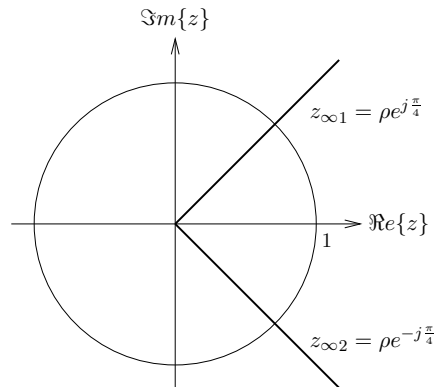


1. Beispiel:

Gruppe A

a) Nullstellen: $z_{01} = 0, z_{02} = \infty$, Pole: $z_{\infty 1,2} = \rho e^{\pm j\frac{\pi}{4}}$



b) $|\rho| < 1$

$$x[n] = \sqrt{2} \rho^n \sin \frac{\pi}{4} n \sigma[n]$$

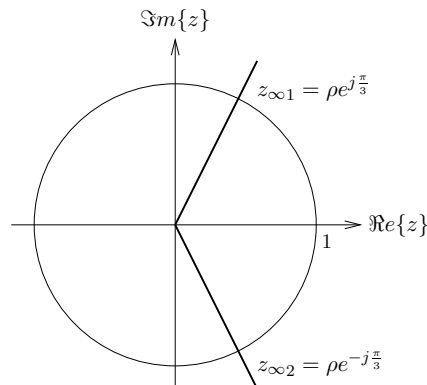
(mit Formelsammlung oder Partialbruchzerlegung)

$$X(z) = \frac{\rho}{z_{\infty 1} - z_{\infty 2}} \left(\frac{z}{z - z_{\infty 1}} - \frac{z}{z - z_{\infty 2}} \right)$$

$$x[n] = \frac{\rho}{z_{\infty 1} - z_{\infty 2}} (z_{\infty 1}^n - z_{\infty 2}^n) \sigma[n]$$

Gruppe B

a) Nullstellen: $z_{01} = 0, z_{02} = \infty$, Pole: $z_{\infty 1,2} = \rho e^{\pm j\frac{\pi}{3}}$



b) $|\rho| < 1$

$$x[n] = \frac{2}{\sqrt{3}} \rho^n \sin \frac{\pi}{3} n \sigma[n]$$

(mit Formelsammlung oder Partialbruchzerlegung)

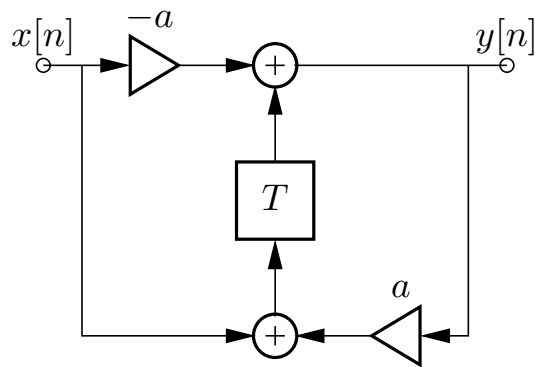
$$X(z) = \frac{\rho}{z_{\infty 1} - z_{\infty 2}} \left(\frac{z}{z - z_{\infty 1}} - \frac{z}{z - z_{\infty 2}} \right)$$

$$x[n] = \frac{\rho}{z_{\infty 1} - z_{\infty 2}} (z_{\infty 1}^n - z_{\infty 2}^n) \sigma[n]$$

