ECE 102 Discussion 1

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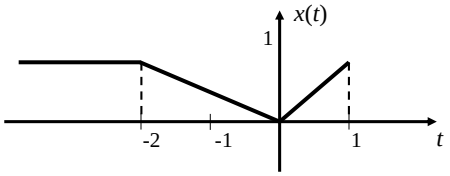
Problem 1: Basic signal operations

a Consider the following signal.

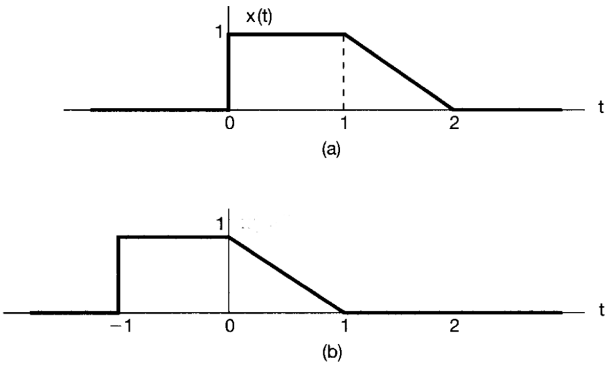


Sketch the following:

A $x(-t+3)$

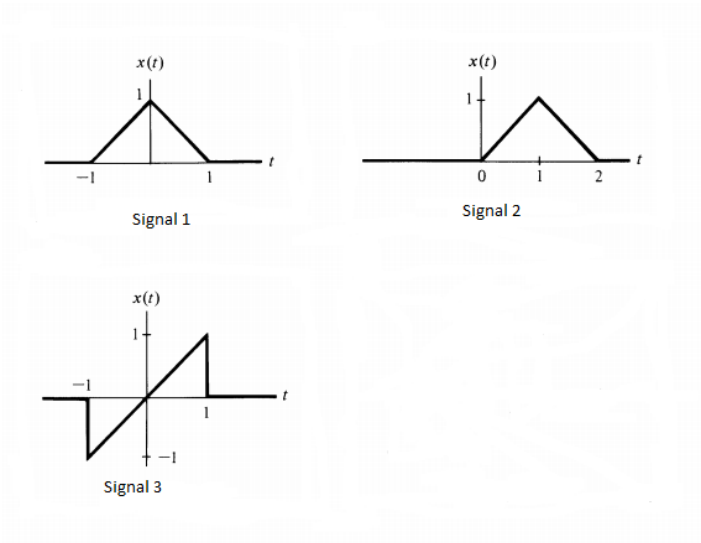
B $x(-2t)$

b Consider the two signals. If the first signal is $x(t)$ then what is the signal shown in figure (b)?



Problem 2: Even-Odd decomposition of signals

a For each of the following signals, determine whether it is even, odd, or neither:



b Find the even and odd component of

$$x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$$

Problem 3: Periodic signals

Let $x(t)$ be a continuous-time signal, and let $y_1(t) = x(2t)$ and $y_2(t) = x(t/2)$.

The signal $y_1(t)$ represents a speeded up version of $x(t)$ in the sense that the duration of the signal is cut in half. Similarly, $y_2(t)$ represents a slowed down version of $x(t)$ in the sense that the duration of the signal is doubled. Consider the following statements:

1. If $x(t)$ is periodic, then $y_1(t)$ is periodic.
2. If $y_1(t)$ is periodic, then $x(t)$ is periodic.
3. If $x(t)$ is periodic, then $y_2(t)$ is periodic.
4. If $y_2(t)$ is periodic, then $x(t)$ is periodic.

For each of these statements, determine whether it is true, and if so, determine the relationship between the fundamental periods of the two signals considered in the statement. If the statement is not true, produce a counterexample to it.