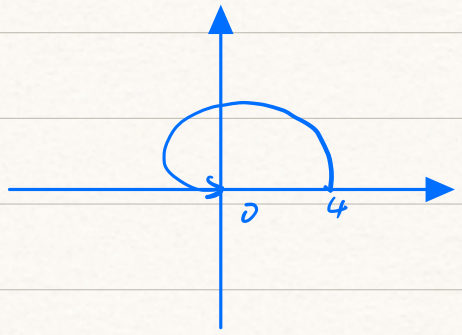
E8.1 $G(s)=\frac{4}{(s+1)^2}$

$G(j\omega)=\frac{4}{(j\omega+1)^2}$

$|G(j\omega)|=\frac{4}{\omega^2+1}$

$\angle\theta=0-2\arctan\omega$



ω	0	0.5	1	2	4	$+\infty$
$\lvert G(j\omega)\rvert$	4	3.2	2	0.8	0.2	0
$\angle\theta$	0	$-53°$	$-90°$	$-126.9°$	$-151.9°$	$-180°$

E8.3 $G(s)=\frac{300(s+100)}{s(s+10)(s+40)}$

$G(j\omega)=\frac{300(j\omega+100)}{j\omega(j\omega+10)(j\omega+40)}$

$|G(j\omega)|=\frac{300\sqrt{\omega^2+10000}}{\omega\sqrt{\omega^2+100}\sqrt{\omega^2+1600}}$

$\angle\theta=\arctan\frac{\omega}{100}-\frac{\pi}{2}-\arctan\frac{\omega}{10}-\arctan\frac{\omega}{40}$

$\angle\theta=-180°$

$\arctan\frac{\omega}{10}+\arctan\frac{\omega}{40}-\arctan\frac{\omega}{100}=90°$

$\arctan\frac{4000\omega+\omega^3}{40000-5\omega^2}=90°$

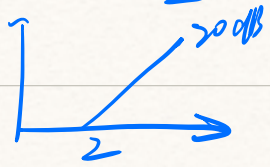
$40000-5\omega^2=0$

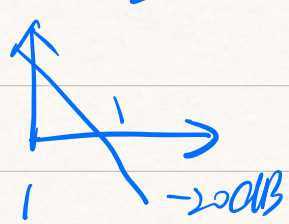
$\omega=28.3$

与4有关 $-20\lg|G(j28.3)|=-25\,dB$ magnitude 增益裕度

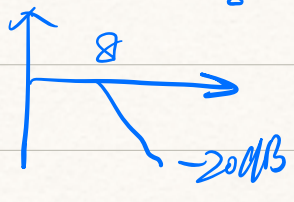
E8.5 $G(s)=\frac{K(1+0.5s)(1+as)}{s(1+\frac{s}{8})(1+bs)(1+\frac{s}{36})}$

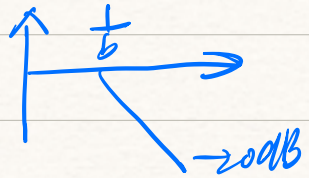
$G_1=K$ $G_2=1+\frac{s}{2}$ $G_3=1+as$ $G_4=\frac{1}{s}$

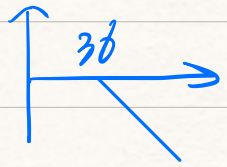




$G_5 = \frac{1}{1+\frac{s}{8}}$ $G_6 = \frac{1}{1+bs}$ $G_7 = \frac{1}{1+\frac{s}{36}}$





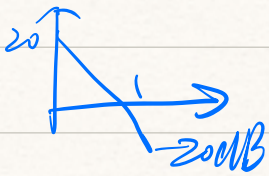


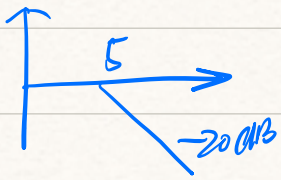
$\frac{1}{a} = 4$ $\frac{1}{b} = 24$

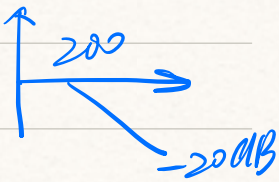
$\frac{0-y}{\lg 8 - \lg 1} = -20$ $y = 20\lg 8$ $K = 8$

