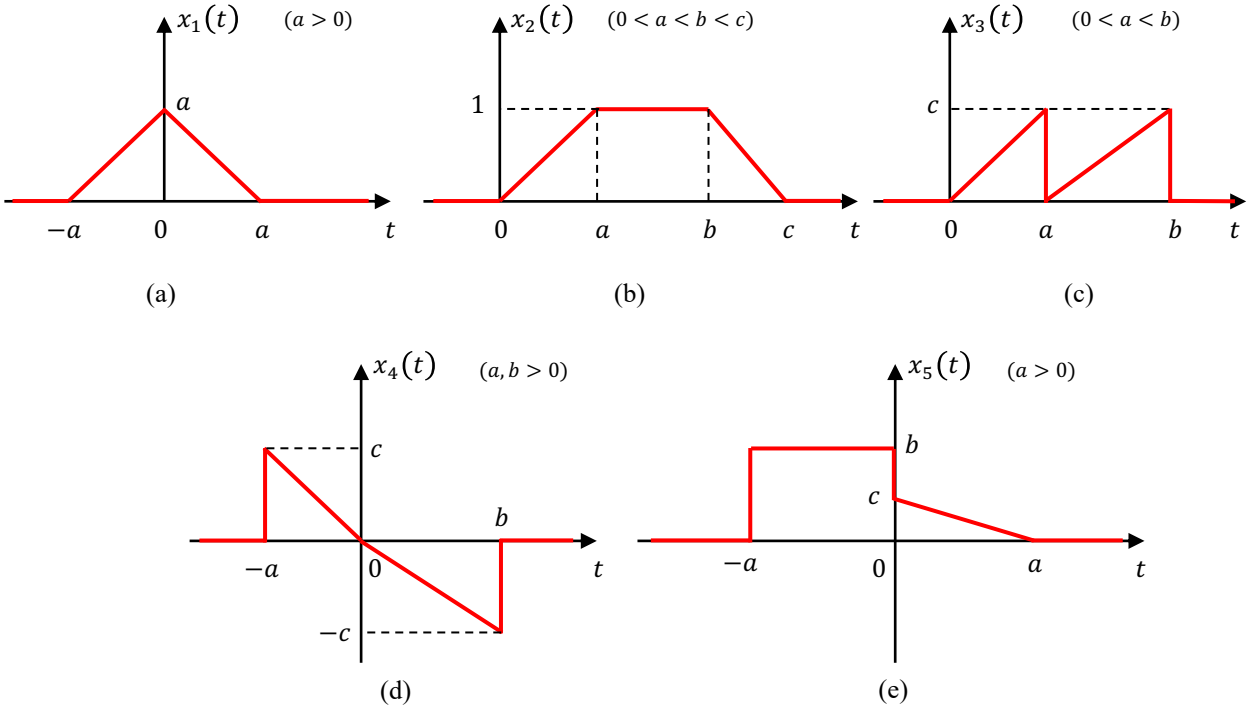
ECE 213 – Continuous-Time Signals and Systems
Spring 2024

Homework 2
Due: Friday, February 16, 2024 at 5:00 PM
(*Submit answers* on the WeBWorK server and upload on Gradescope.com)

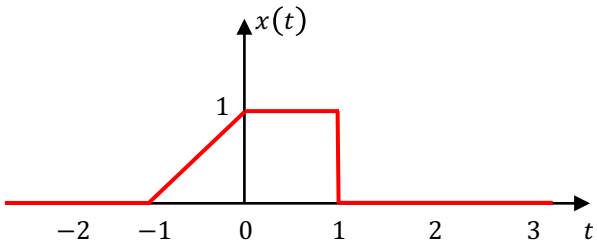
1. (25 pts, WeBWorK) Find the expressions of the following waveforms in terms of the ramp $[r(t)]$ and step $[u(t)]$ functions. Symbols a, b, and c are non-zero, real constants. (5 pts each)



