

ECE301

HW 1

DUE ON TUESDAY SEP. 13TH

**Please provide steps to explain
your answer**

Question 1

Sketch and label carefully each of the following signals:

- $x_1(3t + 1)$
- $x_1(2t)u(t)$
- $x_1(-2t)u(-t)$
- $x_2[4n + 1]$
- $x_2[(n + 1)^2]$

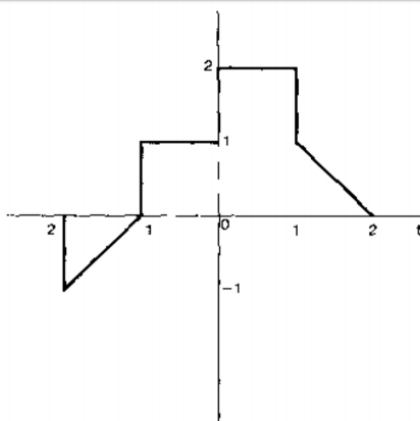


Figure 1: $x_1(t)$

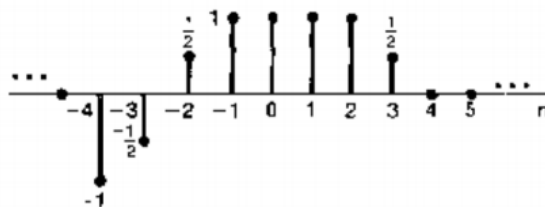


Figure 2: $x_2[n]$

Question 2

Determine if each of the following signals is periodic and justify your answer. If the signal is periodic, determine the fundamental frequency.

- $x(t) = e^{j(2\pi t - 1)}$
- $x(t) = [\cos(3t - \frac{2\pi}{3})]^2$
- $x[n] = \cos(\frac{\pi n}{7} - pi)$
- $x[n] = 2\cos(\frac{\pi n}{5}) + \sin(\frac{\pi n}{3}) - 2\cos(\frac{\pi n}{15})$

Question 3

a.) For any signal , prove the following:

- 1.) $E(x(t)) = \frac{1}{2}[x(t) + x(-t)]$ is an even function
- 2.) $O(x(t)) = \frac{1}{2}(x(t) - x(-t))$ is an odd function

b.) Suppose $x(t)$ is an odd signal and $y(t)$ is an even signal, determine if each the following is an even signal, odd signal, or neither, and prove your answer:

- 1.) $x(t)y(t)$
- 2.) $y(t)y(t)$

Question 4

a.) Suppose $x(t)$ is an odd signal, determine if the following signal is even or odd or neither and prove your answer:

- 1.) $x(t)x(t)$

b.) For the signal $x(t)$ shown below, sketch and label carefully:

- 1.) The odd part $O(x(t))$
- 2.) The even part $E(x(t))$

c.) For the signals $x(t)$ and $y(t)$ shown below, sketch and label carefully:

- 1.) $O(x(t))y(t)$

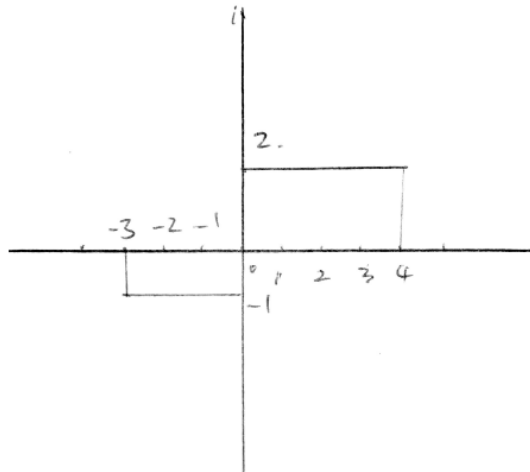


Figure 3: $x(t)$

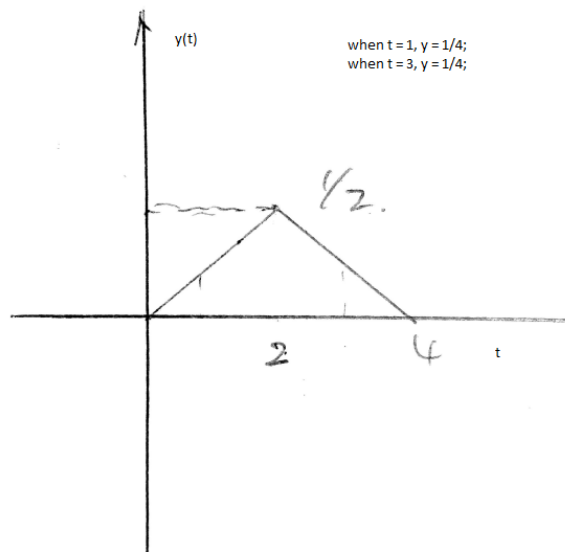


Figure 4: $y(t)$

Question 5

Determine the values of P_∞ and E_∞ for each of the following signals:

- a.) $x(t) = e^{j(3t + \frac{\pi}{6})}$
- b.) $x(t) = \sin(t)$
- c.) $x[n] = (\frac{1}{3})^n u[n]$
- d.) $x[n] = e^{j(\frac{4\pi n}{3} + \frac{\pi}{8})}$
- f.) $x[n] = j \sin(\frac{\pi n}{4})$