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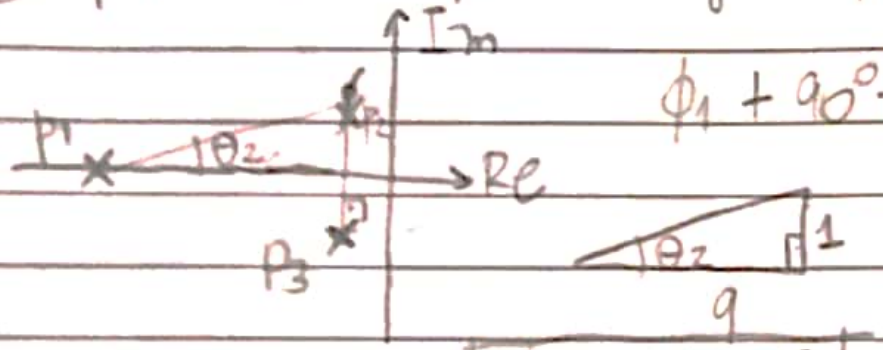
RODRIGO ALVES DE ALMEIDA
LISTA 7 CMC-12 COMP-22

Q1 • $p_1 = -10 \quad p_2 = -1 + j \quad p_3 = -1 - j$



$\phi_1 + 90° + \theta_2 = 180°$

$\theta_2 = \text{atan}(1/q) = 6,34°$

$\boxed{\phi_1 = 83,7°}$

• $G(s) = \frac{-1}{K}$, $s = a \cdot i$

$$\frac{-1}{K} = \frac{10}{-a^3 i - 12a^2 + 22ai + 20}$$

$a^3 i = 22ai$

$a = \pm\sqrt{22}$

$\boxed{s = \sqrt{22}\, i}$

• $G(s) = \frac{10}{-12 \cdot 22 + 20} = -0,041$

$K = \frac{1}{0,041} = 24,4$

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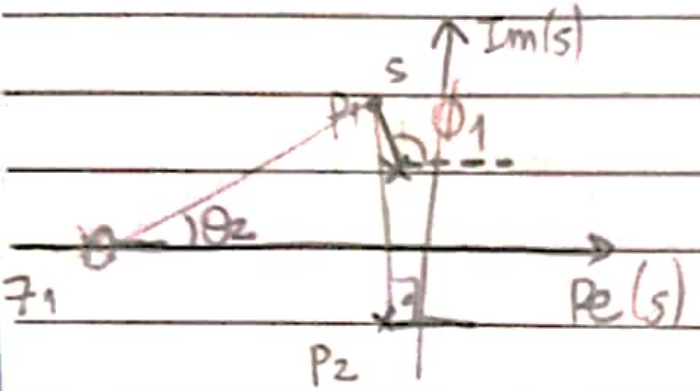
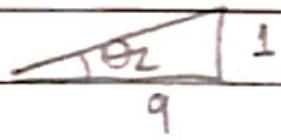
Q2 • $z_1 = -10$ $p_1 = -1+j$ $p_2 = -1-j$



