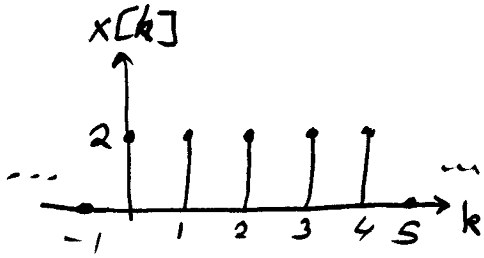
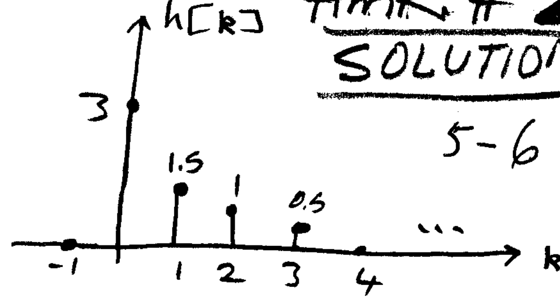
Hmk #2 SOLUTION

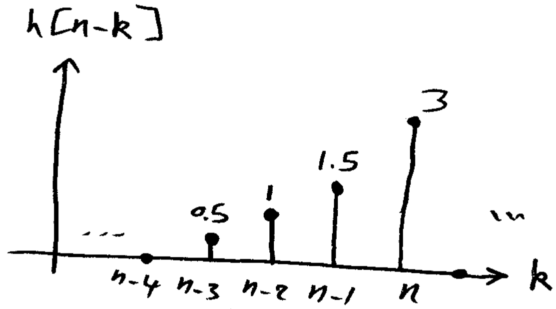
5-6-04

10.8 c)





$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]\, h[n-k]$$



for $n < 0$, $y[n] = 0$

for $n = 0$, $y[n] = (3)(2) = 6$

for $n = 1$, $y[n] = (3)(2) + (1.5)(2) = 6 + 3 = 9$

for $n = 2$, $y[n] = (3)(2) + (1.5)(2) + (1)(2) = 11$

for $n = 3$, $y[n] = (3)(2) + (1.5)(2) + (1)(2) + (0.5)(2) = 12$

for $n = 4$, $y[n] = (3)(2) + (1.5)(2) + (1)(2) + (0.5)(2) = 12$

for $n = 5$, $y[n] = (1.5)(2) + (1)(2) + (0.5)(2) = 6$

for $n = 6$, $y[n] = (1)(2) + (0.5)(2) = 3$

for $n = 7$, $y[n] = (0.5)(2) = 1$

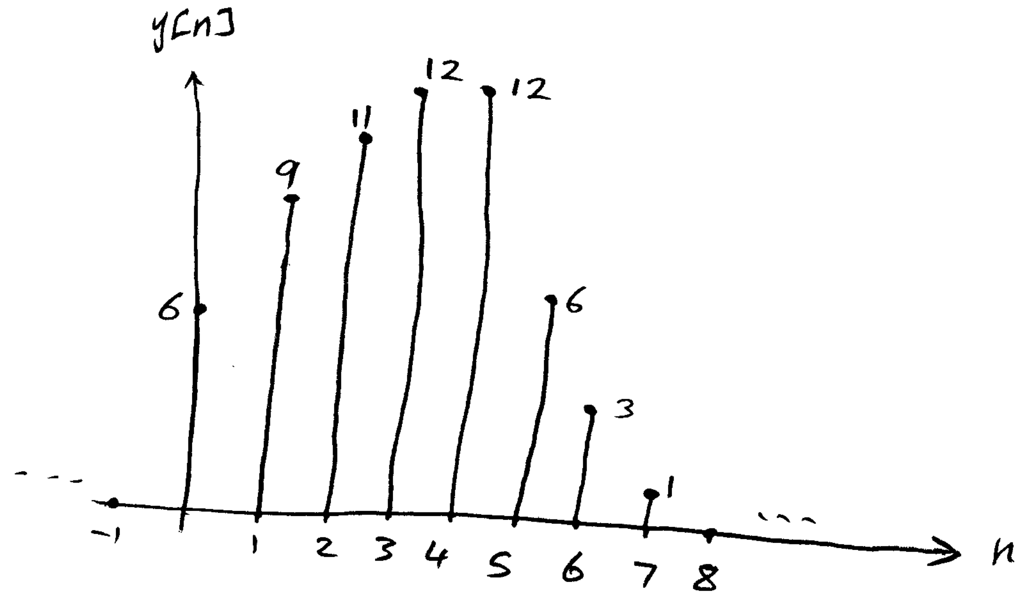
for $n \geq 8$, $y[n] = 0$

ECE 120b

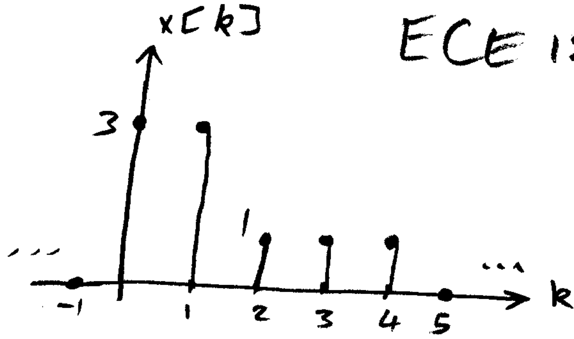
Hwk. #2 (CONT)

