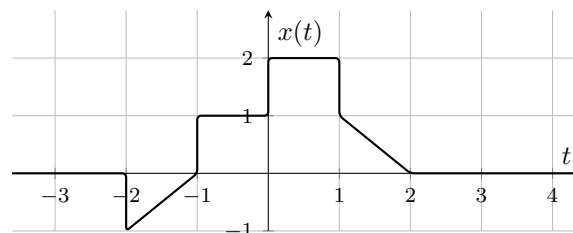


Signals and Systems

Homework 1 — Due : Mar. 1 2024

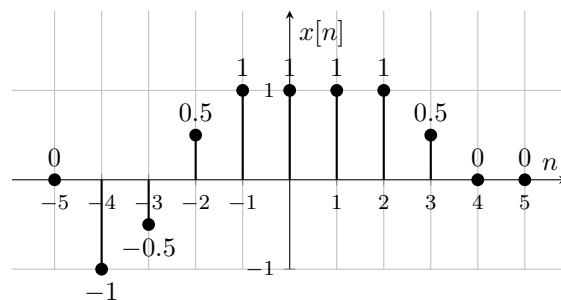
Problem 1 (20 pts). A continuous-time signal $x(t)$ is shown in the figure. Sketch and label carefully each of the following signals:



(a) $x(t - 1)$ (c) $x(2t + 1)$

(b) $x(2 - t)$ (d) $x(4 - \frac{t}{2})$

Problem 2 (30 pts). A discrete-time signal is shown in the figure. Sketch and label carefully each of the following signals:

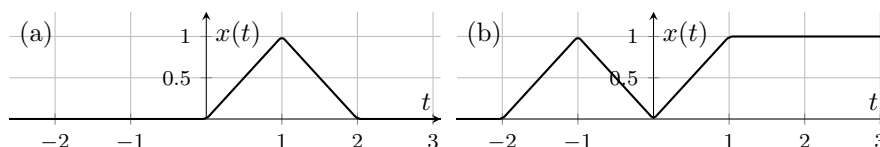


(a) $x[n - 4]$ (d) $x[3n + 1]$

(b) $x[3 - n]$ (e) $\frac{1}{2}x[n] + \frac{1}{2}(-1)^n x[n]$

(c) $x[3n]$ (f) $x[(n - 1)^2]$

Problem 3 (20 pts). Determine and sketch the even and odd parts of the signals depicted in the following figures. Label your sketches carefully.



Problem 4 (24 pts). Determine whether or not each of the following continuous-time signal is periodic. If the signal is periodic, determine its fundamental period.

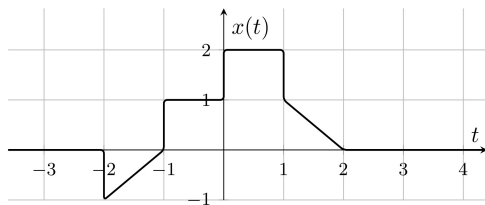
(a) $x(t) = 3 \cos(4t + \frac{\pi}{3})$

(b) $x(t) = e^{j(\pi t - 1)}$

(c) $x(t) = [\cos(2t - \frac{\pi}{3})]^2$

Problem 5 (6 pts). Show that if the fundamental period of signal $x(t)$ is T , then $1.5T$ is not a period of $x(t)$.

Problem 1 (20 pts). A continuous-time signal $x(t)$ is shown in the figure. Sketch and label carefully each of the following signals:

