4.13 a. $x[n] = \frac{7}{\pi}\cos(1.8\pi + 2.03)$ Convert to primary alias

$= \frac{7}{\pi}\cos(0.2\pi - 2.03)$

$= \frac{7}{\pi}\cos(2\pi(1600t)) - 2.03$

↑ Reconstruction Sampling Frequency

$\boxed{\text{Frequency that will be heard is } 3200 \text{ Hz}}$

b. $x(t) = \cos(2\pi(1800t) + \pi/3)$

~~$\cos(3600\pi t \; 3600\pi + \frac{\pi}{3}) = \cos(1 + \frac{\pi}{3}) \Rightarrow$ fsamp must be 2400 Hz~~

$x[\frac{n}{f}] = \cos(2\pi(\frac{1800nt}{2400}) + \pi/3) \rightarrow \cos(\frac{36\pi nt}{24} + \pi/3) \rightarrow \cos(\frac{3\pi nt}{2} + \frac{\pi}{3})$

Convert to primary alias $\rightarrow \cos(-\frac{\pi nt}{2} + \frac{\pi}{3}) \rightarrow \cos(\frac{\pi nt}{2} - \frac{\pi}{3})$

To achieve a frequency of 2400 Hz $f_s(\frac{\pi}{2}) = 2\pi(2400)$

$f_s = 2(4800) = 9600$

c) Duration = 64 x 8000 = 512000 / 40000 = 12.8

Frequency = $\frac{1}{\text{Duration}}$ Original Time = 0.2

4.15 $x[n] = 7\cos(0.7\pi n + 0.2\pi) ; n \in \mathbb{Z}$ $f_s = \frac{1}{T_s} = 8000 \frac{s}{sec}$

a) Find $x_1(t)$ & $x_2(t)$ such that $x[n] = x_1(nT_s) = x_2(nT_s)$ if $T_s = 125\mu s$

Replace n w/ f_s

$x(t) = 7\cos(0.7\pi(8000t) + 0.2\pi)$

$= 7\cos(5600\pi t + 0.2\pi) \rightarrow \boxed{f = 1400}$

Sub 2π to 0, use even parity

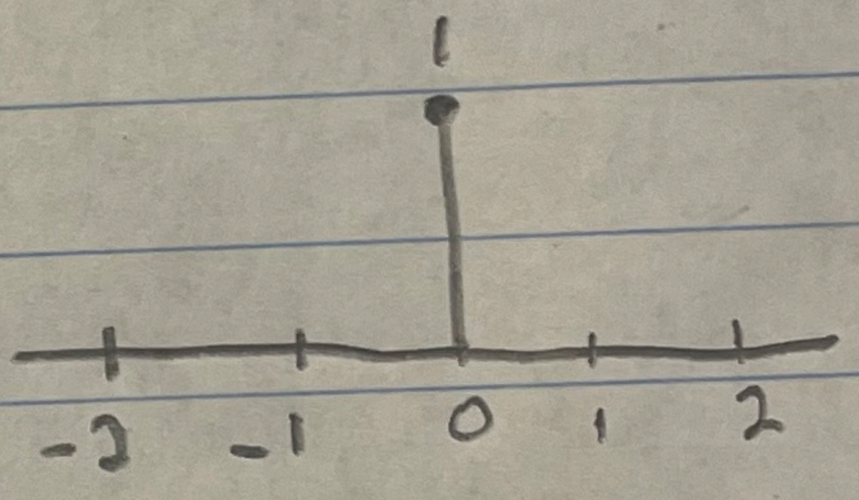
$x(t) = 7\cos(1.3\pi(8000t) - 0.2\pi \rightarrow \boxed{f = 5200}$