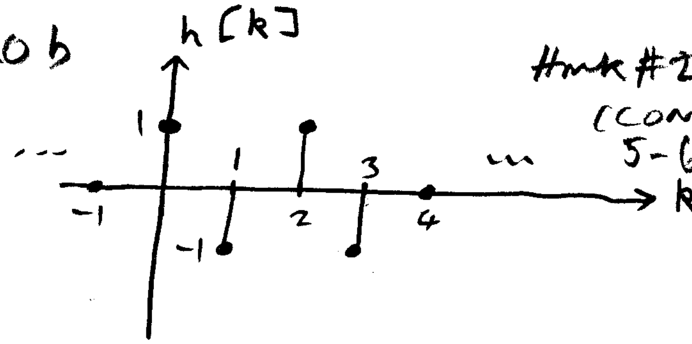
5-6-04

$$y[n] = \begin{cases} 0 & , n < 0 \\ 6 & , n = 0 \\ 9 & , n = 1 \\ 11 & , n = 2 \\ 12 & , n = 3, 4 \\ 6 & , n = 5 \\ 3 & , n = 6 \\ 1 & , n = 7 \\ 0 & , n > 7 \end{cases}$$

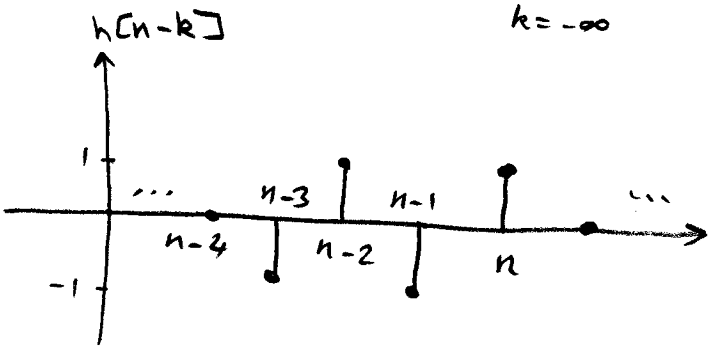


10.8 d)





