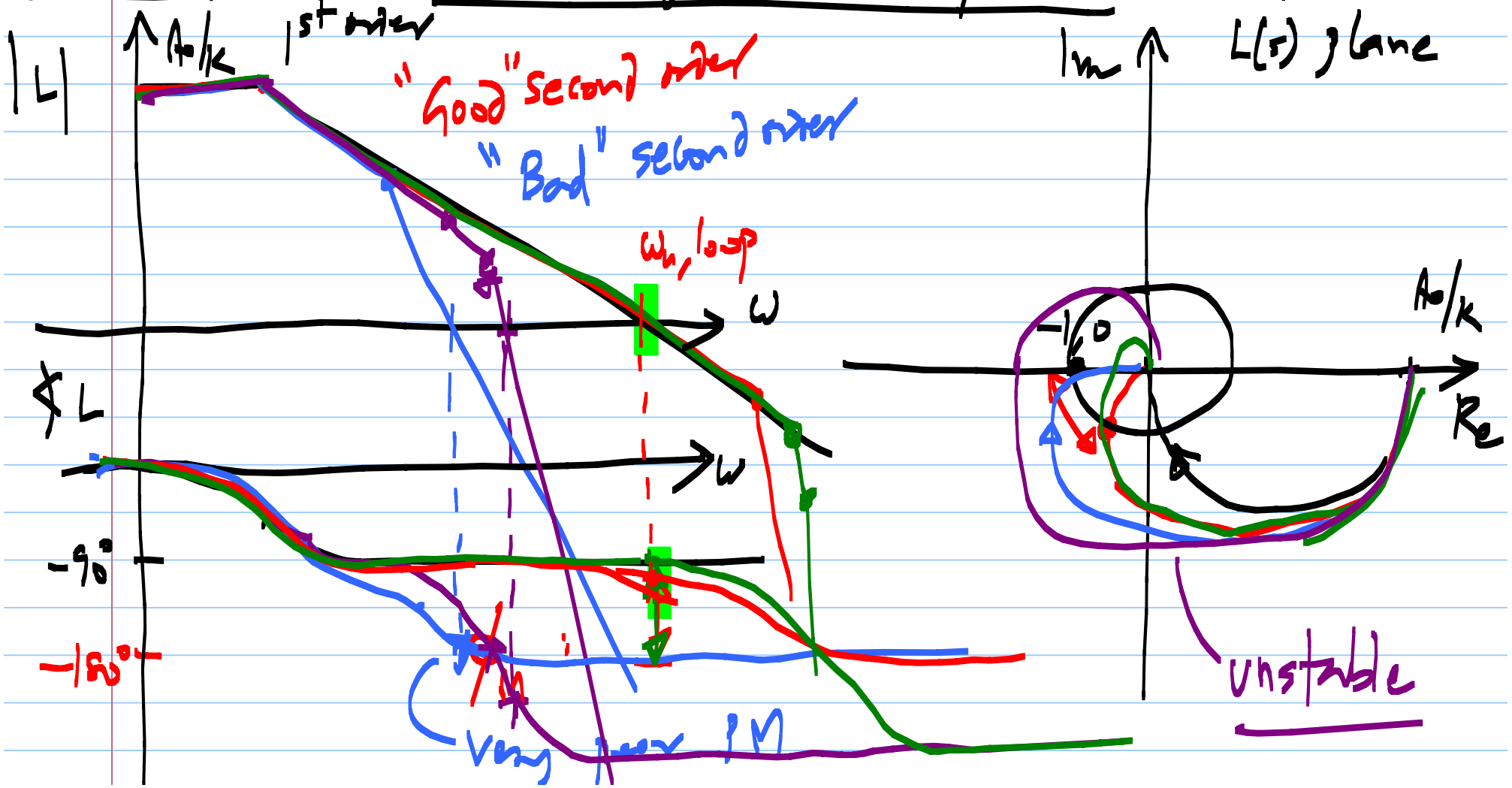
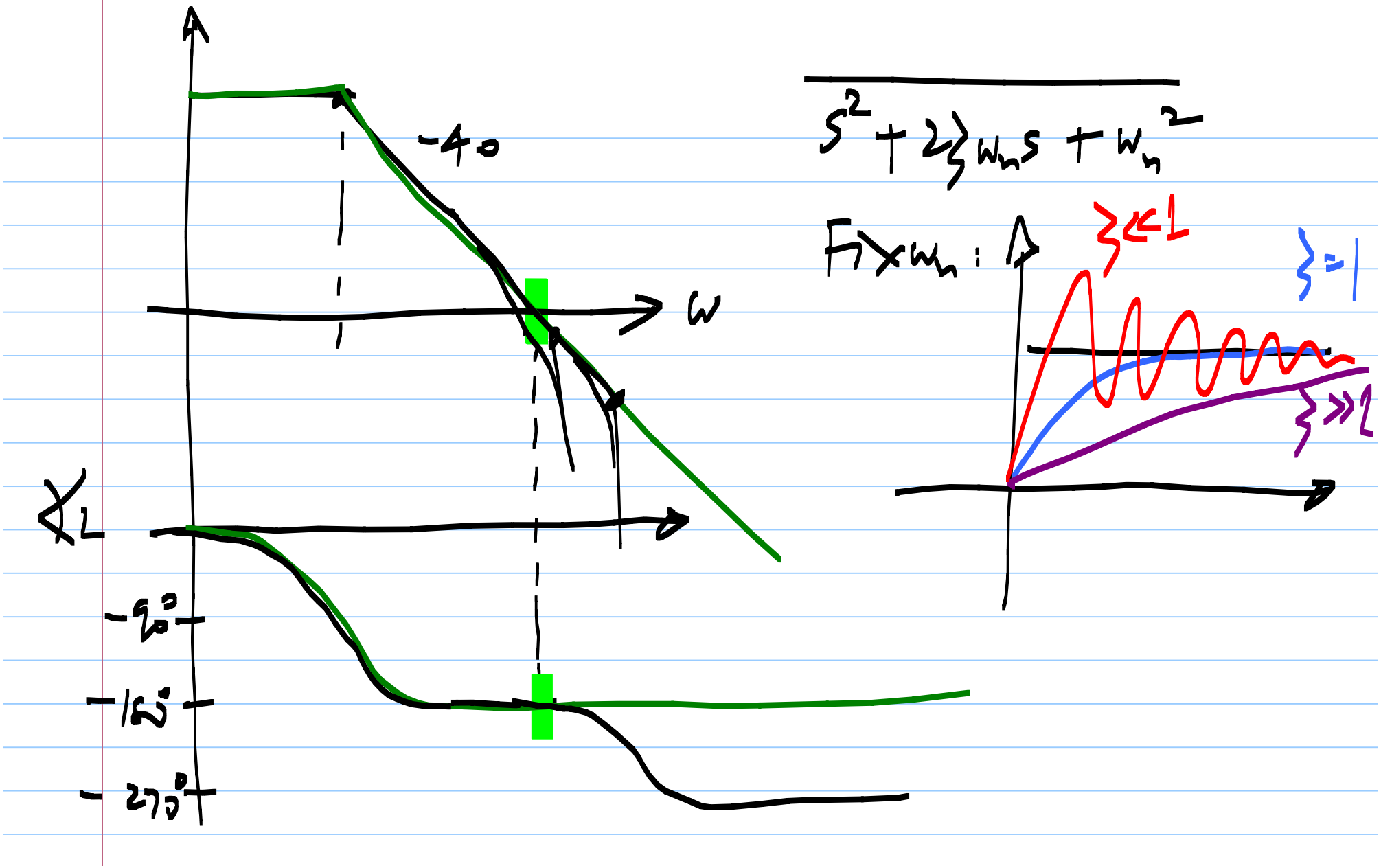
EE2019 Stability of -ve fb systems 22/2/2018