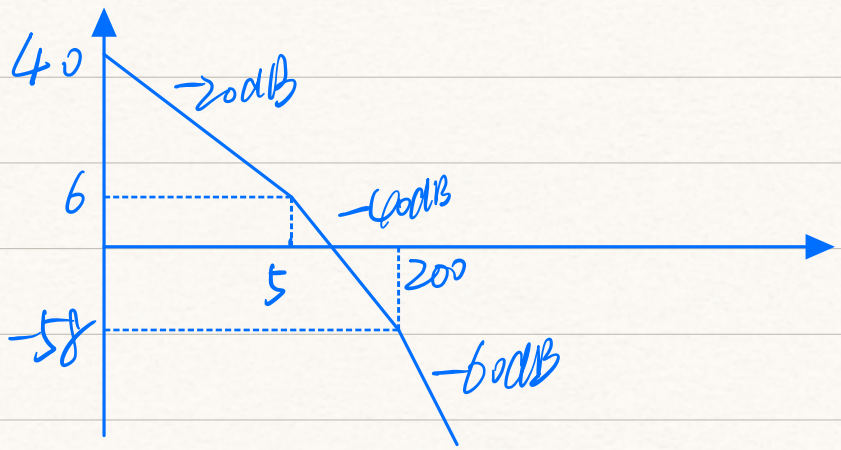
E8.6 $G(s) = \frac{10}{s(\frac{s}{5}+1)(\frac{s}{200}+1)}$

$G_1 = 10$ $G_2 = \frac{1}{s}$ $G_3 = \frac{1}{\frac{s}{5}+1}$ $G_4 = \frac{1}{\frac{s}{200}+1}$





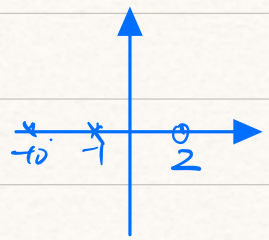




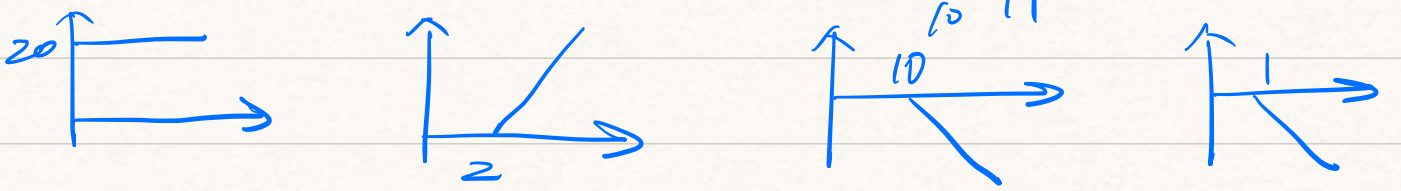
$\frac{0-6}{\lg\omega_0 - \lg 5} = -40$ $\omega_0 = 7.1$

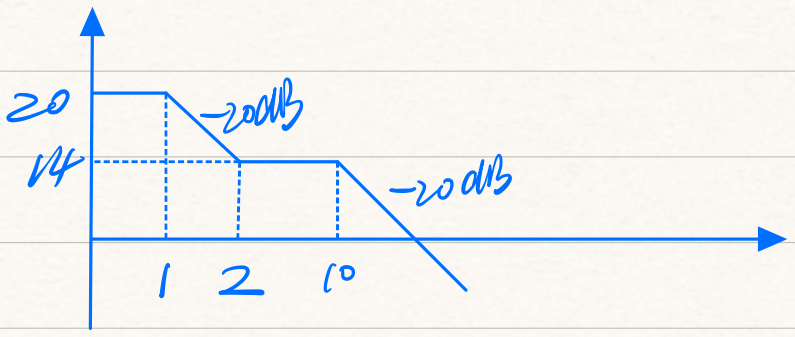
E8.8

$$G(s)H(s) = \frac{50(s-2)}{s^2+11s+10} = \frac{10\left(\frac{s}{2}-1\right)}{\left(\frac{s}{10}+1\right)(s+1)}$$



(a) $G_1 = 10$ $G_2 = \frac{s}{2} - 1$ $G_3 = \frac{1}{\frac{s}{10}+1}$ $G_4 = \frac{1}{s+1}$