b) $x[n] = 7\cos(0.7\pi n + 0.2\pi)$

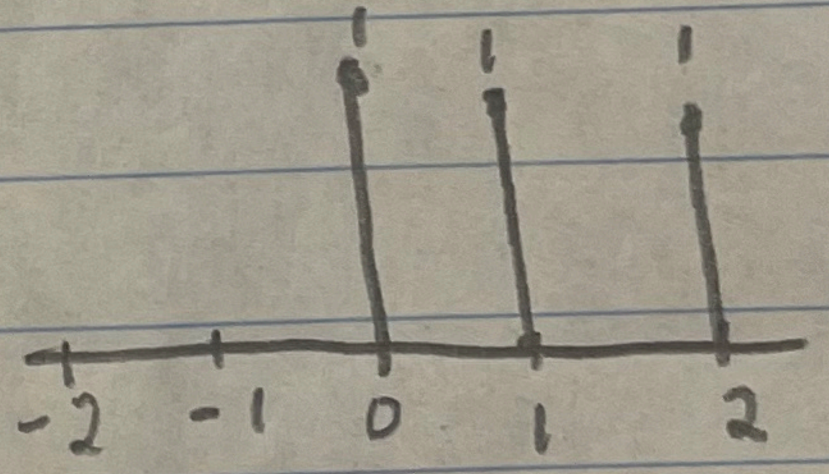
$x(t) = 7\cos(0.7\pi(5000t) + 0.2\pi)$

$= \boxed{7\cos(3500\pi t + 0.2\pi)}$

$\delta[n]$: unit impulse = $\begin{cases} 1 & \text{when } n=0 \\ 0 & \text{when } n \neq 0 \end{cases}$



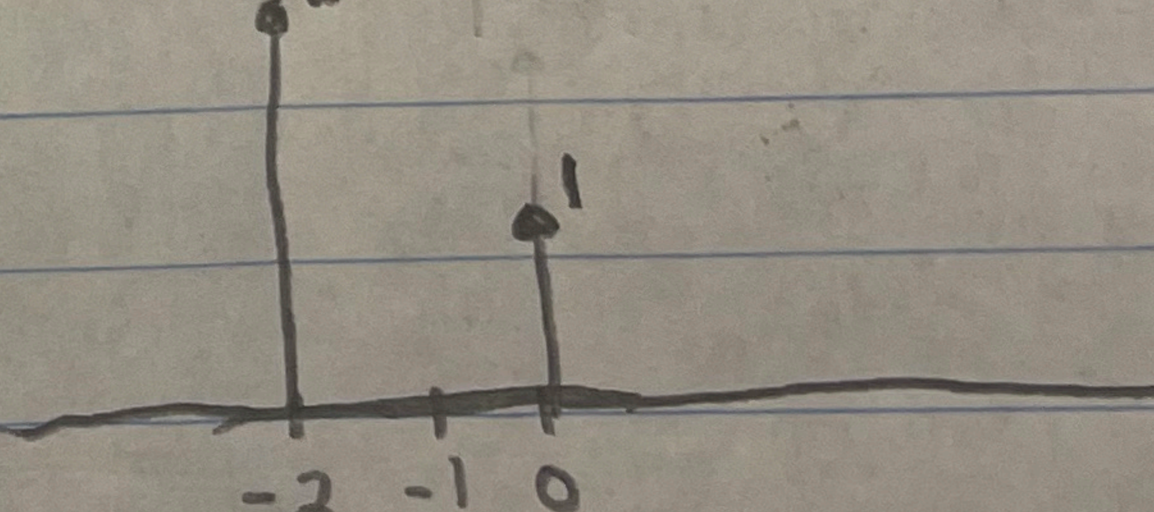
$u[n]$: unit step $\begin{cases} 1 & \text{when } n \geq 0 \\ 0 & \text{when } n < 0 \end{cases}$



