EECS2602 Z: Continuous Time Signals and Systems
Instructor: Hui Jiang
Quiz # 1 (8% of the course) your mark: / 21
Time Allowed: 50 minutes

Name: ______________________________

Student ID Number: ______________________ Email: ______________________

1. (4 points) For each of the following signals, determine whether it is periodic or not. If it is, find the fundamental period:

1.1 $x(t) = \exp(\pi t / 24) + \cos(\pi t / 12)$

$\exp(\pi t / 24)$ is an exponential signal, not periodic

No

1.2 $y(t) = \sin(10t) + \cos(3\pi t + \pi / 3)$

$\omega 1 = 10 \rightarrow T1 = 2\pi / \omega 1 = \pi / 5$

$\omega 2 = 3\pi \rightarrow T2 = 2\pi / \omega 2 = 2/3$

$T1/T2 = 3\pi / 10$ (*not a rational number*)

No

1.3 $z(t) = \cos^2(2\pi t)$

$z(t) = \cos^2(2\pi t) = \frac{1}{2}(1 + \cos(4\pi t))$

Yes

$\omega = 4\pi \Rightarrow T = \frac{1}{2}$

1.4 $g(t) = e^{-2t} \cos(2\pi t)$

No, it has an exponential term.

2. (4 points) Evaluate the integral $\int_{-\infty}^{+\infty} [\sin(3\pi t / 4) + \exp(j(\pi / 4)t)] \cdot \delta(-t - 2) \; dt$.

$$= \int_{-\infty}^{+\infty} [\sin(3\pi t/4) + \exp(j(\pi/4)t)] \cdot \delta(t+2)\ dt$$

$$= \int_{-\infty}^{+\infty} [\sin(3\pi t/4) + \exp(j(\pi/4)t)]\Big|_{t=-2} \cdot \delta(t+2)\ dt$$

$$= \int_{-\infty}^{+\infty} [\sin(-3\pi/2) + \exp(j(-\pi/2))] \cdot \delta(t+2)\ dt$$

$$= \int_{-\infty}^{+\infty} [\sin(-3\pi/2) + \exp(j(-\pi/2))] \cdot \delta(t+2)\ dt$$

$$= \sin(-3\pi/2) + \exp(j(-\pi/2)) = 1 - j$$

3. (4 points) Determine the average power of a complex exponential signal: $x(t) = D \cdot \exp[j(\omega t + \theta)]$, where D is a complex number.

1. it is a period function with fundamenal period T=$\dfrac{2\pi}{\omega}$

$$P = \frac{1}{T}\int_0^{2\pi/\omega} |x(t)|^2\ dt = \frac{\omega}{2\pi}\int_0^{2\pi/\omega} x(t)\cdot x^*(t)\ dt = \frac{\omega}{2\pi}\int_0^{2\pi/\omega} D\cdot e^{j(\omega t+\theta)} \cdot D^* \cdot e^{-j(\omega t+\theta)} dt$$

$$= \frac{\omega}{2\pi}\int_0^{2\pi/\omega} D\cdot D^* dt = |D|^2$$

3. (9 points) A CT signal $x(t)$ is shown in Figure P2.