$$\frac{0+14}{\lg\omega_0 - \lg 10} = +20$$

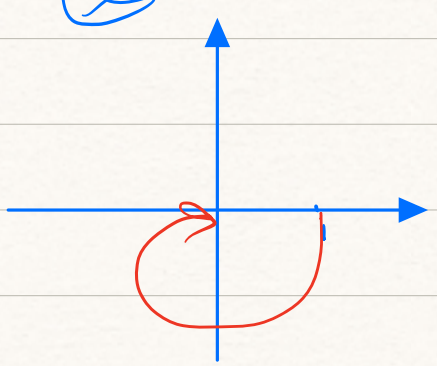
$$\lg\frac{7}{10} = \lg\omega_0$$

P8.1 (a) $GH(s) = \frac{1}{(1+0.5s)(1+2s)}$

$$G(j\omega) = \frac{1}{(1+0.5j\omega)(1+2j\omega)}$$

$$|G(j\omega)| = \frac{1}{\sqrt{1+\frac{\omega^2}{4}}\sqrt{1+4\omega^2}}$$

$$\angle\theta = -\arctan\frac{\omega}{2} - \arctan 2\omega$$



ω	0	1	5	10	$+\infty$
$\lvert G\bar{G}(j\omega)\rvert$	1	0.4	0.37	0.0098	0
$\angle\theta$	0	$-90°$	$-152°$	$-166°$	$-180°$

(b) $G\,H(s) = \dfrac{(1+0.5s)}{s^2}$

$G(j\omega) = \dfrac{(1+j\frac{\omega}{2})}{-\omega^2}$

$|G(j\omega)| = \dfrac{\sqrt{1+\frac{\omega^2}{4}}}{\omega^2}$

$\angle\theta = \arctan\frac{\omega}{2} - \pi$

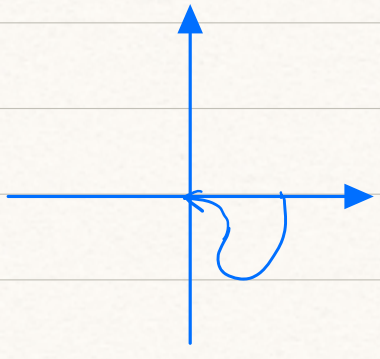
ω	0	1	5	10	$+\infty$
$\lvert G(j\omega)\rvert$	∞	1.1	0.1	0.05	0
$\angle\theta$	$-\pi$	$-153°$	$-112°$	$-101°$	$-90°$

(c) $G\,H(s) = \dfrac{s-10}{s^2+6s+10}$

$G(j\omega) = \dfrac{j\omega-10}{10-\omega^2+j6\omega}$

$|G(j\omega)| = \dfrac{\sqrt{\omega^2+100}}{\sqrt{(10-\omega^2)^2+36\omega^2}}$

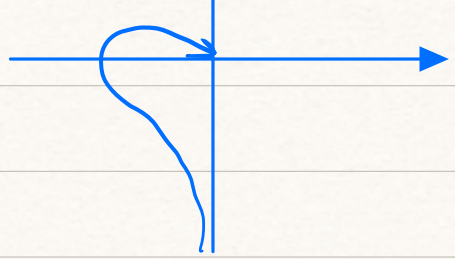
$\angle\theta = \arctan(-\frac{\omega}{10}) - \arctan\frac{6\omega}{10-\omega^2}$



ω	0	1	5	10	100	$+\infty$
$\lvert G(j\omega)\rvert$	1	0.9	0.3	0.1	0.01	0
$\angle\theta$	0	$-39°$	$-37°$	$-11°$	$-91°$	$-90°$

(d) $G\,H(s) = \dfrac{30(s+8)}{s(s+2)(s+4)}$

$$G(j\omega) = \frac{30(j\omega+8)}{j\omega(j\omega+2)(j\omega+4)}$$

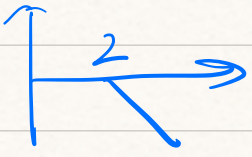


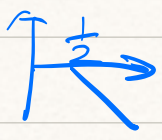
$$|G(j\omega)| = \frac{30\sqrt{\omega^2+64}}{\omega\sqrt{\omega^2+4}\sqrt{\omega^2+16}}$$

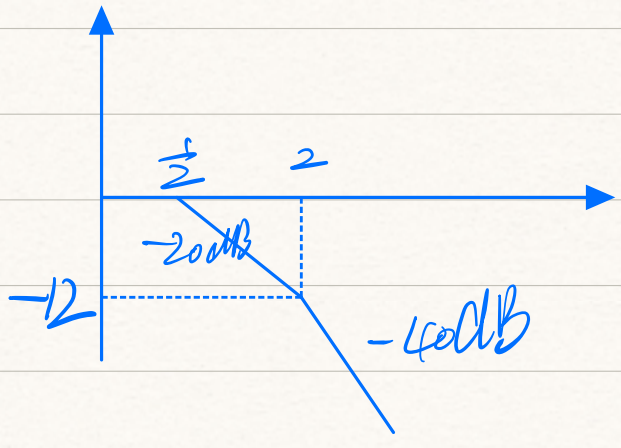
$$\angle\theta = \arctan\frac{\omega}{8} - \frac{\pi}{2} - \arctan\frac{\omega}{2} - \arctan\frac{\omega}{4}$$

