

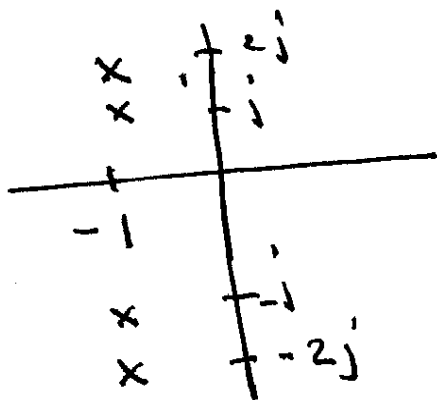
$$s^2 + 2s + 2 = 0$$

$$s = -1 \pm \frac{\sqrt{4-8}}{2} = -1 \pm j$$

$$s^2 + 2s + 5 = 0$$

$$s = -1 \pm \frac{\sqrt{4-20}}{2} = -1 \pm 2j$$

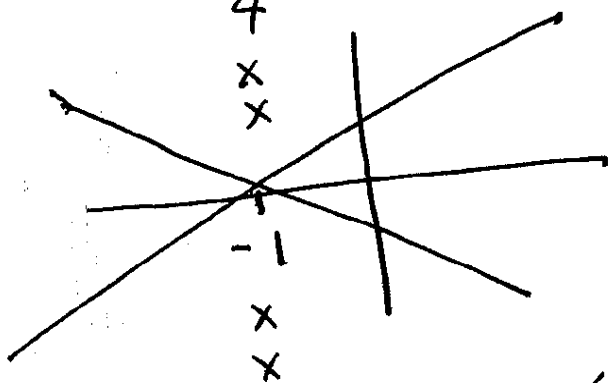
(a)



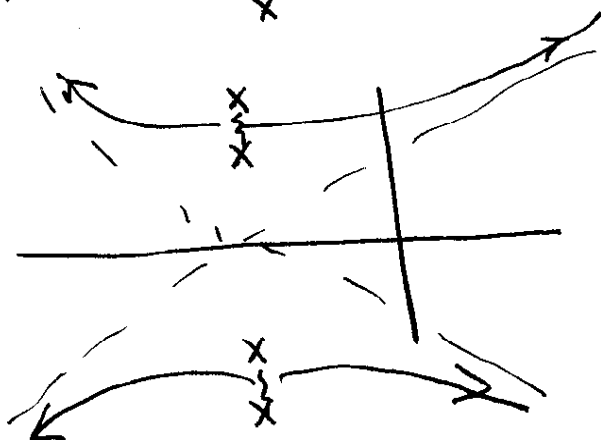
(b)

$$\sigma = \frac{-1+j - 1-j - 1+2j - 1-2j}{4} = -1$$

$$\phi = \pm \frac{\pi(2n+1)}{4} = \pm \frac{\pi}{4}; \pm \frac{3\pi}{4}$$



(c)

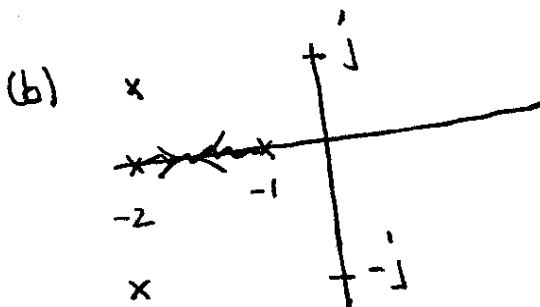


2°

(a)  $s^2 + 4s + 5 \Rightarrow (s+2+j)(s+2-j)$

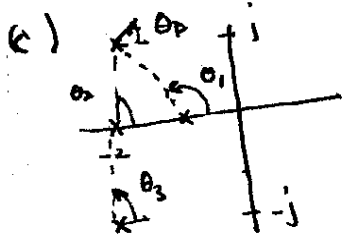
$$GH = \frac{k}{(s+2+j)(s+2-j)(s+2)(s+1)}$$

Poles:  $s = \begin{cases} -2+j \\ -2-j \\ -2 \\ -1 \end{cases}$



$$\angle GH = \frac{\pm (2n+1)\pi}{4-0} = \begin{cases} \pm \pi/4 \\ \pm 3\pi/4 \end{cases}$$

$$\sigma = \frac{-2+j-2-j-2-1}{4} = \frac{-7}{4}$$



$$\angle GH = -\theta_1 - \theta_2 - \theta_3 - \theta_D = \pm \pi (2n+1)$$

$$\theta_1 = \pi - \tan^{-1}\left(\frac{1}{1}\right) = \frac{3\pi}{4}$$

$$\theta_2 = \pi/2$$

$$\theta_3 = \pi/2$$

$$\angle GH = -\frac{3\pi}{4} - \pi/2 - \pi/2 - \theta_D = -\pi$$

$$\theta_D = \pi - \pi/4 = \frac{3\pi}{4}$$

