ZADATAK 9.1

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3.AUT1

$$G(s) = \frac{K}{s(1+sT)}, \quad K=100, \; T=0.1$$

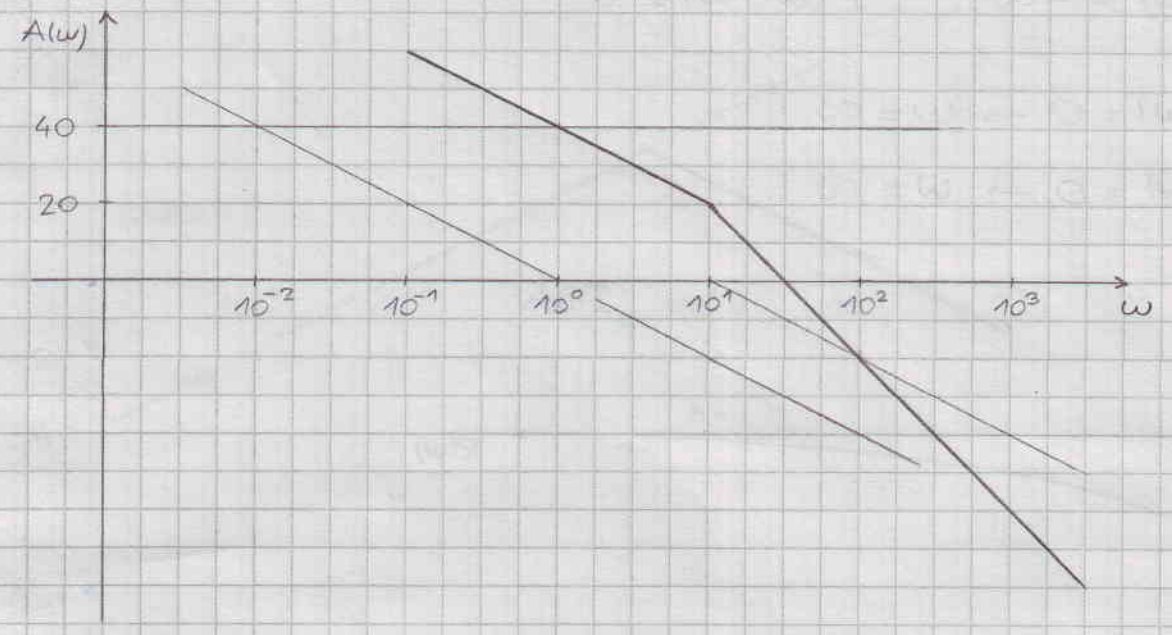
$$G(s) = \frac{100}{s(1+\frac{s}{10})} \rightarrow G(j\omega) = \frac{100}{j\omega(1+j\frac{\omega}{10})}$$

$$A(\omega) = 20\log 100 - 20\log\omega - 20\log\sqrt{1+(\frac{\omega}{10})^2}$$

$$A(\omega) = 40 - 20\log\omega - 20\log\sqrt{1+(\frac{\omega}{10})^2}$$

$$\varphi(\omega) = -\operatorname{arctg}\frac{\omega}{0} - \operatorname{arctg}\frac{\omega}{10}$$