$90 + \Phi_1 - \theta_z = 180$

$\boxed{\Phi_1 = 96,34^\circ}$

$\theta_z = 6,34^\circ$



• $\frac{d}{ds}\left(\frac{10(s^2+2s+2)}{s+10}\right) = 0$

$(2s+2)(s+10) = s^2+2s+2$

$s^2 + 20s + 18 = 0$

$s = \frac{-20 \pm \sqrt{328}}{2} = -10 \pm \sqrt{82}$

$-10+\sqrt{82} > -1 \therefore \boxed{s = -10-\sqrt{82}}$

• $+1 = \frac{1}{k}\left(\frac{+\sqrt{82}}{164+17\sqrt{82}}\right)$

$\boxed{K = 301,1}$

S T Q Q S S D

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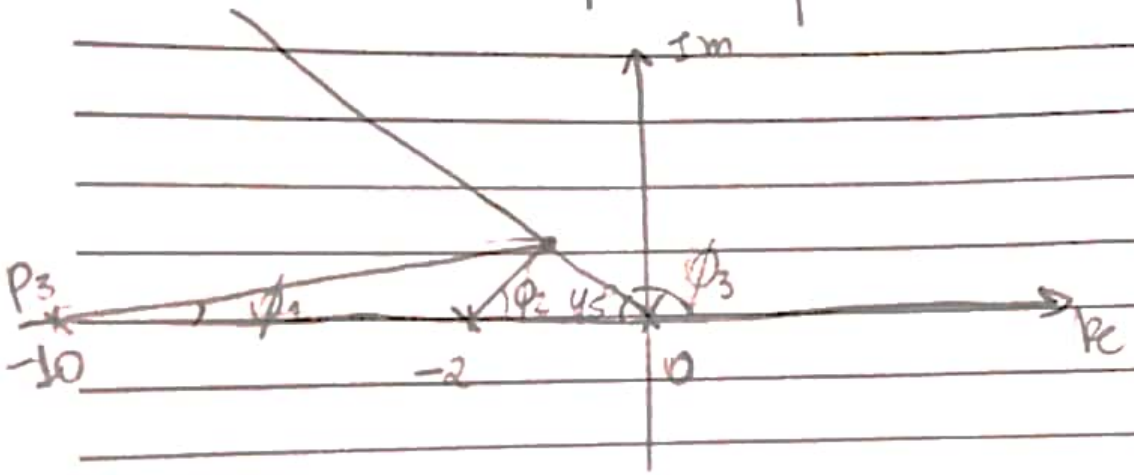
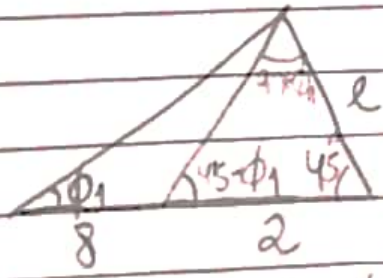
(03) $\xi = \frac{-\ln M_p}{\sqrt{\pi^2 + (\ln M_p)^2}} \rightarrow \xi = 0{,}707$ $\quad \beta = 45°$



$\phi_3 = 135°$

$\phi_1 + \phi_2 = 45°$



$$\frac{\ell}{\sin\phi_1} = \frac{10}{\sin(135-\phi_1)}$$

$$\frac{\ell}{\sin(45-\phi_1)} = \frac{2}{\sin(90+\phi_1)}$$

$$\frac{10\sin\phi_1}{\sin(135-\phi_1)} = \frac{2\sin(45-\phi_1)}{\sin(90+\phi_1)}$$

$\phi_1 = 5{,}65°$ $\quad \phi_2 = 39{,}35°$

$\ell = 1{,}27315$

$s = 0{,}9(-1+j)$

$$\frac{-1}{K} = \frac{5}{1{,}15j(s+1) - 1{,}15(-1+j)}$$

$\boxed{K = 3{,}308}$

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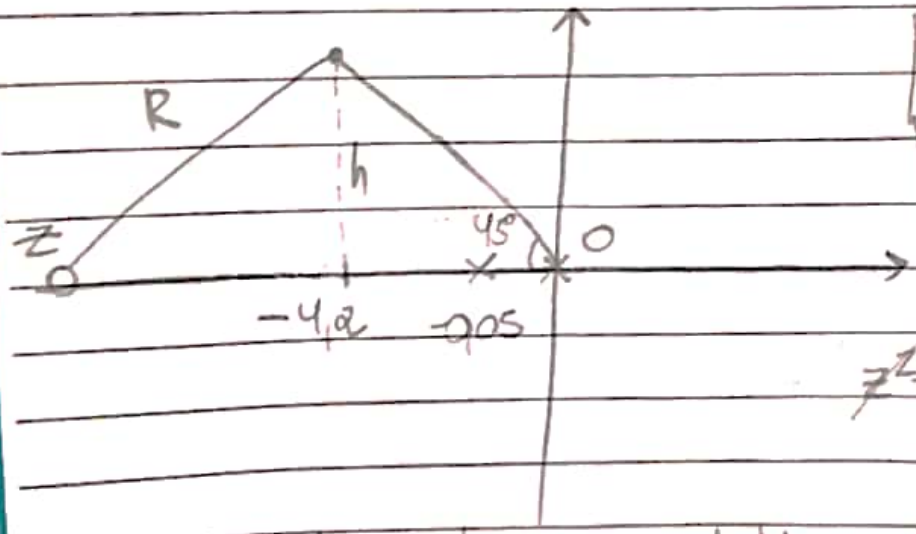
04) $C(s) = k\frac{(s-z)}{s}$; $K_p = k$ $K_i = -kz$

$G'(s) = \frac{(s-z)}{s(1000s+50)} = \frac{1}{1000}\frac{(s-z)}{s(s+0,05)}$

$\omega_n = 6\ rad/s$	$\beta = 45,6°$
$\zeta = 0,7$	$\sigma = 4,2\ s^{-1}$



$R = \sqrt{(z-p1)(z-p2)}$

$R^2 = h^2 + (z+4,2)^2$

$h = 4,2\ tg\ 45° = 4,239$

$z^2 + 0,05z = 17,64 + z^2 + 8,4z + 1$

$z = -4,4059$

$s = 4,2(-1+\lambda)$

$K = \left|\frac{1}{G'(s)}\right| = \frac{1000|s||s+0,05|}{|s-z|} = \frac{1000 \cdot 4,2\sqrt{2} \cdot 5,904}{4,205}$

$= 8339,6$

$K_p = 8339,6$
$K_i = 36743,4$

05) $G_f(s) = \frac{10(s+a)}{10(s+a) + s(s+1)(s+2)}$

$D_f(s) = 0 \rightarrow s^3 + s(s+1)(s+2) = -a$

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