

ECE 302 - Linear System Analysis

Homework #2

Due Date: September 10, 2025

1. **Signal Classification:** For each signal below determine whether it is (i) continuous-time or discrete-time and (ii) analog or digital. Clearly and explicitly justify your answers for full credit.

(a) $x(t) = |\sin(t)|, t \in \mathbb{R}$

(b) $x(t) = n, n \leq t < n + 1, t \in \mathbb{R}^+, n$ is any nonnegative integer

(c) $x(n) = 2^n$ for each integer n

2. **Signal Models:** Sketch and numerically label the following functions:

(a) $x(t) = u(2t) + 1$

(b) $x(t) = 2\delta(t - 2) - 3\delta(t - 1)$

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

3. **Properties of Impulse Functions:** Simplify the following expressions:

(a) $(at^2 + bt + c)\delta(t + 1), a, b, c \in \mathbb{R}$

(b) $e^{-j\pi t} [\delta(t - 2) - \delta(t + 2)]$

(c) $\sum_{k=1}^{\infty} \frac{1}{t} \delta(t - k)$.

4. **Impulse Functions and Integrals:** Evaluate the following integrals:

(a) $\int_{-\infty}^{\infty} \cosh(2\pi\tau) \delta(\tau - 2) d\tau$

(b) $\int_{-\infty}^t \cosh(2\pi\tau) \delta(\tau - 2) d\tau$

(c) $\int_t^{\infty} \cosh(2\pi\tau) \delta(\tau - 2) d\tau$.

5. **Rectangular/Polar Forms of Complex Numbers:** For each complex number below, compute either its rectangular form or its polar form (whichever is missing) and plot the point in the complex plane.

(a) $2 - j3$

(b) $2 + j2$

(c) $e^{j6\pi}$

(d) $3e^{-j5\pi/4}$