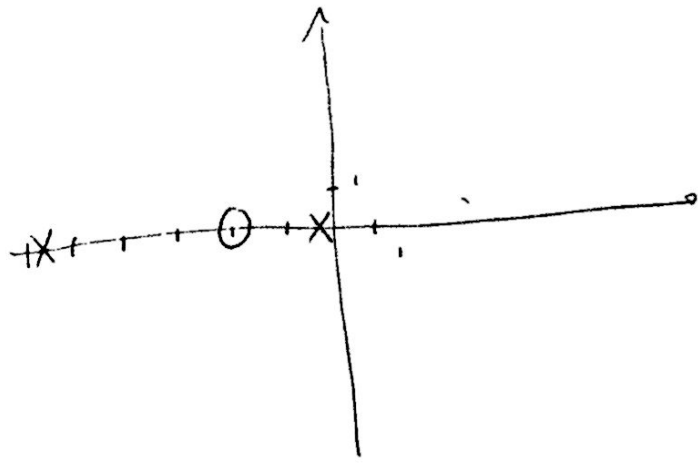
Opgave 5

A

i) poler $s^2+6s+2=0$ $s = -0,35$

$s = -5,64$

nulpunkter $s+2=0$ $s = -2$



ii) poler: $s^4-30s^3+260s^2-1010s+776=0$

$s = 5+4j$ $s = 5-4j$

$s = 19$ $s = 1$

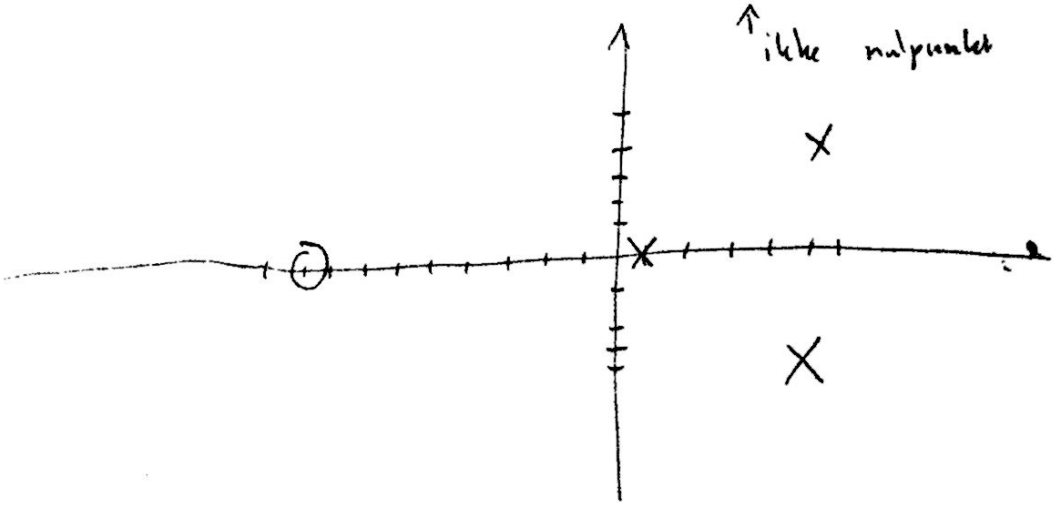
↑ ikke pol

nulpunkter:

$s^2-10s-171$

$s = 19$ $s = -9$

↑ ikke nulpunkter



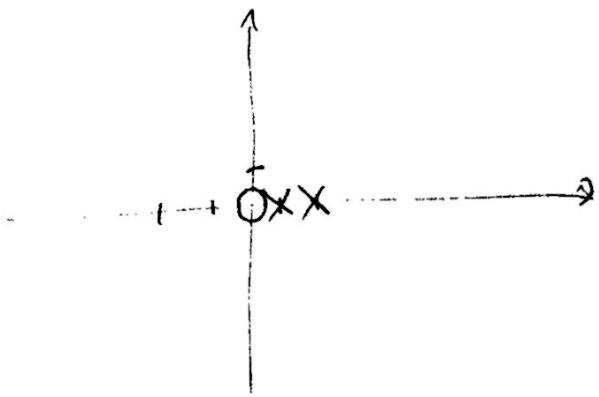
Opgave 5

A

iii) poler: $s^2 - 3s + 2 = 0$

$s = 2 \quad s = 1$

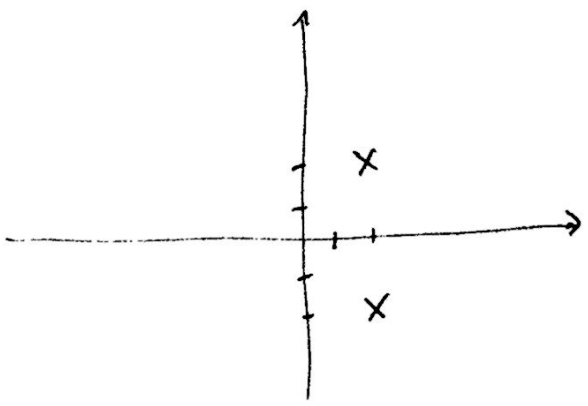
nulpunkter: $s = 0$



iv) poler: $s^2 - 4s + 8 = 0$

$s = 2 + 2j \quad s = 2 - 2j$

nulpunkter: ingen



Opgave 5

A

v) $$\frac{(s+2)s + 8(s^3+6s^2-11s+40)}{s(s^3+6s^2-11s+40)}$$

$$= \frac{s^2+2s+8s^3+48s^2-88s+320}{s^4+6s^3-11s^2+40s}$$

$$= \frac{8s^3+49s^2-86s+320}{s^4+6s^3-11s^2+40s}$$

nulpunkter:

$$8s^3+49s^2-86s+320=0$$

$s = 0,97 + 2,0j$

$s = 0,97 - 2,0j$

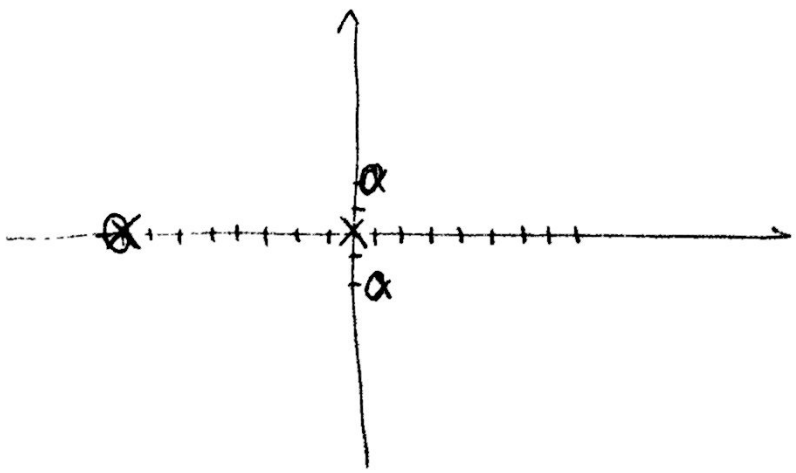
$s = -8,07$

poler:

$$s^4+6s^3-11s^2+40s=0$$

$s = 1+2j$ $\quad s = 1-2j$

$s = 0$ $\quad s = -8$



Opgave 5

A

vi)
$$\frac{(s+2)(s^2-3s+2)+s(s^2+6s+2)}{(s^2+6s+2)(s^2-3s+2)}$$

pole $s = +2$ , $s = +1$

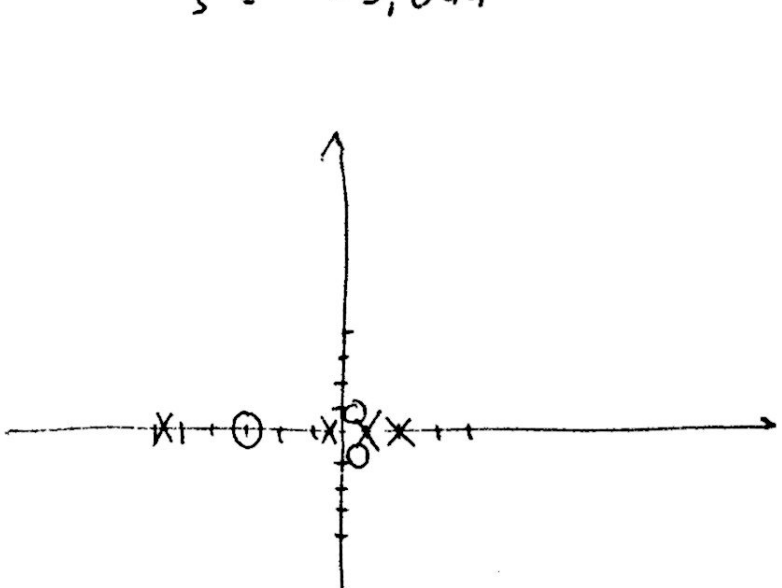
$s = -0,35$ $s = -5,64$

nulpunkt

$s = 0,27 + 0,76j$

$s = 0,27 - 0,76j$

$s = -3,044$



Opgave 5

A

vi)