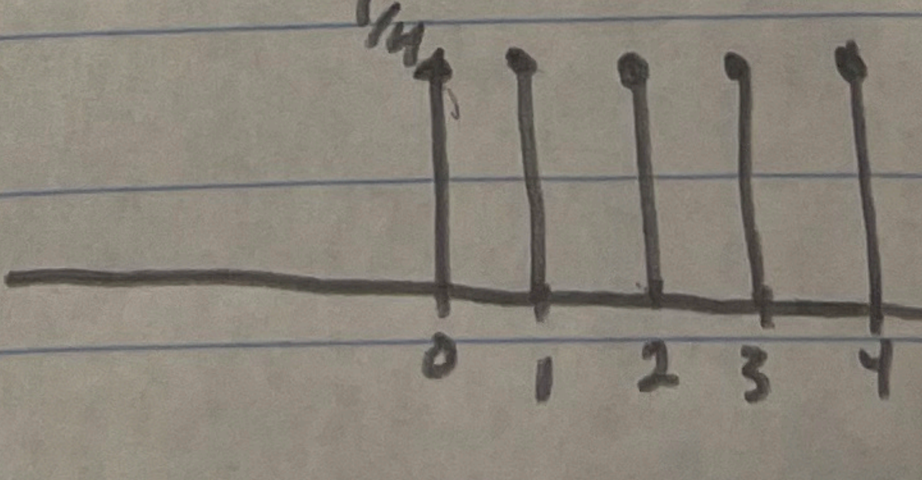
h denotes ~~output~~ impulse response

Dr Harleys Examples

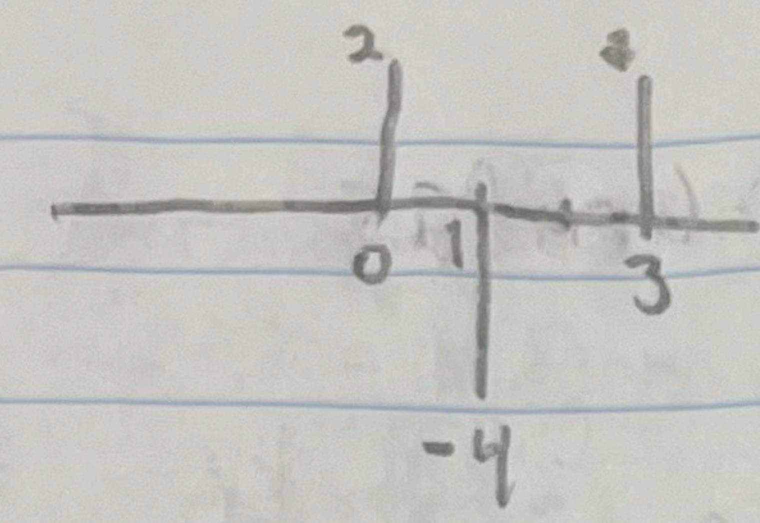
2b) $h[n] = 2\delta[n+2] + \delta[n]$



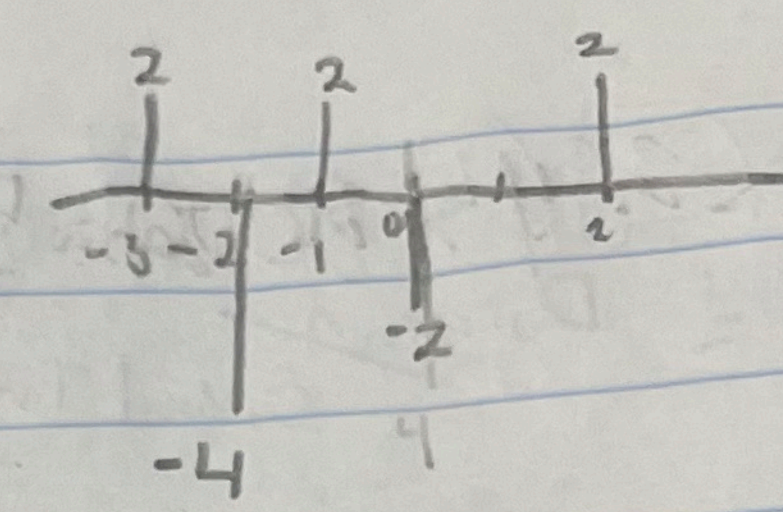
c) $h[n] = \frac{1}{4}\sum_{m=0}^{4} \delta[n-m]$



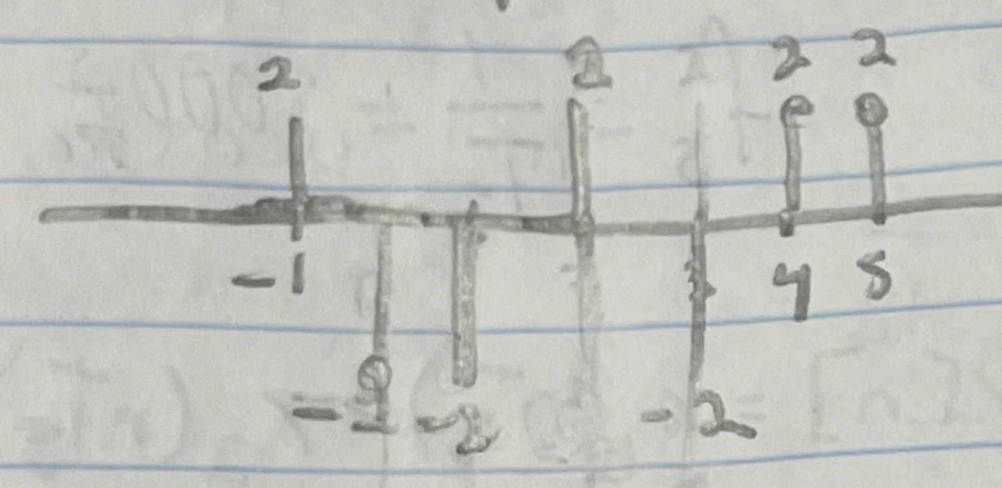
5. a)