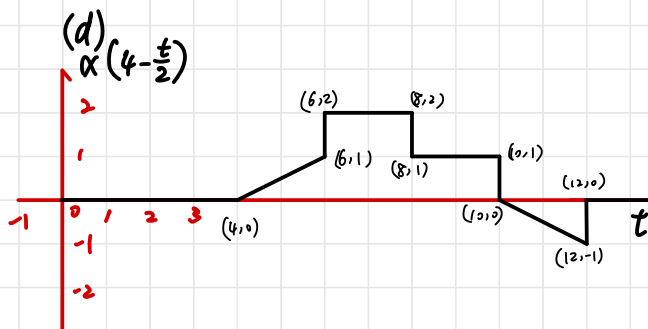
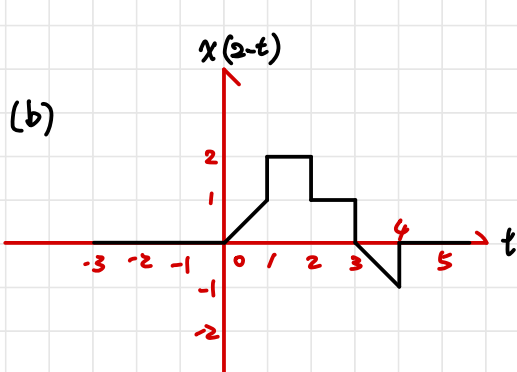
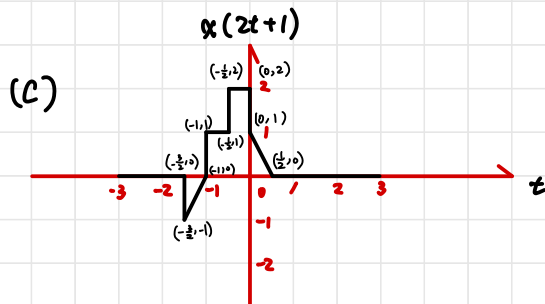
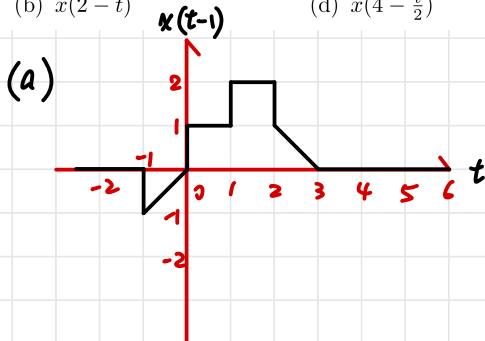


(a) $x(t-1)$

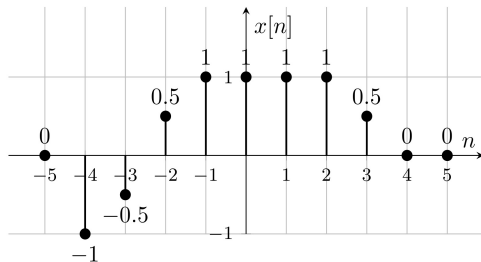
(c) $x(2t+1)$

(b) $x(2-t)$

(d) $x(4-\frac{t}{2})$



Problem 2 (30 pts). A discrete-time signal is shown in the figure. Sketch and label carefully each of the following signals:



(a) $x[n-4]$

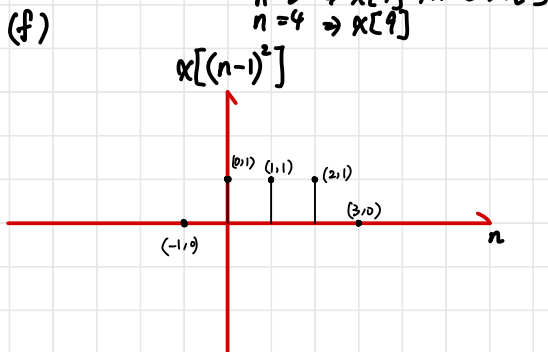
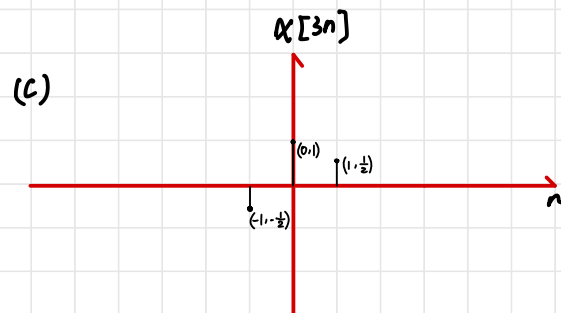
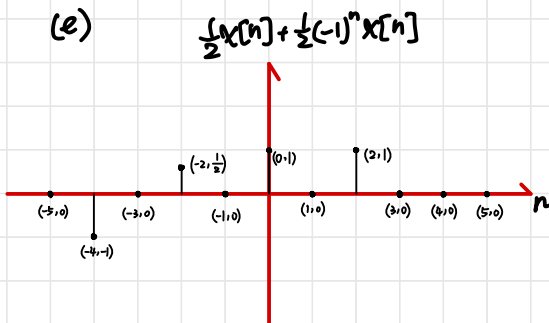
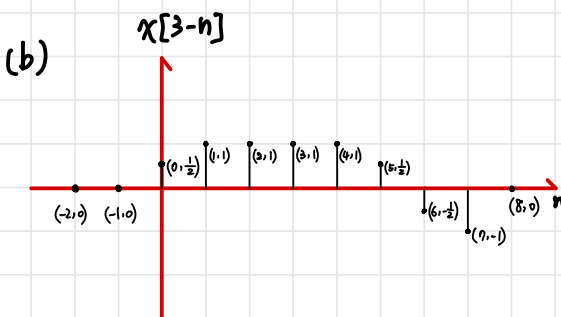
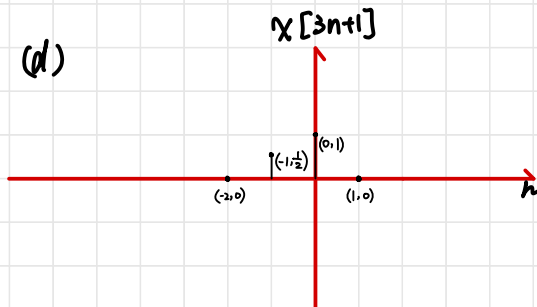
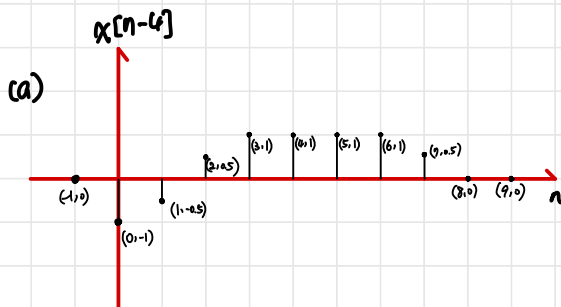
(d) $x[3n+1]$