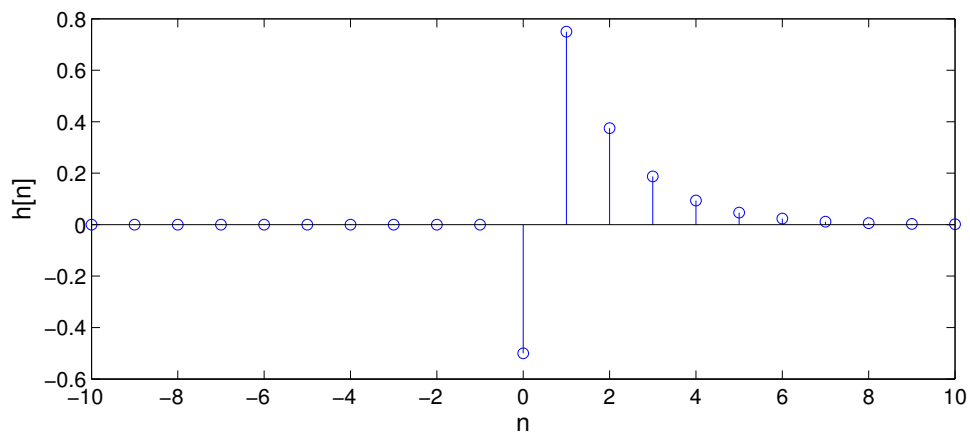
2. Beispiel:

Gruppe A

a)



b) $h[n] = a^{n-1} \sigma[n-1] - a^{n+1} \sigma[n]$

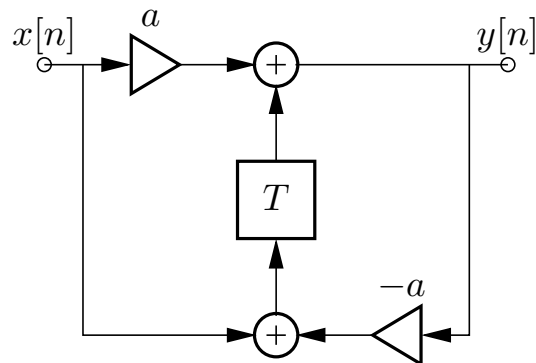


c) $H(z) = \frac{1 - az}{z - a}, \quad |H(e^{j\theta})| \equiv 1$

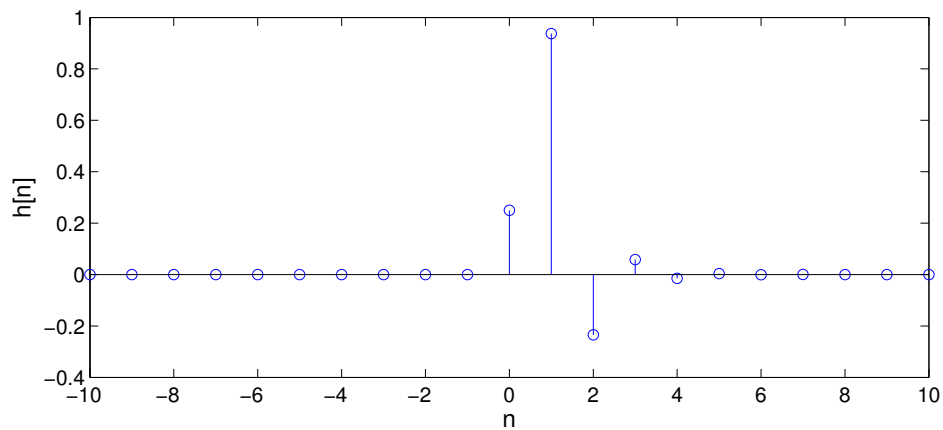
d) $y[n] = a^{n-1} \sigma[n-1]$

Gruppe B

a)



b) $h[n] = (-a)^{n-1}\sigma[n-1] - (-a)^{n+1}\sigma[n]$



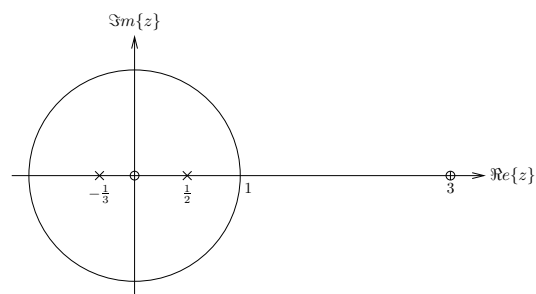
c) $H(z) = \frac{1 + az}{z + a}, \quad |H(e^{j\theta})| \equiv 1$