$$\varphi(\omega) = -\frac{\pi}{2} - \operatorname{arctg}\frac{\omega}{10}$$



$$G(jw) = \frac{1000}{jw(10+jw)}$$

$$G(jw) = \frac{1000}{(-w^2+10jw)} \cdot \frac{-w^2-10jw}{-w^2-10jw}$$

$$G(jw) = \frac{-1000w^2}{w^4+100w^2} + j\frac{-10000w}{w^4+100w^2}$$

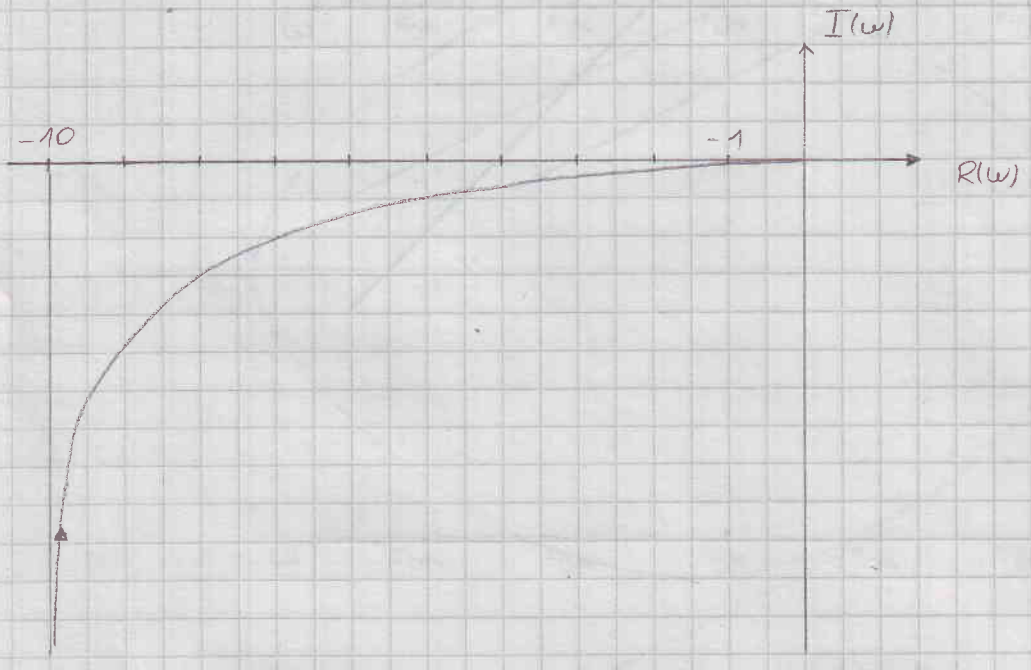
$$G(jw) = \underbrace{\frac{-1000}{w^2+100}}_{R(w)} + j\underbrace{\frac{-10000}{w^3+100w}}_{I(w)}$$

$R(w=0) = -10$ $\quad$ $R(w=\infty) = 0$

$I(w=0) = -\infty$ $\quad$ $I(w=\infty) = 0$

$R(w) = 0 \rightarrow w = \infty$

$I(w) = 0 \rightarrow w = \infty$



ZADATAK 9.2

$$G(s) = \frac{Ks}{(1+sT)^2}, \quad K = 10, \quad T = 0.2$$

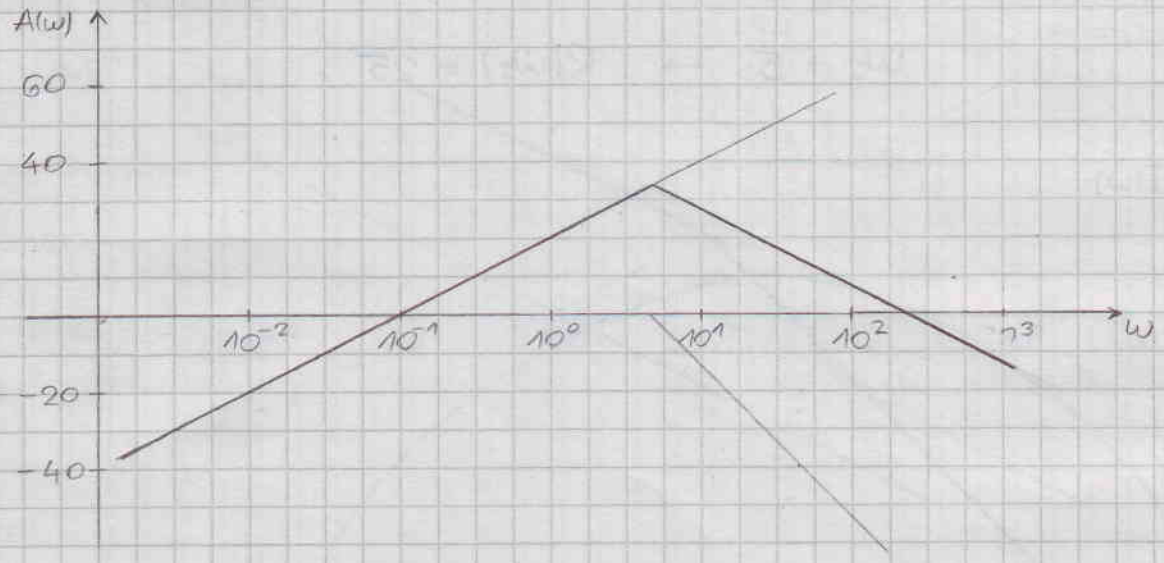
$$G(s) = \frac{10s}{(1+\frac{s}{5})^2} \rightarrow G(j\omega) = \frac{j\frac{\omega}{10^{-1}}}{(1+j\frac{\omega}{5})^2}$$