$$s^2 + 2\zeta\omega_n s + \omega_n^2$$

Fix ω_n :

$$\frac{A_0/k}{(1+s/p_1)(1+s/p_2)}$$

$$p_2 \gg \frac{A_0}{k} \cdot p_1$$

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

$$p_2 = 4\,\frac{A_0}{k} p_1$$

$$\omega_\eta = \sqrt{p_1 p_2}\,\sqrt{1+\frac{A_0}{k}}$$

Calculate ϕ_m:

$$\frac{A_0/k}{\left(1+\frac{s}{\beta_1}\right)\left(1+\frac{s}{\beta_2}\right)^2}$$

$\zeta = 1$

$\zeta = 1/\sqrt{2}$

$\zeta = 1/2$

$s = j\omega_{n,loop}$

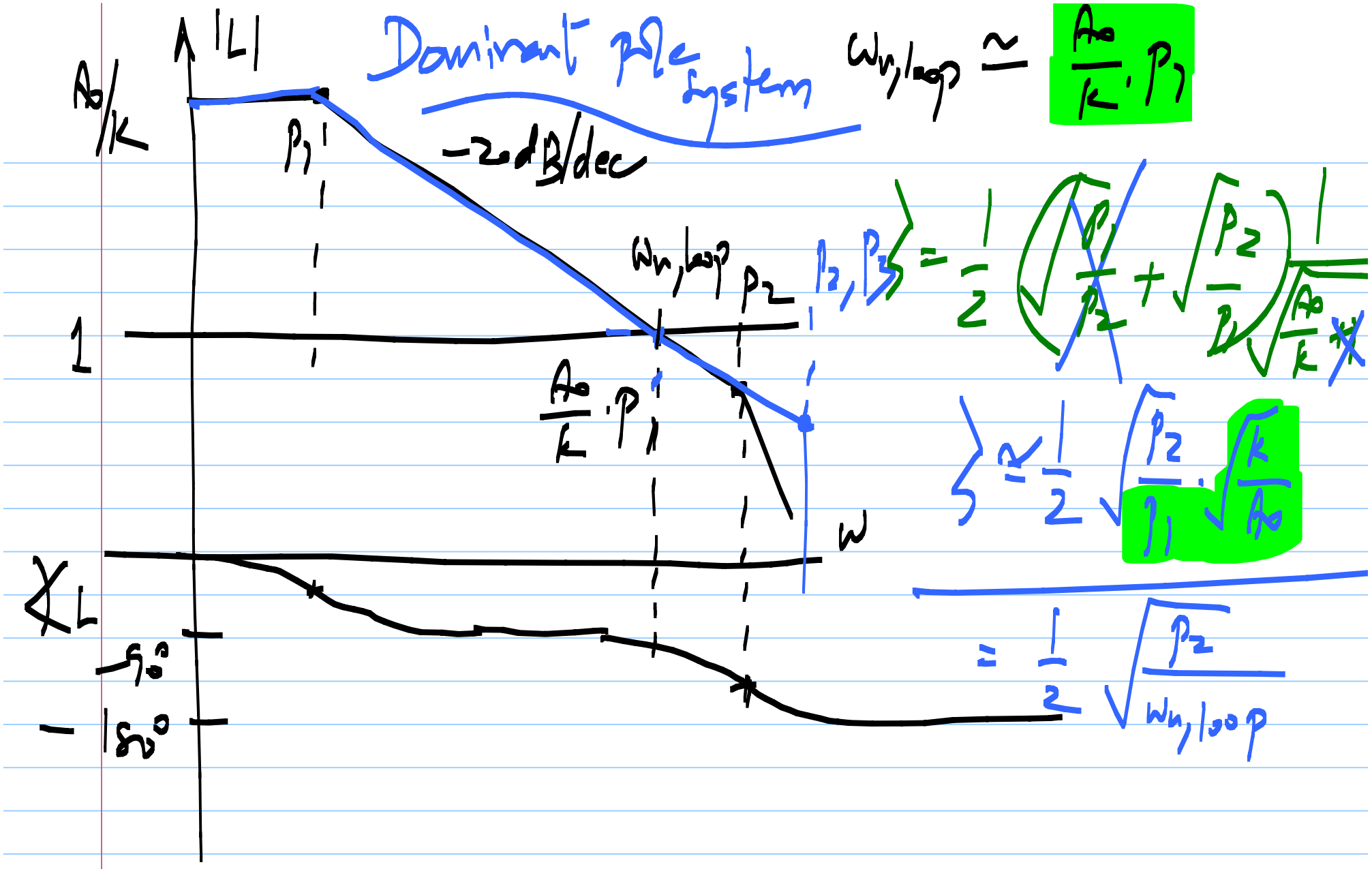
$-90^\circ - \tan^{-1}(\quad) - 2\tan^{-1}\left(\frac{\omega_{n,loop}}{\beta_2}\right)$

$-\tan^{-1}(\quad)$

1

4°

7°



Dominant pole system

$$\omega_{u,loop} \simeq \frac{A_0}{K} \cdot p_1$$

$$\left.\begin{matrix} p_2 \\ p_3 \end{matrix}\right\} = \frac{1}{2}\left(\sqrt{\frac{p_2}{p_2}} + \sqrt{\frac{p_2}{p_2}}\right)\sqrt{\frac{A_0}{K}}$$

$$\left.\begin{matrix} p_2 \\ p_3 \end{matrix}\right\} \simeq \frac{1}{2}\sqrt{\frac{p_2}{p_1}\cdot\frac{K}{A_0}}$$

$$= \frac{1}{2}\sqrt{\frac{p_2}{\omega_{u,loop}}}$$

	ζ	$P_2/\omega_{1,\log}$	Phase lag	ϕ_M
	1	4	$-90^\circ - \tan^{-1}(1/4)$	$\tan^{-1}4 = 76^\circ$
	$1/\sqrt{2}$	2	$-90^\circ - \tan^{-1}(1/2)$	$\tan^{-1}2 = 63^\circ$
X	$1/2$	1	$-90^\circ - \tan^{-1}(1)$	$\tan^{-1}1 = 45^\circ$

Smile