nulpunkt

$s + 2 = 0$

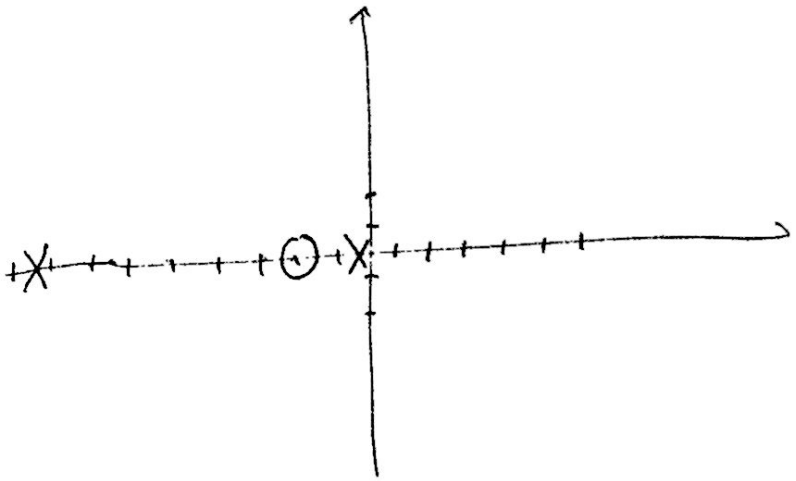
$s = -2$

pole

$s^2 + 9s + 4 = 0$

$s = -0,47$

$s = -8,53$



## Opgave B

(a) $\frac{s}{s+2} \Rightarrow \frac{jw}{jw+2}$

$$\frac{|w|}{\sqrt{w^2+4}} \angle \tan^{-1}\left(\frac{2}{w}\right)$$

(b) $\frac{1}{jw+10}$

$$\frac{1}{\sqrt{w^2+100}} \angle \tan^{-1}(0,1 \cdot w)$$

## Opgave C

i matlab skriv:

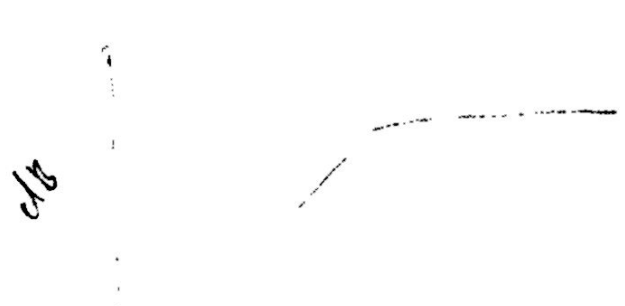
(a)
```
TT = tf([1 0],[1 2]);
bode(TT)
```

(b)
```
TT = tf([1],[1 10])
bode(TT)
```

Opgave 5

D| Amplitude plot for $\frac{s}{s+2}$

(a)




maksimal forstærkning ved $\omega \to \infty$

for $\omega \to \infty$ $\quad \frac{|\omega|}{\sqrt{\omega^2+4}} \to 1$

maksimal forsterkning er altså $\underline{\underline{1}}$

(b) Amplitudeplot for $\frac{1}{s+10}$


maksimal forsterkning ved $\omega = 0$

for $\omega = 0$ $\quad \frac{1}{\sqrt{\omega^2+100}} = \frac{1}{10}$

skal derfor multipliseres med 10.

Opgave 5

## Opgave E

Så eksisterer funktionen ikke i det punkt, og systemet har derfor ingen steady-state og er så ustabil.

## Opgave F

Brug matlabs

TT = tf( ) - funktion

for pol-nulpunktsdiagram bruges

p2map(TT)

for bodeplot - funktion

bode(TT)