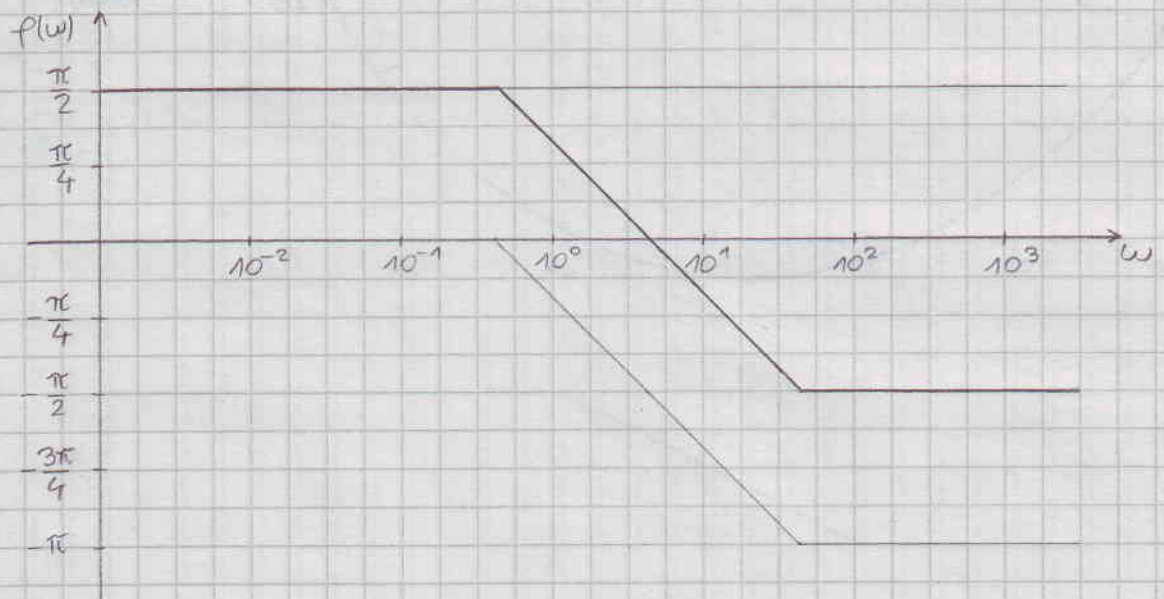
$$A(\omega) = 20\log\left(\frac{\omega}{10^{-1}}\right) - 20\log\sqrt{1+\left(\frac{\omega}{5}\right)^2} - 20\log\sqrt{1+\left(\frac{\omega}{5}\right)^2}$$

$$A(\omega) = 20\log\left(\frac{\omega}{10^{-1}}\right) - 40\log\sqrt{1+\left(\frac{\omega}{5}\right)^2}$$

$$\varphi(\omega) = \operatorname{arctg}(+\infty) - \operatorname{arctg}\frac{\omega}{5} - \operatorname{arctg}\frac{\omega}{5}$$

$$\varphi(\omega) = \frac{\pi}{2} - 2\operatorname{arctg}\frac{\omega}{5}$$





$$G(jw) = \frac{10jw}{1 - 0.04w^2 + j0.4w}$$

$$G(jw) = \underbrace{\frac{4w^2}{(1-0.04w^2)^2 + (0.4w)^2}}_{R(w)} + j \underbrace{\frac{0.4w^3 - 10w}{(1-0.04w^2)^2 + (0.4w)^2}}_{I(w)}$$