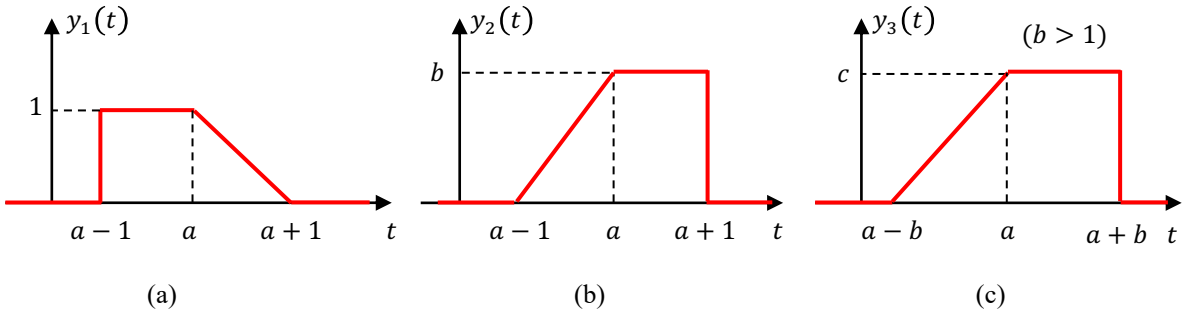
2. (25 pts, WeBWorK) For each of the following signals, determine its even and odd components. Symbols a, b, and c below indicate non-zero, real constants. (5 pts each)

(a) $x_1(t) = \cos(at)r(t)$. Your answer should not contain the step function $u(t)$ nor the ramp function $r(t)$.
(b) $x_2(t) = a + b(t+1) + c(t+1)^2$
(c) $x_3(t) = a + te^{jbt}$
(d) $x_4(t) = a\cos(bt + c)$
(e) The waveform $x_5(t)$ in Question 1(e) with the constants a, b, and c given on the webpage. Your answer can contain $u(t)$ and $r(t)$.

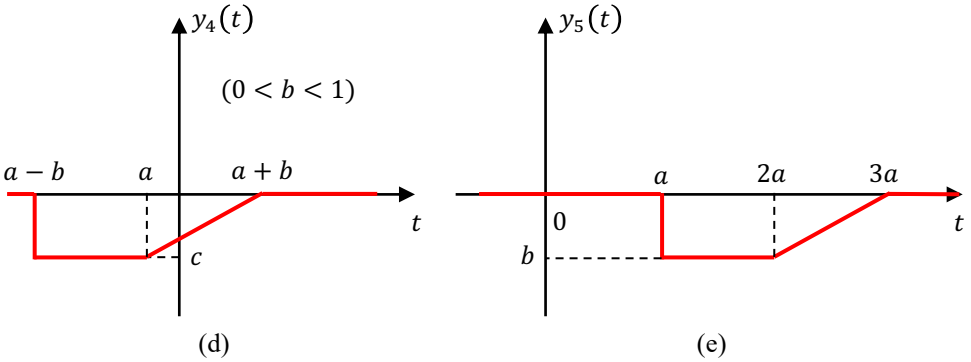
3. (25 pts, WeBWorK) Consider the following signal $x(t)$.



For each of the following signals, find its expression as a transformed copy of $x(t)$ after amplitude scaling, time shift, and/or time scaling. The symbols a, b, and c are non-zero, real constants. (5 pts each)



(a) (b) (c)



(d) (e)

4. (25 pts, Gradescope) Determine if the following signals of time t in seconds are periodic. For periodic signals, find the fundamental angular frequency ω_0 in rad/s and the fundamental period T_0 in seconds. For non-periodic signals, explain why. (5 pts each)

(a) $x_1(t) = \cos(|2t|)$
(b) $x_2(t) = \sqrt{\cos^2(2t)}$
(c) $x_3(t) = 2\cos\left(\frac{100}{99}t\right) + 3\sin\left(\frac{100}{101}t\right)$
(d) $x_4(t) = 2\cos\left(\frac{100}{99}t\right) + 3\sin\left(\frac{100\sqrt{2}}{101}t\right)$
(e) $x_5(t) = \cos\left(\frac{t}{3}\right)\sin\left(\frac{t}{4}\right)$