d) $y[n] = (-a)^{n-1}\sigma[n-1] + (-a)^{n+1}\sigma[n]$

3. Beispiel:

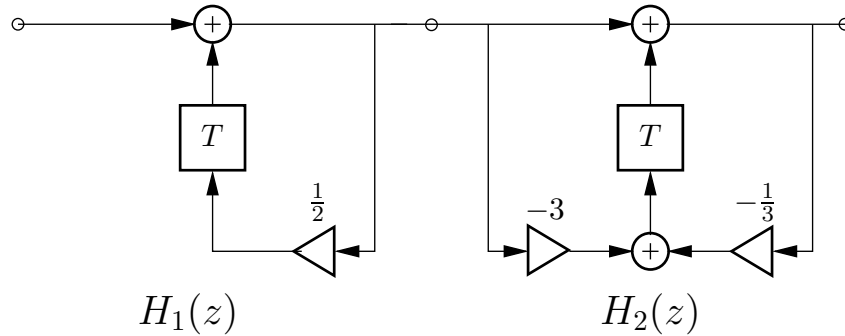
Gruppe A

a) Nullstellen: $z_{01} = 0, z_{02} = 3$, Pole: $z_{\infty 1} = \frac{1}{2}, z_{\infty 2} = -\frac{1}{3}$

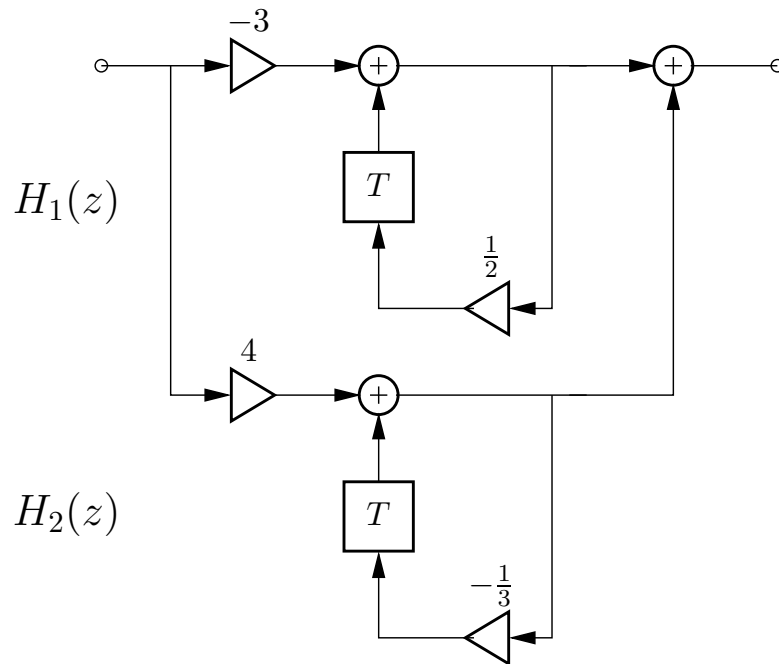


b)

$$b_1) H(z) = H_1(z) H_2(z) = \underbrace{\frac{1}{1 - \frac{1}{2}z^{-1}}}_{H_1(z)} \underbrace{\frac{1 - 3z^{-1}}{1 + \frac{1}{3}z^{-1}}}_{H_2(z)}$$



$$b_2) H(z) = H_1(z) + H_2(z) = \underbrace{\frac{-3}{1 - \frac{1}{2}z^{-1}}}_{H_1(z)} + \underbrace{\frac{4}{1 + \frac{1}{3}z^{-1}}}_{H_2(z)}$$



c) mit Partialbruchzerlegung (Parallelform):