ω	0	1	5	10	$+\infty$
$\lvert G(j\omega)\rvert$	∞	26	1.6	0.3	0
$\angle\theta$	$-90°$	$-123°$	$-178°$	$-185°$	$-180°$

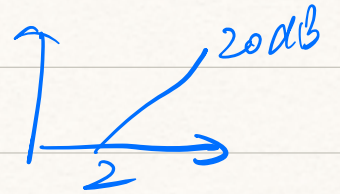
P8.2 (a) $G_1 = \frac{1}{1+0.5s}$ $G_2 = \frac{1}{1+2s}$

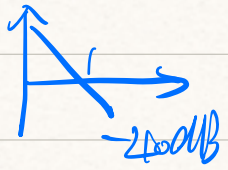


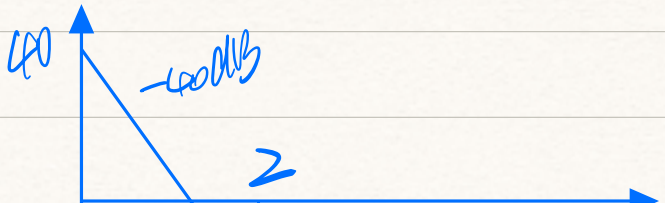


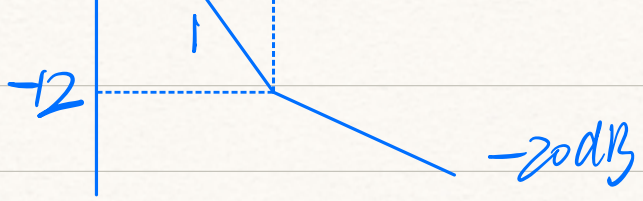


(b) $G_1 = 1 + \frac{1}{2}s$ $G_{2,3} = \frac{1}{s}$



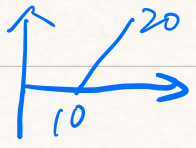




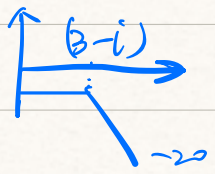


(c) $G(s)H(s) = \dfrac{(s-10)}{(s+3-i)(s+3+i)} = \dfrac{(\frac{s}{10}-1)}{(\frac{s}{3-i}+1)(\frac{s}{3+i}+1)}$

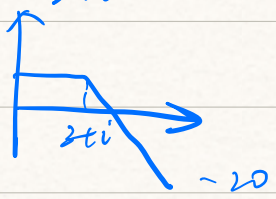
$G_1 = \dfrac{s}{10} - 1$

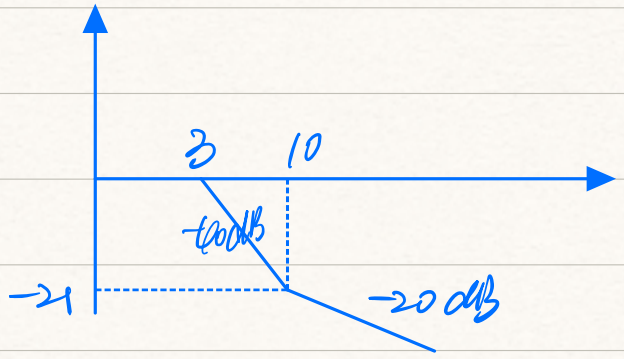


$G_2 = \dfrac{1}{\frac{s}{3-i}+1}$

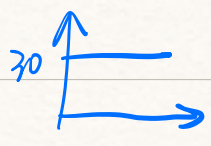


$G_3 = \dfrac{1}{\frac{s}{3+i}+1}$

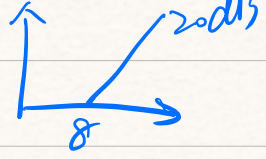




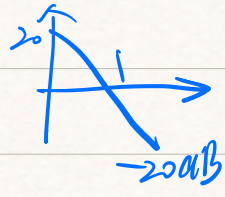
(d) $G_1 = 30$



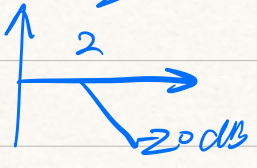
$G_2 = \dfrac{s}{8} + 1$



$G_3 = \dfrac{1}{s}$



$G_4 = \dfrac{1}{\frac{s}{2}+1}$



$G_5 = \dfrac{1}{\frac{s}{4}+1}$