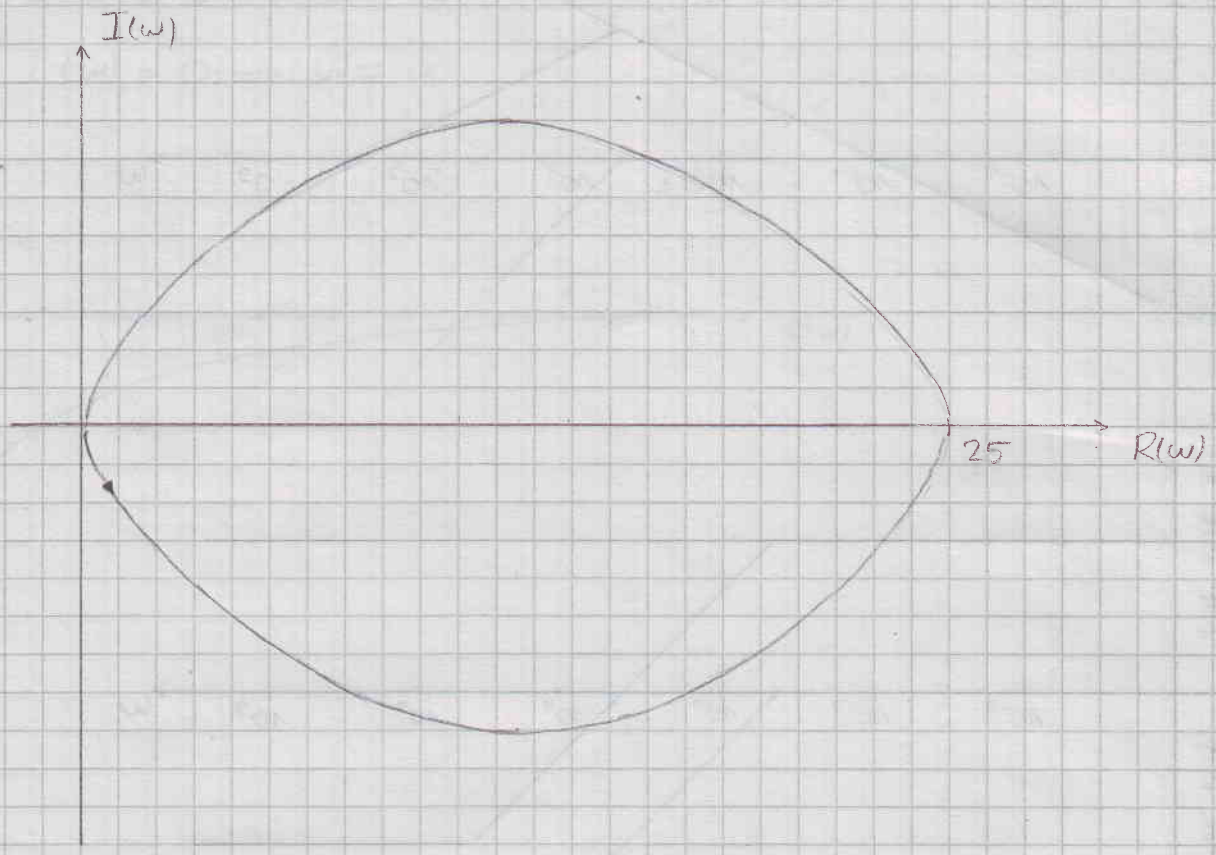
$R(w=0) = 0$ $\qquad$ $R(w=\infty) = 0$

$I(w=0) = 0$ $\qquad$ $I(w=\infty) = 0$

$R(w) = 0 \rightarrow w = 0$

$I(w) = 0 \rightarrow w_1 = 0$

$w_2 = 5 \rightarrow R(w_2) = 25$



ZADATAK 9.4

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$$G(s) = \frac{20(s-1)}{(s+1)(s+10)}$$

$$G(s) = \frac{-20\left(1-\frac{s}{1}\right)}{10\left(1+\frac{s}{1}\right)\left(1+\frac{s}{10}\right)}$$

$$G(s) = -2\,\frac{\left(1-\frac{s}{1}\right)}{\left(1+\frac{s}{1}\right)\left(1+\frac{s}{10}\right)}$$

