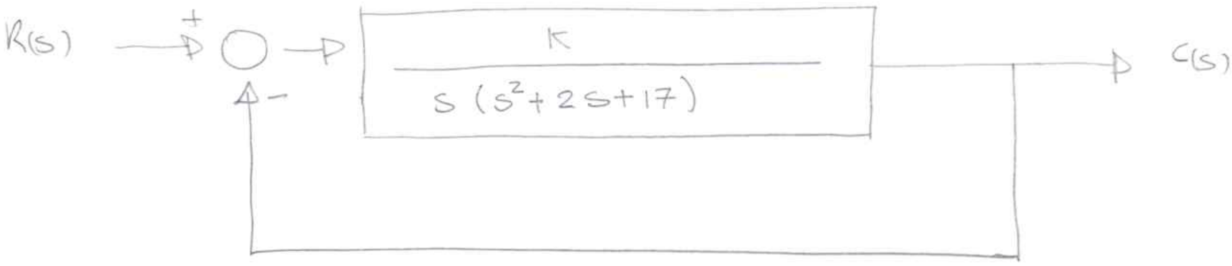
5 a)



$$G(s) = \frac{K}{s(s^2+2s+17)}$$

sai no exam!

- Determine the closed loop transfer function:

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1+G(s)} = \frac{K}{s^3+2s^2+17s+K}$$

- In order to obtain a stable system all roots of the denominator must have negative real part.
  → Apply Routh-Hurwitz criterion

$$P(s) = s^3 + 2s^2 + 17s + K$$

3	1	17		
2	2	K		
1	b_{n-1}	∅		
0	c_{n-1}	∅		

$$b_{n-1} = -\frac{\begin{vmatrix} 1 & 17 \\ 2 & K \end{vmatrix}}{2} = -\frac{(1K - 2.17)}{2} = \frac{34-K}{2}$$

$$c_{n-1} = -\frac{\begin{vmatrix} 2 & K \\ b_{n-1} & \emptyset \end{vmatrix}}{b_{n-1}} = -\frac{(2.\emptyset - K\cancel{b_{n-1}})}{\cancel{b_{n-1}}} = K$$

- In order ~~to~~ the system to be stable $\begin{cases} b_{n-1} > 0 \\ c_{n-1} > 0 \end{cases}$

$$\begin{cases} \frac{34-K}{2} > 0 \\ K > 0 \end{cases} \Leftrightarrow \begin{cases} K < 34 \\ K > 0 \end{cases} \quad \boxed{0 < K < 34}$$

5 b) K = ? In order to the system to have a pair of imaginary roots

Special case 1.1:

If "case 1" and the sign of the coefficient above ε is the same as that below, it indicates that there are a pair of imaginary roots.

so one of the terms of the first column must be zero.

$$\begin{cases} \dfrac{34-K}{2} = \emptyset \\ K > 0 \end{cases} \Rightarrow \begin{cases} K = 34 \\ K > \emptyset \end{cases}$$

If $K = 34$ the system has a pair of imaginary roots and is stable.

5)

a) $G(s) = \frac{K}{s(s^2+2s+17)}$

K para estável

$$\frac{\frac{K}{s(s^2+2s+17)}}{1+\frac{K}{s(s^2+2s+17)}}$$

$$\frac{K}{s(s^2+2s+17)} \qquad \frac{1}{1+\frac{K}{s(s^2+2s+17)}}$$

$$\frac{K}{s(s^2+2s+17)+K}$$

$$s^3+2s^2+17s+K$$

$$\begin{array}{c|ccc} 3 & 1 & 17 & 0 \\ 2 & 2 & K & 0 \\ 1 & b_{n-1} & & \\ 0 & K & & \end{array}$$

$K \to$ para ser positivo

$K>0$

$K - 34$

$$b_{n-1} = -\frac{1}{2}\begin{vmatrix} 1 & 17 \\ 2 & K \end{vmatrix}$$

$$= -\frac{1}{2}(K-34)$$

$$= \frac{-K}{2} + \frac{34}{2}$$

eixo imaginario

b) $\frac{-K}{2} + \frac{34}{2} = 0$

$0 < K < 34$

$K = 34$