b)

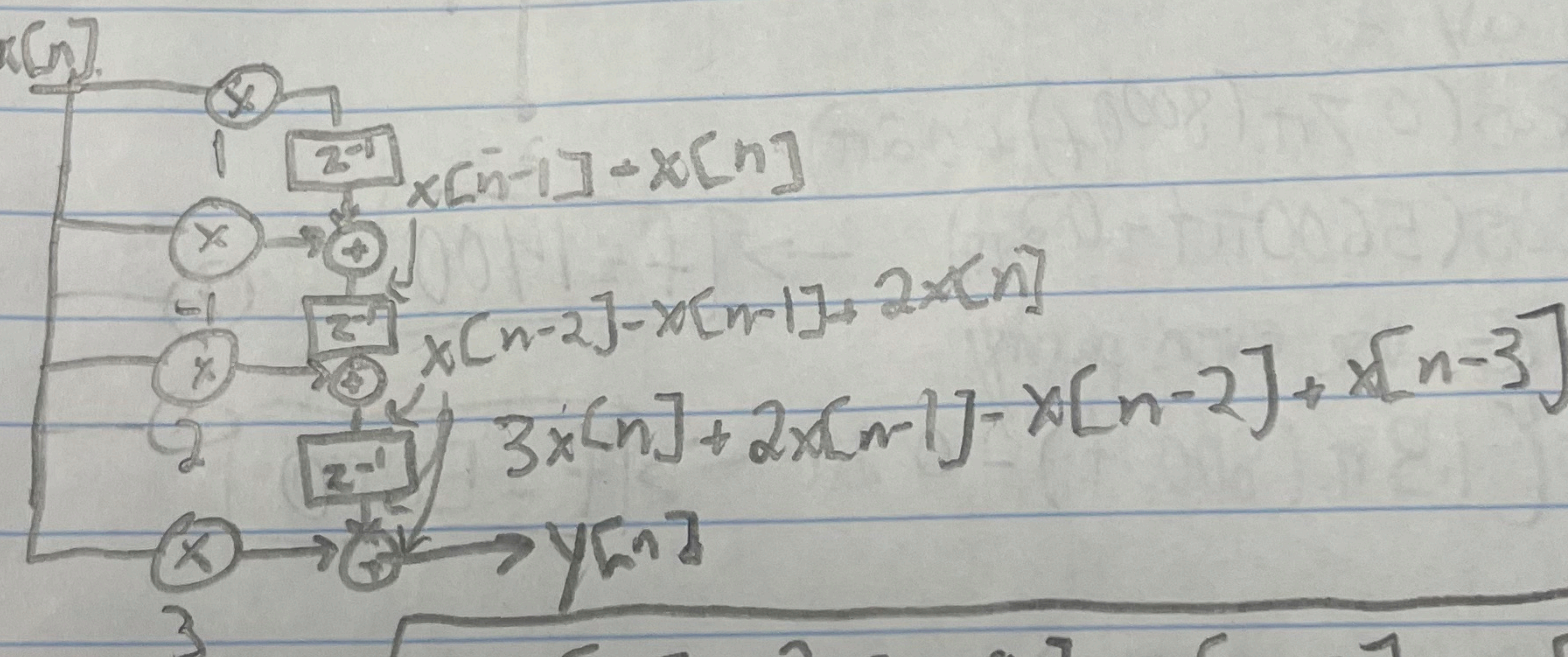


c)



Prob not correct, rushing

6. c.



$$\boxed{3x[n] + 2x[n-1] - x[n-2] + x[n-3]}$$