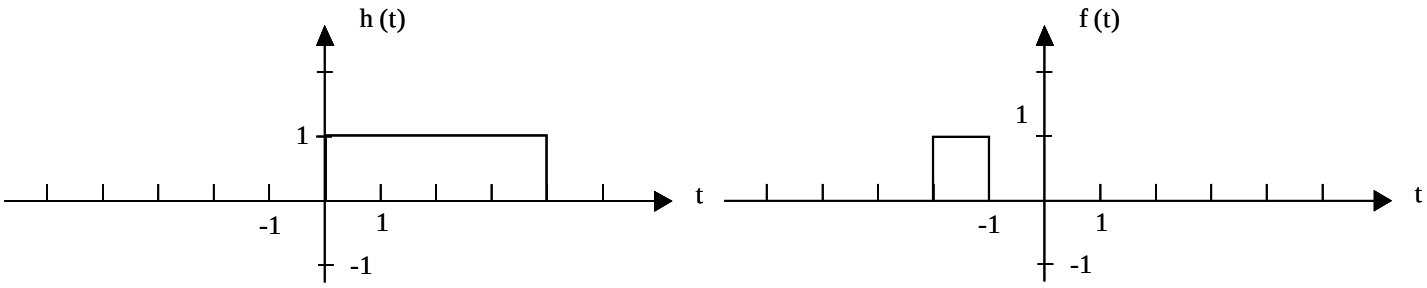
ECE 3337 Sum-3, 2016 Hebert, Homework 7, Thurs Due 7/6

Problem 1.

Find the convolution of $f(t) = e^{-2t}u(t)$ and $h(t) = e^{-3t}u(t-1)$ by taking the FT of each, multiplying the FFTs together, then finding the inverse FT of the product (use partial fractions).

Problem 2.

For $f(t)$ and $h(t)$ below, find $g(t) = f(t) * h(t)$ using the graphical method.



Problem 3.

Find the convolution of $f(t) = [u(t-1) - u(t-2)]$ and $h(t) = u(t+3) - u(t+2)$ using the graphical method. (pictorial). Mark your leading and/or trailing edges in your plots.

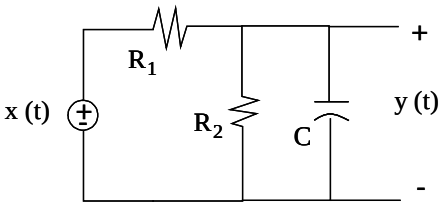
Problem 4.

Find the convolution of $f(t) = t^2\,[u(t-1) - u(t-2)]$ and $h(t) = 2\,u(3-t)$ using the graphical method. Mark your leading and/or trailing edges in your plots.

Problem 5. Problem 2-32(a,b,c,d,) in your book – Ziemer

(a) **show** that the input-output differential equation relationship is given by $R_1 C\, y'(t) + \left[1 + \frac{R_1}{R_2}\right] y(t) = x(t)$

(b) **show** that the impulse response h(t)
(i.e. the output of the circuit when the input voltage = Dirac delta function)
is given by $h(t) = \frac{1}{R_1 C} \exp\left[\frac{-t}{\tau}\right] u(t)$



where $\tau = \frac{R_1 R_2 C}{R_1 + R_2}$. You can use Fourier domain circuit analysis.

(c) **Show** that the step response $y_{step}(t)$
(i.e. the output of the circuit when the input voltage = step function u(t))
is given by $y_{step}(t) = \frac{R_2}{R_1 + R_2}\left[1 - \exp\left(\frac{t}{\tau}\right)\right] u(t)$. You can use Fourier domain circuit analysis.

(d) If the input is $x(t) = \Pi\left[\frac{t-1}{2}\right]$, **obtain** the output $y(t)$. You can use the transfer function H(w) = FT{ h(t) } from part (b) and multiply it times the FT{ x(t) }, then inverse FT.