EECS 16A Designing Information Devices and Systems I
Spring 2015 Discussion 12F

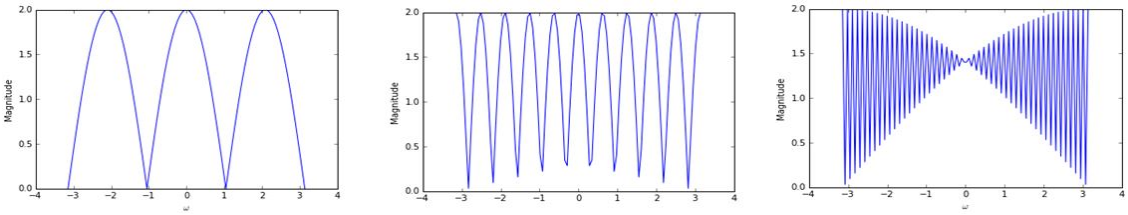
1. Notch Filter

You have learned about low-pass filters and how they allow low frequencies to go through, and attenuate the higher frequencies. What if we want to remove a particular frequency from the signal?

(a) Find the frequency response of the system $y(n) = x(n) + x(n-2)$

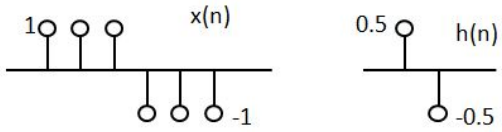
(b) How will your answer change if the system is $y(n) = x(n) + x(n-k)$?

(c) Match the given frequency responses to systems of the form $y(n) = x(n) + x(n-k)$, for k = 3,10,50.

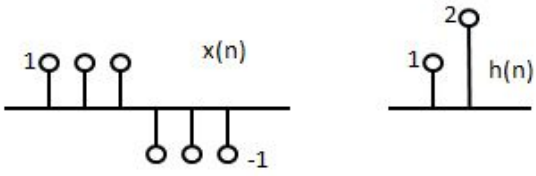


2. Convolution The questions below have an input signal $x(n)$ and a system $h(n)$. Write the expression for $x(n)$ and plot the output signal $y(n)$.

(a) Assume both signals begin at 0.



(b) Assume both signals begin at 0.



(c) $x(n) = a^n u(n)$ and $h(n) = u(n)$ (solve computationally!) Remember the formula for convolution is

$$y(n) = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$$

Decibels (dB)

Decibels is a unit that represents the ratio between two values on a logarithmic scale. The decibel value of a physical values (F) compared to a reference value (F_0) can be calculated in the following way:

$$20\log_{10}(\frac{F}{F_0})dB$$

Therefore, if $F = 10F_0$, the corresponding decibel value would be 20 dB.

For example, HW9 plotted the magnitude of the frequency response of $A(t)$ using decibels. What do you think the reference amplitude was in that case?

HW9 also used the 3dB point as a reference to check the bandwidth. 3dB is a special value since it represents the point at which power has dropped to half it's original value. Since the relationship between power and voltage is squared, it means the voltage has dropped to $\frac{1}{\sqrt{2}}$ of its original value.