(b) $x[3-n]$

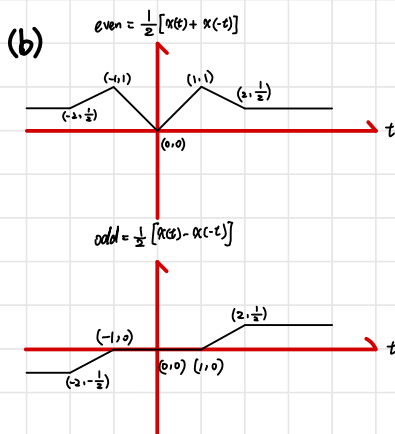
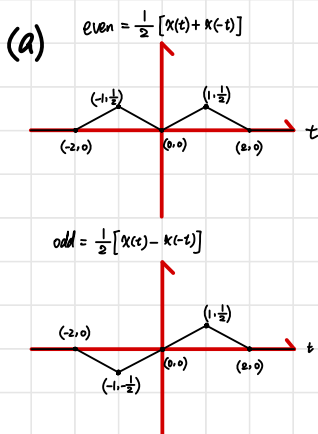
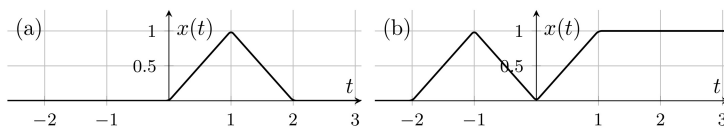
(e) $\frac{1}{2}x[n] + \frac{1}{2}(-1)^n x[n]$

(c) $x[3n]$

(f) $x[(n-1)^2]$



Problem 3 (20 pts). Determine and sketch the even and odd parts of the signals depicted in the following figures. Label your sketches carefully.



Problem 4 (24 pts). Determine whether or not each of the following continuous-time signal is periodic. If the signal is periodic, determine its fundamental period.

(a) $x(t) = 3 \cos(4t + \frac{\pi}{3})$

(b) $x(t) = e^{j(\pi t - 1)}$

(c) $x(t) = [\cos(2t - \frac{\pi}{3})]^2$

(a) $x(t)$ is periodic

(b) $x(t) = \cos(\pi t - 1) + j \sin(\pi t - 1)$

(c) $x(t)$ is periodic

fundamental period

$x(t)$ is periodic.

fundamental period

$$= \frac{2\pi}{4} = \frac{\pi}{2}$$

fundamental period

$$= \frac{2\pi}{2} \times \frac{1}{2} = \frac{\pi}{2}$$

$$= \frac{2\pi}{\pi} = 2$$

Problem 5 (6 pts). Show that if the fundamental period of signal $x(t)$ is T , then $1.5T$ is not a period of $x(t)$.

$$\because x \text{ is periodic } \therefore x(t+1.5T) = x(t+0.5T)$$

$$\because T \text{ is the fundamental period and } 0.5T < T \therefore x(t) \neq x(t+0.5T) = x(t+1.5T)$$

\Rightarrow If the fundamental period of signal $x(t)$ is T ,

then $1.5T$ is not a period of $x(t)$.