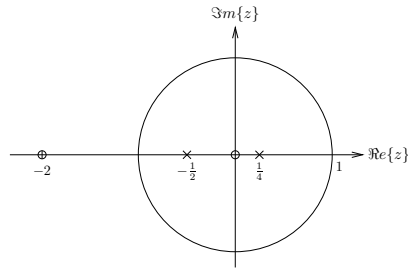
$$h[n] = -3 \left(\frac{1}{2}\right)^n \sigma[n] + 4 \left(-\frac{1}{3}\right)^n \sigma[n]$$

$$d) x[n] = \delta[n] - \frac{17}{6} \delta[n-1] - \frac{11}{36} \delta[n-2] - \frac{113}{216} \delta[n-3]$$

$$X[k] = 1 - \frac{17}{6} e^{-j\frac{\pi}{2}k} - \frac{11}{36} e^{-j\pi k} - \frac{113}{216} e^{j\frac{\pi}{2}k}, \quad k = 0, 1, 2, 3$$

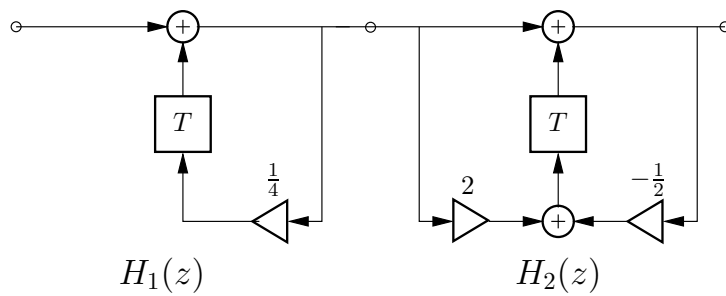
Gruppe B

a) Nullstellen: $z_{01} = 0$, $z_{02} = -2$, Pole: $z_{\infty 1} = \frac{1}{4}$, $z_{\infty 2} = -\frac{1}{2}$

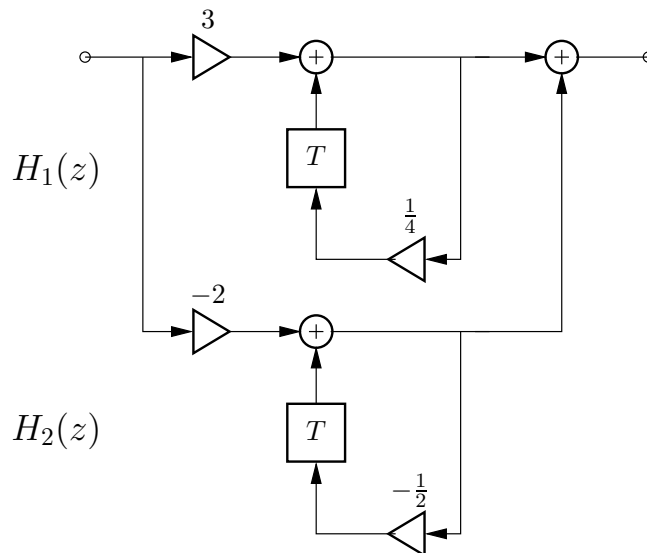


b)

$$b_1) H(z) = H_1(z) H_2(z) = \underbrace{\frac{1}{1 - \frac{1}{4}z^{-1}}}_{H_1(z)} \underbrace{\frac{1 + 2z^{-1}}{1 + \frac{1}{2}z^{-1}}}_{H_2(z)}$$



$$b_2) H(z) = H_1(z) + H_2(z) = \underbrace{\frac{3}{1 - \frac{1}{4}z^{-1}}}_{H_1(z)} + \underbrace{\frac{-2}{1 + \frac{1}{2}z^{-1}}}_{H_2(z)}$$



c) mit Partialbruchzerlegung (Parallelform):

$$h[n] = 3 \left(\frac{1}{4}\right)^n \sigma[n] - 2 \left(-\frac{1}{2}\right)^n \sigma[n]$$

$$d) x[n] = \delta[n] + \frac{7}{4} \delta[n-1] - \frac{5}{16} \delta[n-2] + \frac{19}{64} \delta[n-3]$$

$$X[k] = 1 + \frac{7}{4} e^{-j\frac{\pi}{2}k} - \frac{5}{16} e^{-j\pi k} + \frac{19}{64} e^{j\frac{\pi}{2}k}, \quad k = 0, 1, 2, 3$$