$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]\, h[n-k]$$



for $n < 0$, $y[n] = 0$

for $n = 0$, $y[n] = (1)(3) = 3$

for $n = 1$, $y[n] = (1)(3) + (-1)(3) = 0$

for $n = 2$, $y[n] = (1)(1) + (-1)(3) + (1)(3) = 1$

for $n = 3$, $y[n] = (1)(1) + (-1)(1) + (1)(3) + (-1)(3) = 0$

for $n = 4$, $y[n] = (1)(1) + (-1)(1) + (1)(1) + (-1)(3) = -2$

for $n = 5$, $y[n] = (-1)(1) + (1)(1) + (-1)(1) = -1$

for $n = 6$, $y[n] = (1)(1) + (-1)(1) = 0$

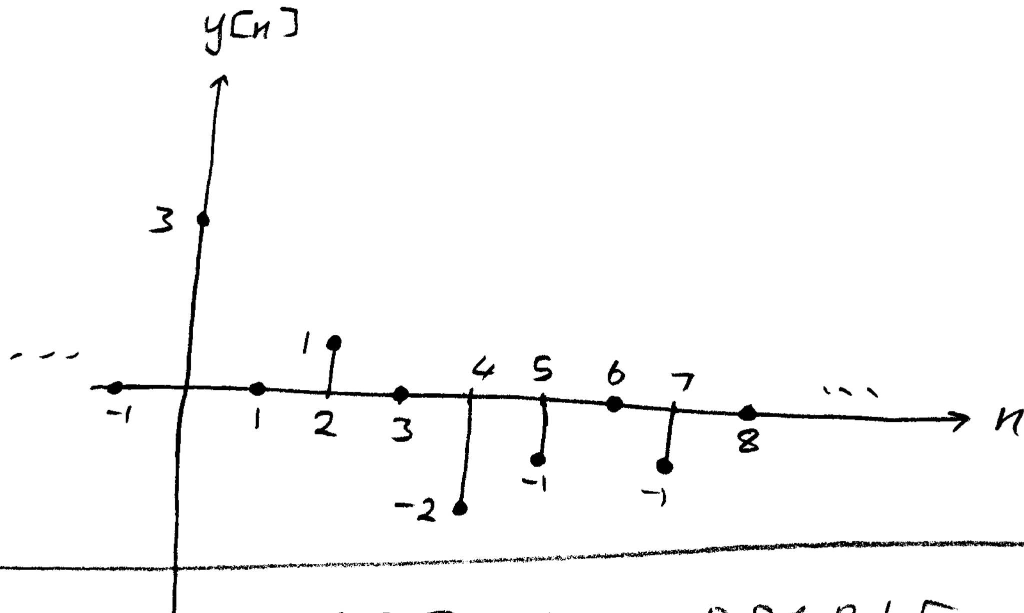
for $n = 7$, $y[n] = (-1)(1) = -1$

for $n \geq 8$, $y[n] = 0$

ECE 120 b

Hwk #2 (CONT)
5-6-04

$$y[n] = \begin{cases} 0 & , n<0 \\ 3 & , n=0 \\ 0 & , n=1 \\ 1 & , n=2 \\ 0 & , n=3 \\ -2 & , n=4 \\ -1 & , n=5 \\ 0 & , n=6 \\ -1 & , n=7 \\ 0 & n>7 \end{cases}$$



SPECIAL PROBLEM

Part (a) will be available later
Part (b) is on the remaining two sheets

ECE 120n Special Problem part (b) Hmk#2 (CONT)

5-6-04

(b) $y[n] + \frac{1}{2}y[n-1] = x[n]$, $y[-1]=0$, $x[n] = (-\frac{1}{2})^n u[n]$

(i) $y_p[n] = An(-\frac{1}{2})^n$

$y_p[n-1] = A(n-1)(-\frac{1}{2})^{n-1}$

$\therefore An\cancel{(-\frac{1}{2})^n} + \frac{1}{2}A(n-1)\cancel{(-\frac{1}{2})}^{n-1} = \cancel{(-\frac{1}{2})^n}$

$An + \frac{1}{2}A(n-1)(-\frac{1}{2})^{-1} = 1$

$An - A(n-1) = 1$

$An - An + A = 1$

$\therefore A = 1$

$\Rightarrow y_p[n] = n(-\frac{1}{2})^n$

(ii) $y_c[n] = ??$

$\alpha + \frac{1}{2} = 0 \Rightarrow \alpha = -\frac{1}{2}$

$\therefore y_c[n] = B(-\frac{1}{2})^n$

(iii) $y[n] = B(-\frac{1}{2})^n + n(-\frac{1}{2})^n$

$y[-1] = B(-2) + (-1)(-2) = 0$

$-2B = -2 \Rightarrow B = 1$

$$\boxed{\therefore y[n] = (-\frac{1}{2})^n + n(-\frac{1}{2})^n}$$

ECE 120b

Hmwk #L (CONT)

5-6-04

(iv) Zero State response:

$$y[n] = -\tfrac{1}{2} y[n-1] + x[n]$$

$$\therefore h[n] = -\tfrac{1}{2} h[n-1] + \delta[n]$$

$$h[0] = \cancel{-\tfrac{1}{2} h[-1]}^{0} + \delta[0] = 1$$

$$h[n] = A[-\tfrac{1}{2}]^n$$

$$\therefore h[0] = A[-\tfrac{1}{2}]^0 = A = 1$$

$$\Rightarrow h[n] = [-\tfrac{1}{2}]^n$$

$$y_{zs}[n] = \sum_{n=0}^{n} h[n-k]\, x[k]$$

$$= \sum_{k=0}^{n} (-\tfrac{1}{2})^{n-k} (-\tfrac{1}{2})^{k}$$

$$= (-\tfrac{1}{2})^n \sum_{k=0}^{n} (-\tfrac{1}{2})^{k-k} = (-\tfrac{1}{2})^n \sum_{k=0}^{n} 1 = (-\tfrac{1}{2})^n (n+1)$$

$$y_{zs}[n] = (-\tfrac{1}{2})^n + n(-\tfrac{1}{2})^n$$

(v) Zero input response

$$y_{zi}[n] = -\tfrac{1}{2} y[n-1]$$

$$y_{zi}[0] = -\tfrac{1}{2} y[-1] = 0$$

$$y_{zi}[n] = A(-\tfrac{1}{2})^n$$

$$y_{zi}[0] = A(-\tfrac{1}{2})^0 = 0 \Rightarrow A = 0$$

$$\therefore y_{zi} = 0$$

(vi) $\boxed{y = y_{zs} + y_{zi} = (-\tfrac{1}{2})^n + n(-\tfrac{1}{2})^n}$

(vii) (iii) and (vi) are the same ☒

END