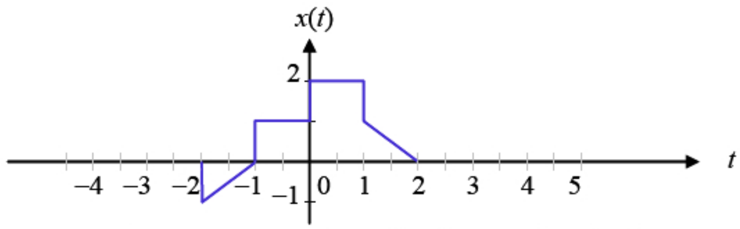


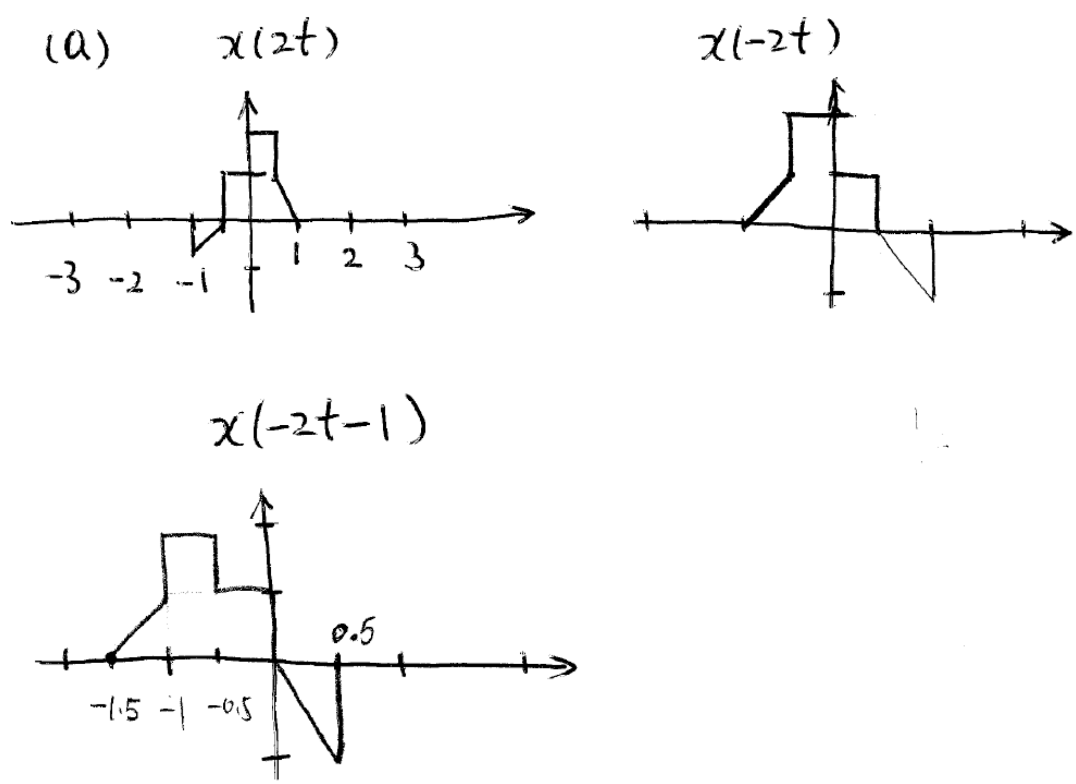
Figure P2: Waveform for the CT signal $x(t)$

Sketch and label carefully each of the following signals.

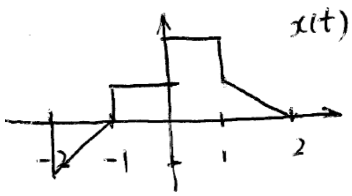
(a) [3 points] $x(-1-2t)$

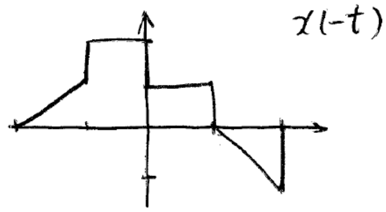
(b) [3 points] Even component of $x(t)$

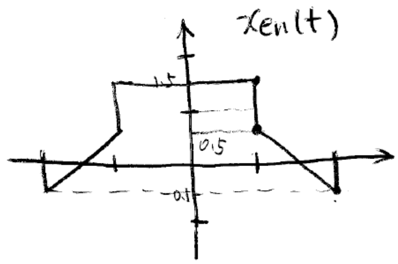
(c) [3 points] $x(\frac{t}{2})\sum_{k=-\infty}^{+\infty}\delta(t-2k-1)$

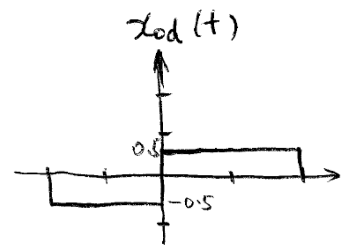


(b) $x_{ev}(t) = \frac{1}{2}\left[x(t) + x(-t)\right]$

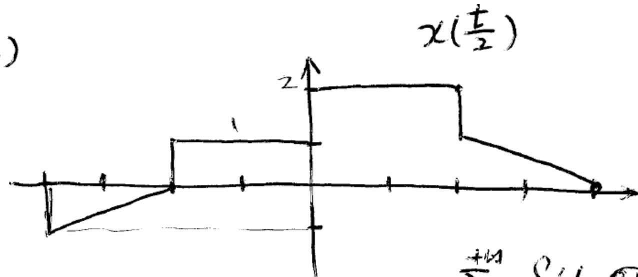








(c)



$\sum_{k=-\infty}^{+\infty} \delta(t - 2k - 1)$