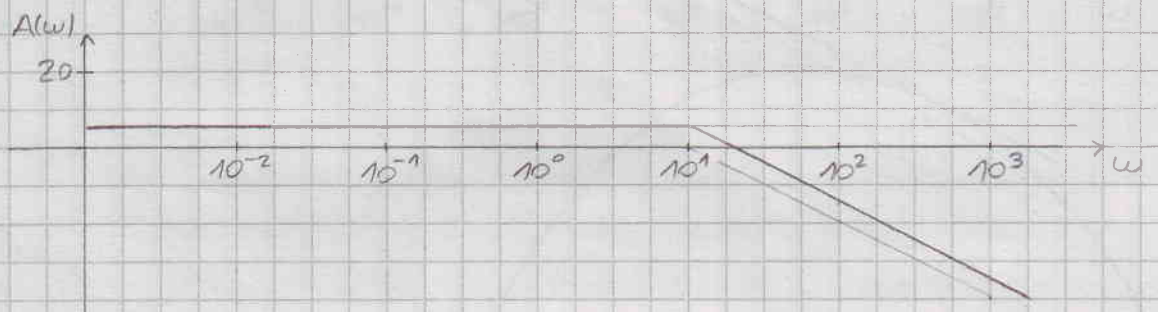
$$G(j\omega) = -2\,\frac{\left(1-j\frac{\omega}{1}\right)}{\left(1+j\frac{\omega}{1}\right)\left(1+j\frac{\omega}{10}\right)}$$

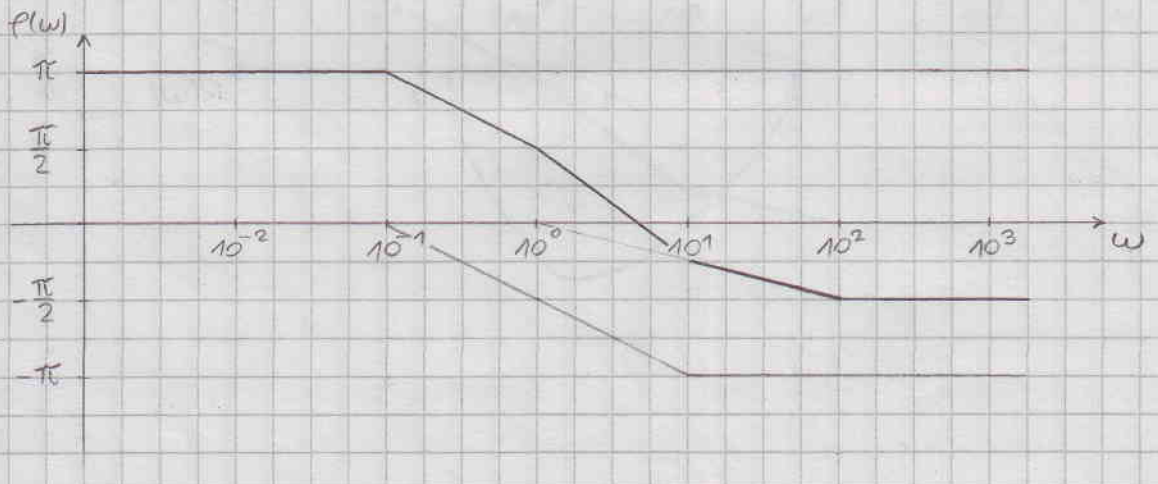
$$A(\omega) = 20\log 2 + 20\log\sqrt{1+\left(\frac{\omega}{1}\right)^2} - 20\log\sqrt{1+\left(\frac{\omega}{1}\right)^2} - 20\log\sqrt{1+\left(\frac{\omega}{10}\right)^2}$$

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

$$\varphi(\omega) = \operatorname{arctg}\frac{0}{-2} + \operatorname{arctg}\frac{-\omega}{1} - \operatorname{arctg}\frac{\omega}{1} - \operatorname{arctg}\frac{\omega}{10}$$

$$\varphi(\omega) = \pi - 2\operatorname{arctg}\frac{\omega}{1} - \operatorname{arctg}\frac{\omega}{10}$$





