1. Consider a function \( x(t) \) defined for \( t \in (-\infty, \infty) \) as follows.

\[
x(t) = \begin{cases} 
0 & : -\infty < t < 0 \\
1 - t & : 0 \leq t \leq 1 \\
0 & : 1 < t < \infty
\end{cases}
\]

(a) Sketch this function with appropriate labels for the axes. Next, give a sketch of functions \( x(-t) \), \( x(-t - 0.5) \), and \( x(-t + 0.5) \).

(b) Define new functions \( u(t) := x(-t) \), \( v(t) := x(t - 0.5) \), \( w(t) := u(t - 0.5) \), and \( z(t) := v(-t) \). Give sketches of \( w(t) \) and \( z(t) \).

**Remark:** \( v(t) \) is a time-translate of \( x(t) \), and \( u(t) \) is a time-reversed version of \( x(t) \). Further, \( w(t) \) is obtained by first doing a time-reversal on \( x(t) \) and then doing time-translation. On the other hand, \( z(t) \) is obtained by first doing time-translation and then time-reversal. Compare the effects.

2. A function \( x : \mathbb{R} \to \mathbb{R} \) is said to be **even** if \( x(-t) = x(t) \) for every \( t \in \mathbb{R} \). It is said to be **odd** if instead \( x(-t) = -x(t) \) for every \( t \in \mathbb{R} \). Check whether the following are odd or even, or neither.

\[
(1) \quad x_e(t) = \frac{1}{2}(x(t) + x(-t)) \\
(2) \quad x_o(t) = \frac{1}{2}(x(t) - x(-t))
\]

3. A square wave voltage is applied to a series connection of a resistor and a capacitor. Sketch the waveforms of the steady-state periodic voltages developing across the resistor and capacitor. Can this circuit be used as a simple filter? What type. Give your views.