Lektion 2

2.4-11 Zero-state-lösningar i **(a)–(c)**:

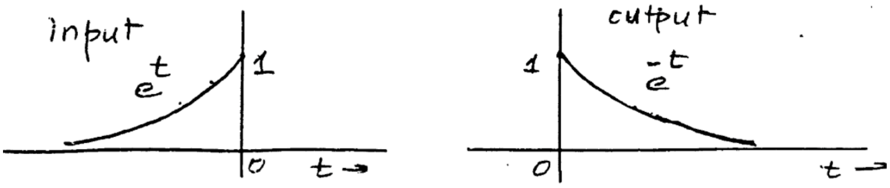
(a) $y_a(t) = \left(e^{-t} - e^{-2t}\right)u(t)$

(b) $y_b(t) = e^6 y_a(t) = e^6\left(e^{-t} - e^{-2t}\right)u(t)$

(c) $y_c(t) = e^{-6} y_a(t-3) = e^{-6}\left(e^{-(t-3)} - e^{-2(t-3)}\right)u(t-3)$

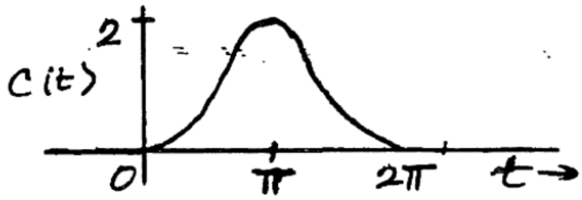
2.4-12 **(a)** $y_{zs}(t) = e^{-t}u(t)$

(b)



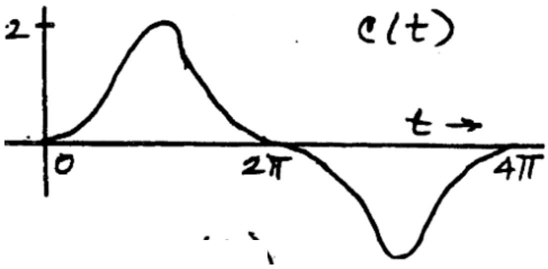
2.4-16

$$c(t) = \begin{cases} 0; & t < 0 \\ 1 - \cos(t); & 0 \le t \le 2\pi \\ 0; & t > 2\pi \end{cases}$$



2.4-17

$$c(t) = \begin{cases} 0; & t < 0 \\ 1 - \cos(t); & 0 \le t < 2\pi \\ \cos(t) - 1; & 2\pi \le t < 4\pi \\ 0; & t \ge 4\pi \end{cases}$$



2.6-5 **(b)** Systemet är stabilt och icke-kausalt.

2.6-3 **(c)** Systemet är inte stabil, det är dock *marginellt* stabilt.

2.6-7 **(a)** Systemet är kausalt **(b)** Systemet är stabilt

6.1-7

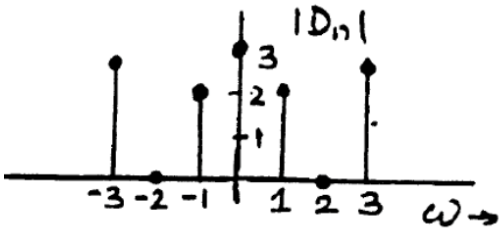
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**
periodic ?	yes	yes	no	yes	no	yes	yes	yes	yes
ω_0	1	1		π		$\frac{1}{70}$	$\frac{3}{4}$	1	2
period	2π	2π		2		140π	$\frac{8\pi}{3}$	2π	π

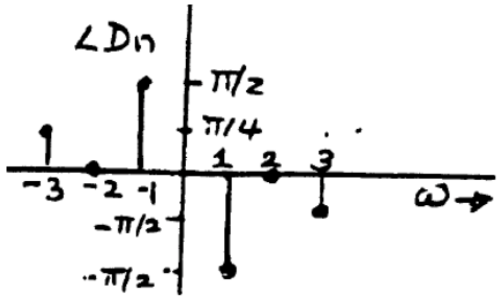
6.3-1 **(a)** $D_{n>0} = \dfrac{2}{\pi n}\sin\left(\dfrac{n\pi}{2}\right) = \mathrm{sinc}_{\mathrm{N}}\left(\dfrac{n}{2}\right),\ D_0 = 0$

(b) $D_n = \dfrac{1}{\pi n}\sin\left(\dfrac{n\pi}{5}\right) = \dfrac{1}{5}\sin c_N\left(\dfrac{n}{5}\right),\ D_0 = \dfrac{1}{5}$

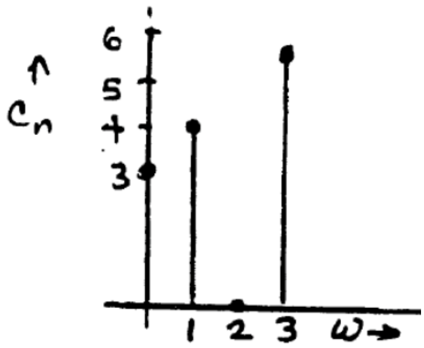
(c) $D_n = \dfrac{j}{2\pi n},\quad D_0 = 0.5$