$$G(jw) = \frac{20(jw-1)}{(jw+1)(jw+10)}$$

$$G(jw) = \frac{20(jw-1)}{10-w^2+11jw} \cdot \frac{10-w^2-11jw}{10-w^2-11jw}$$

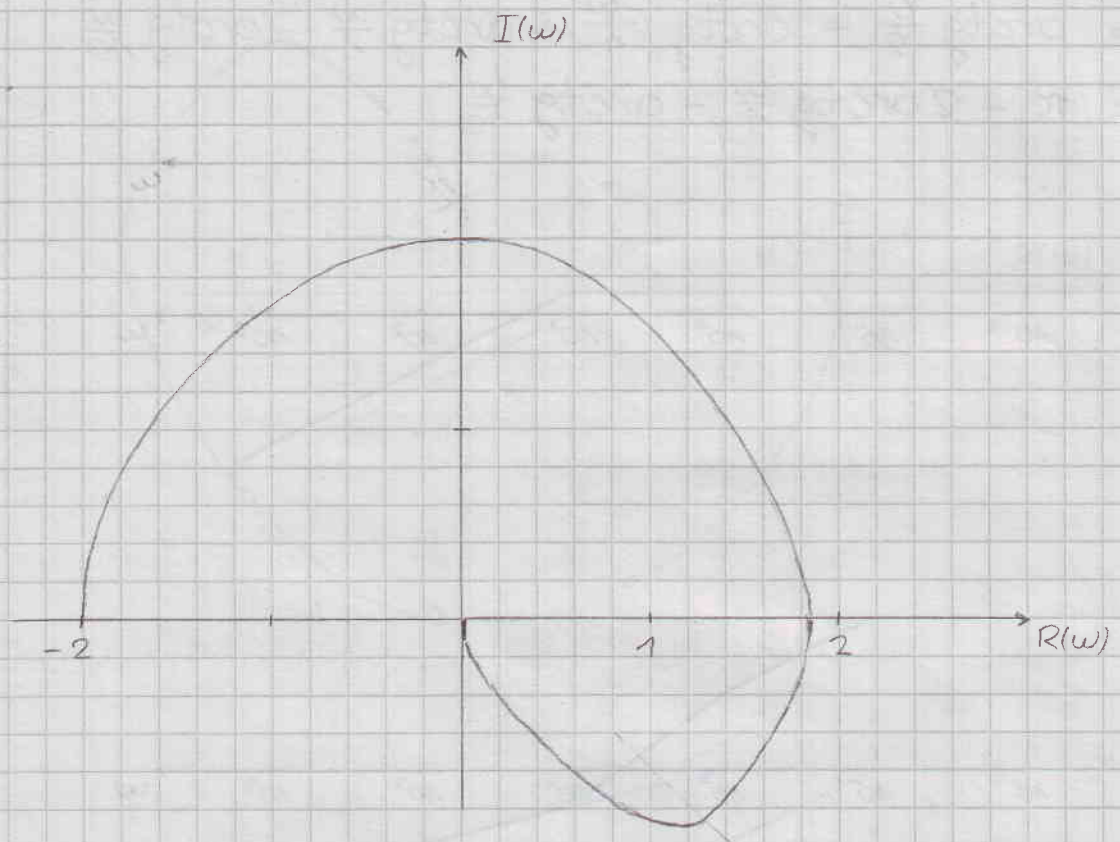
$$G(jw) = \underbrace{\frac{20(12w^2-10)}{(10-w^2)^2+(11w)^2}}_{R(w)} + j \underbrace{\frac{20(-w^3+21w)}{(10-w^2)^2+(11w)^2}}_{I(w)}$$

