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Problem 1: To separate two sinusoidal signals of frequencies 1 kHz and 2 kHz.

1) Sketch the spectrum of
   $s_1(t) = \cos(2\pi f_1 t)$ and
   $s_2(t) = \cos(2\pi f_2 t)$
   where, f_1 = 1 kHz and f_2 = 2 kHz
2) Let $y(t) = s_1(t) + s_2(t)$. Obtain the filter $h(t)$ that can be used to get $s_1(t)$ from $y(t)$.

Problem 2: Let $H(z) = G\frac{1-z^{-2}}{1-2rcos(\omega_0)z^{-1}+r^2z^{-2}}$ where $r = 0.95, \omega_0 = \pi/3$ and $max\{|H(e^{j\omega})|\} = 1$

1) Find G.
2) Write the input output relation for this discrete system.
3) Plot $|H(e^{j\omega})|$.
4) Find the impulse response for the given system.

Problem 3: Consider $x_1(n)$={1,1,1,1}

1) Find $x_1(n) * x_1(-n)$.
2) Let $x_2(n)$={1,1,-1,-1}, find $x_1(n) * x_2(-n)$.
3) Let $x_3(n)$={1,1,1,-1}, find $x_1(n) * x_3(-n)$.