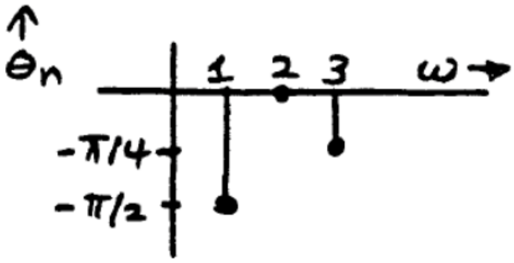
6.3-5 **(a)** $x(t) = \left(2\sqrt{2}e^{j\pi/4}\right)e^{-j3t} + 2e^{j\pi/2}e^{-jt} + 3 + 2e^{-j\pi/2}e^{jt} + \left(2\sqrt{2}e^{-j\pi/4}\right)e^{j3t}$





(b)



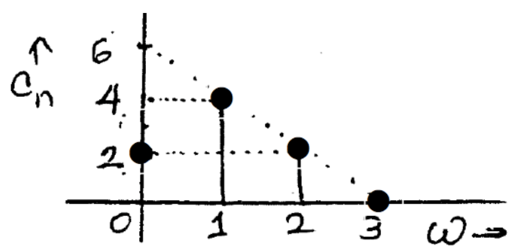


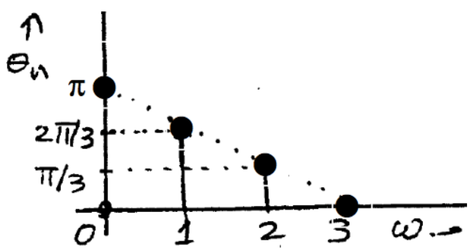
$x(t) = 3 + 4\cos\left(t - \dfrac{\pi}{2}\right) + 4\sqrt{2}\cos\left(3t - \dfrac{\pi}{4}\right)$

(d) Signalens bandbredd är $(3-0)\omega_0 = 3$ rad/s $\left(\text{dvs. } \dfrac{3}{2\pi}\text{ Hz}\right)$.

6.3-7 **(a)** $x(t) = -2 + 2e^{j2\pi/3}e^{jt} + 2e^{-j2\pi/3}e^{-jt} + e^{j\pi/3}e^{j2t} + e^{-j\pi/3}e^{-j2t}$

(b)





(c) $x(t) = -2 + 4\cos\left(t + \dfrac{2\pi}{3}\right) + 2\cos\left(2t + \dfrac{\pi}{3}\right)$

6.3-8 **(a)** $x(t)=\sum_{n=-\infty}^{\infty} D_n e^{jn\omega_0 t}$, **där** $D_n=\begin{cases}\dfrac{4}{\pi^2 n^2}; & \text{udda } n\\ 0; & \text{jämna } n\end{cases}$, $\omega_0=\dfrac{\pi}{4}$ rad/s.

(b) $\hat{x}(t)=x(t-2)=\sum_{n=-\infty}^{\infty} \hat{D}_n e^{jn\omega_0 t}$, **där**

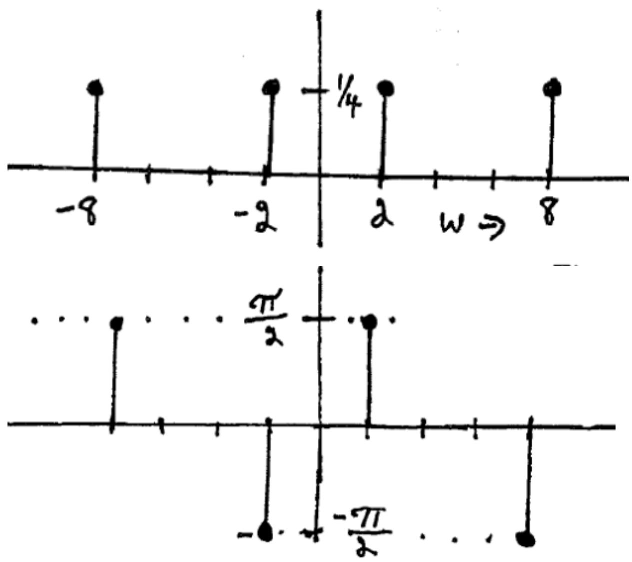
$$\hat{D}_n=D_n e^{-jn\pi/2}=\begin{cases}\dfrac{4}{\pi^2 n^2}e^{-jn\pi/2}; & \text{udda } n\\ 0; & \text{jämna } n\end{cases},\quad \omega_0=\frac{\pi}{4}\text{ rad/s.}$$

(c) $\tilde{x}(t)=x(2t)=\sum_{n=-\infty}^{\infty} \tilde{D}_n e^{jn\tilde{\omega}_0 t}$, **där**

$$\tilde{D}_n=D_n=\begin{cases}\dfrac{4}{\pi^2 n^2}; & \text{udda } n\\ 0; & \text{jämna } n\end{cases},\quad \tilde{\omega}_0=2\omega_0=\frac{\pi}{2}\text{ rad/s.}$$

6.4-2 **(a)** $\cos(5t)\sin(3t)=\frac{1}{4}\left(e^{-j\pi/2}e^{j8t}+e^{j\pi/2}e^{-j8t}+e^{j\pi/2}e^{j2t}+e^{-j\pi/2}e^{-j2t}\right)$

(b)



6.4-3 **(a)** $D_n=\dfrac{1-e^{-1}}{1+j2\pi n}$ *(I bokförfattarens lösningsdokument anges ett svar som är onödigt "otympligt" – där har bl.a. täljare och nämnare multiplicerats med nämnarens komplexkonjugat. Gör hellre som i Lasses alternativa lösning av 6.4-1 och 6.4-3 i dokumentet som finns länkat från lösningswebbsidan!)*