$R(w=0) = -2 \qquad R(w=\infty) = 0$

$I(w=0) = 0 \qquad I(w=\infty) = 0$

$R(w) = 0 \rightarrow w = 0.913 \rightarrow I(w) = 1.99$

$I(w) = 0 \rightarrow w = 4.583 \rightarrow R(w) = 1.81$



ZADATAK 9.5

$$G(s) = \frac{20(1-s)}{(s+1)(s+10)}$$

$$G(s) = 2\,\frac{(1-\frac{s}{1})}{(1+\frac{s}{1})(1+\frac{s}{10})}$$

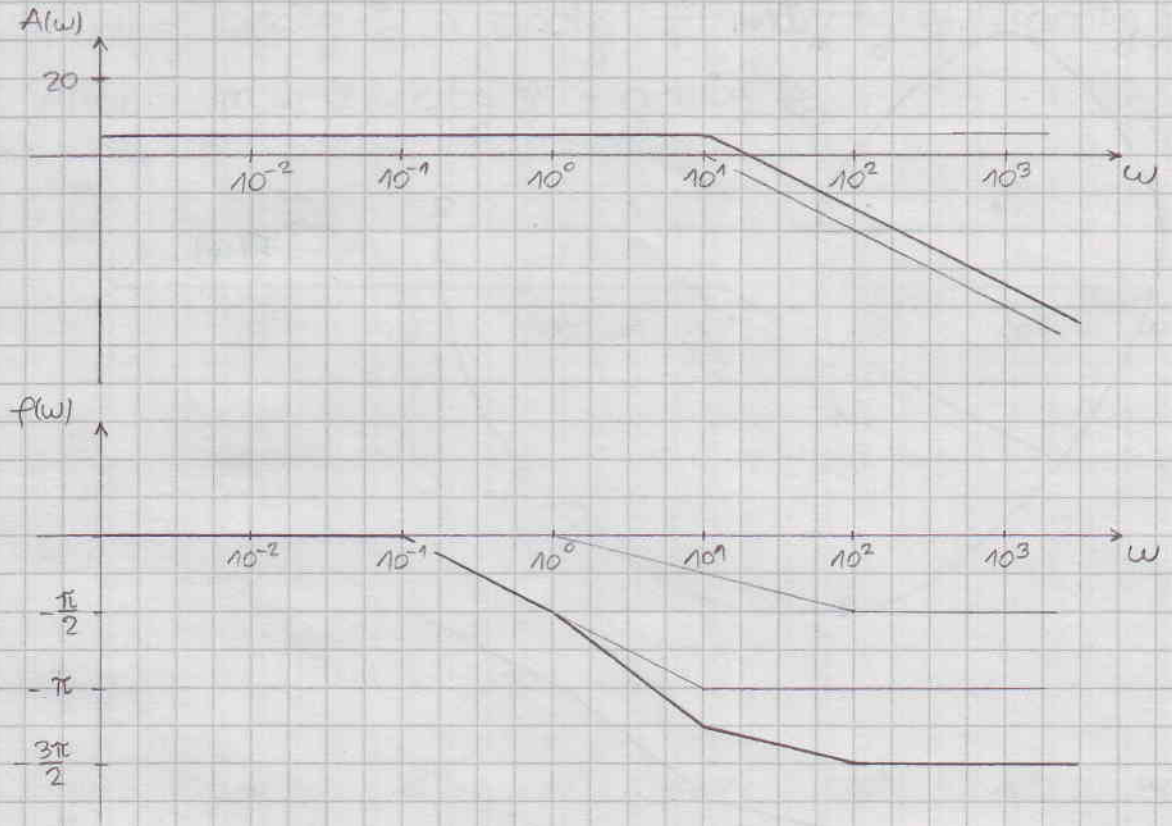
$$G(j\omega) = 2\,\frac{(1-j\frac{\omega}{1})}{(1+j\frac{\omega}{1})(1+j\frac{\omega}{10})}$$

$$A(\omega) = 20\log 2 + 20\log\sqrt{1+(\tfrac{\omega}{1})^2} - 20\log\sqrt{1+(\tfrac{\omega}{1})^2} - 20\log\sqrt{1+(\tfrac{\omega}{10})^2}$$

$$A(\omega) = 20\log 2 - 20\log\sqrt{1+(\tfrac{\omega}{10})^2}$$

$$\varphi(\omega) = \operatorname{arctg}\frac{0}{2} + \operatorname{arctg}\frac{-\omega}{1} - \operatorname{arctg}\frac{\omega}{1} - \operatorname{arctg}\frac{\omega}{10}$$

$$\varphi(\omega) = -2\operatorname{arctg}\frac{\omega}{1} - \operatorname{arctg}\frac{\omega}{10}$$



$$G(jw) = \frac{20(1-jw)}{(jw+1)(jw+10)}$$

$$G(jw) = \frac{20(1-jw)}{10-w^2+11jw} \cdot \frac{10-w^2-11jw}{10-w^2-11jw}$$

$$G(jw) = \underbrace{\frac{20(-12w^2+10)}{(10-w^2)^2+(11w)^2}}_{R(w)} + j \underbrace{\frac{20(w^3-21w)}{(10-w^2)^2+(11w)^2}}_{I(w)}$$

$R(w=0) = 2$ $\qquad$ $R(w=\infty) = 0$

$I(w=0) = 0$ $\qquad$ $I(w=\infty) = 0$

$R(w) = 0 \rightarrow w = 0.913 \rightarrow I(w) = -1.99$

$I(w) = 0 \rightarrow w = 4.583 \rightarrow R(w) = -1.81$