TUTORIAL: SIGNALS & SYSTEMS

1. Express each of the following complex numbers in a polar form

   a. $2+3j$ b. $(1+j)e^{j\pi/3}$ c. $\left(\sqrt{5}+j\right)^2 e^{-j\pi/3}$ d. $\frac{2-\mathrm{j}}{1+\mathrm{j}3}$

2. Determine whether or not each of the following signals is periodic. If the signal is periodic, determine its fundamental period and fundamental frequency.
   (a) $x(t)=e^{j(2\pi t-\pi)}$
   (b) $x(t)=3[\cos(2t)]^2$
   (c) x(t) = cos(4t) .sin(8t)
   (d) x(t) = 4u(t) + 2sin(3t)
   (e) $x(t)=2\cos(2\pi t/3)-2\sin(\pi t/8)+2\cos(2\pi t/7+\pi/6)$

3. Determine the values of Power and Energy for each of the following signals:
   a. $x(t)=e^{-j2t}u(t)$
   b. $x(t)=\begin{cases} t, & 0\le t\le 1 \\ 2+t, & 1\le t\le 2 \\ 0, & otherwise \end{cases}$
   c. $x(t)=\cos(4t+\frac{\pi}{3})$
   d. $x(t)=(\cos(4t+\frac{\pi}{3}))^2$

4. Find the even and odd parts of these functions.

   (a) $g(t)=2t^2-3t+6$
   (b) $g(t)=20\cos\left(40\pi t-\frac{\pi}{4}\right)$
   (c) $g(t)=\frac{2t^2-3t+6}{1+t}$
   (d) $g(t)=\mathrm{sinc}(t)$

5. Consider the Continuous-time signals is shown in fig 1 and fig. 2. Sketch and label carefully each of the following signals:
   a. $x(t-1)$ b. $x(3t-1)$
   c. $-3x(2+t)$ d. $x(t)[\delta(t+1/2)-\delta(t-1/2)]$

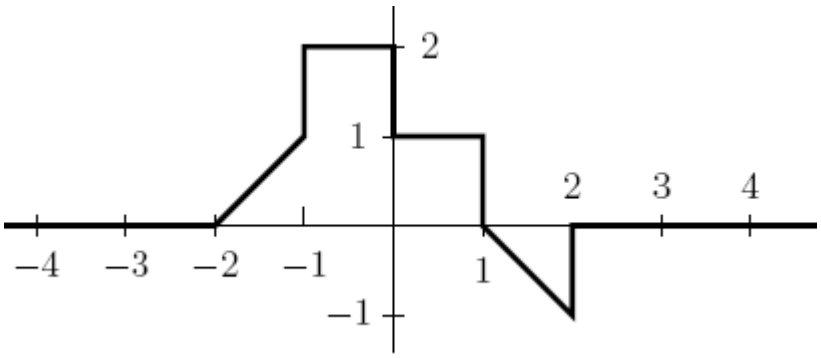

fig 1 x(t)

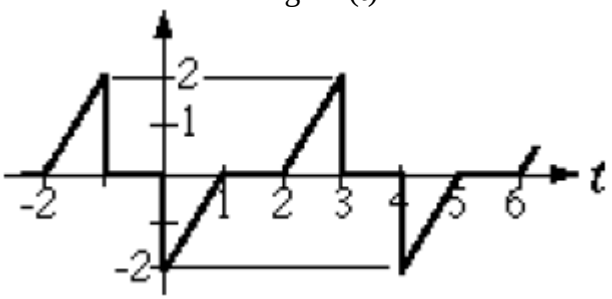

fig 2 (t) is a periodic signal with fundamental period 4

6. Sketch the waveforms of following signals:

a. $x(t) = u(t) - u(t-2)$

b. $x(t) = r(t+1) - r(t) + r(t-2)$

c. $x(t) = u(t+1) - 2u(t) + u(t-2)$

d. $x(t) = r(t+2) - r(t-2)$

7. Determine the properties which hold and which do not hold for each of the following Continuous-time systems. Justify your answers. In each example y (t) denotes the system output and x (t) is the system input.

a. $y(t) = x(t+2) - x(t-2)$

b. $y(t) = \sin[x(t)]$

c. $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$

d. $y(t) = x(2t/5)$

e. $y(t) = \frac{dx(t)}{dt}$

f. $y(t) = \begin{cases} 0, & x(t) < 0 \\ x(t) - x(t-2), & x(t) \geq 0 \end{cases}$

g. $y(t) = tx(t)$

h. $y(t) = \sqrt{x(t)}$