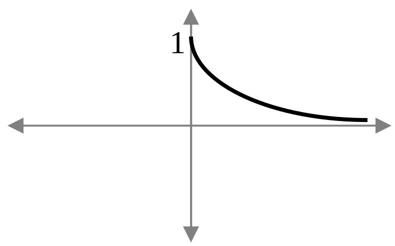
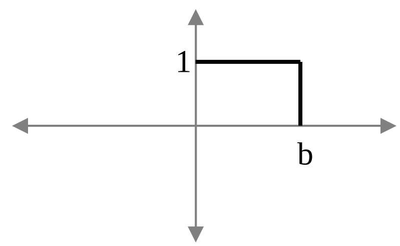
ECE 330 Summer 2006 Final Quiz Review

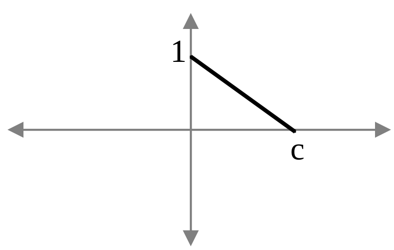
$x_1(t) = e^{-at}$



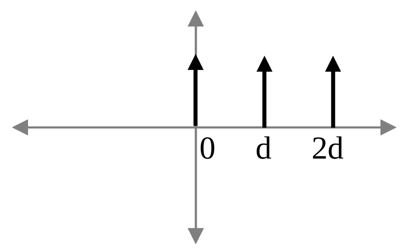
$x_2(t) = u(t) - u(t - b)$



$x_3(t) = \begin{cases} 1 - t/c, & 0 < t < c \\ 0 & \text{otherwise} \end{cases}$



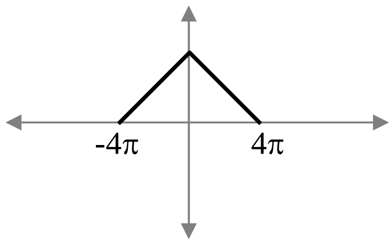
$x_4(t) = \delta(t) + \delta(t - d) + \delta(t - 2d)$



Perform the following convolutions:

1. $x_1 * x_1$ — a = 5 for both signals
2. $x_2 * x_2$ — b = 2 for one signal, 4 for the other.
3. $x_3 * x_3$ — c = 2 for one signal, 3 for the other.
4. $x_4 * x_4$ — d = 1 for both signals.
5. $x_2 * x_3$ — b = 3, c = 1.
6. $x_1 * x_2$ — a = 1, b = 3.
7. $x_3 * x_4$ — c = 1, d = 2.
8. $x_2 * x_4$ — b = 2, d = 1.

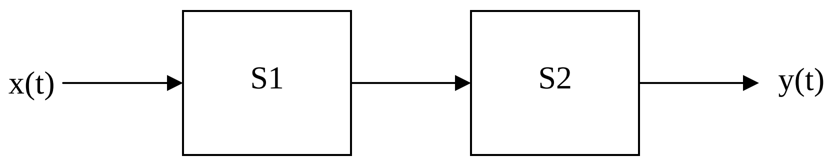
9. A continuous time signal x(t) has the Fourier transform $X(\omega)$ below:



(measured in radians, which is 2π/seconds).

How often (how many times per second) must we sample the time signal in order to be able to reconstruct it perfectly from its Fourier transform? In other words, how often must we sample x(t) so that its discrete Fourier transform $X(\Omega)$ does not experience any aliasing? In other words, what is the Nyquist frequency of x(t)?

10. A signal x(t) is passed through two systems S1 and S2. The impulse response for S1 is $h_1(t)$ and the impulse response for S2 is $h_2(t)$.



If $h_1(t) = x_2(t)$ from page 1, with b = 1,
$h_2(t) = x_4(t)$ from page 1, with d = 1,
and $x(t) = x_3(t)$ from page 1, with c = 1,

show why y(t) is the same as the answer for problem #5.