Fall 2015 – EE312

Homework #5 Solution

2.31)

The input can be written as:

$$x[n]: \underset{\underset{-2}{\uparrow}}{1} \quad 2 \quad 3 \quad 2 \quad 2 \quad 1$$

As given, the LTI system is initially at rest. Hence, since $x[n]=0$ for $n<-3$, thus, $y[n]=0$ for $n<-3$

Now we recursively insert values of input $x[n]$ in the difference equation.

Putting:

$n=-2$, $y[-2]+2y[-3]=x[-2]+2x[-4]$ Thus, $y[-2]=1$.

$n=-1$, y [-1] + 2y [-2] = x [-1] + 2x [-3] Thus, $y[-1]=0$.

$n=0$, $y[0]+2y[-1]=x[0]+2x[-2]$. Thus, $y[0]=5$.

$n=1$, $y[1]+2y[0]=x[1]+2x[-1]$. Thus, $y[1]=-4$.

$n=2$, $y[2]+2y[1]=x[2]+2x[0]$. Thus, $y[2]=16$.

$n=3$, $y[3]+2y[2]=x[3]+2x[1]$. Thus, $y[3]=-27$.

$n=4$, $y[4]+2y[3]=x[4]+2x[2]$. Thus, $y[4]=58$.

$n=5$, $y[5]+2y[4]=x[5]+2x[3]$. Thus, $y[5]=-114$.

$n=6$, $y[6]+2y[5]=x[6]+2x[4]$. Thus, $y[6]=228$.

and so on.

Thus the output y[n] becomes as shown

$$y[n] : \underset{\underset{-2}{\uparrow}}{1} \quad 0 \quad 5 \quad -4 \quad 16 \quad -27 \quad 58 \quad -114 \quad 228 \quad \ldots$$

Where, $y[n] = (-1)^n * (2)^{n-5} * 114$ for $n \geq 6$

2.33. (a)

(ii) We solve this along the lines of Example 2.14. First assume that $y_p(t)$ is of the form Ke^{2t} for $t > 0$. Then using eq. (P2.33-1), we get for $t > 0$

$$2Ke^{2t} + 2Ke^{2t} = e^{2t} \quad \Rightarrow \quad K = \frac{1}{4}.$$

We now know that $y_p(t) = \frac{1}{4}e^{2t}$ for $t > 0$. We may hypothesize the homogeneous solution to be of the form

$$y_h(t) = Ae^{-2t}.$$

Therefore,

$$y_2(t) = Ae^{-2t} + \frac{1}{4}e^{2t}, \qquad \text{for } t > 0.$$

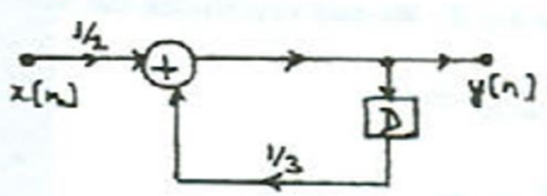
Assuming initial rest, we can conclude that $y_2(t) = 0$ for $t \leq 0$. Therefore

$$y_2(0) = 0 = A + \frac{1}{4} \quad \Rightarrow \quad A = -\frac{1}{4}.$$

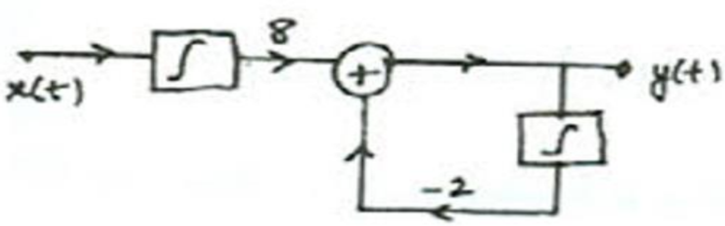
Then,

$$y_2(t) = \left[-\frac{1}{4}e^{2t} + \frac{1}{4}e^{-2t}\right] u(t).$$

2.38) (a):



2.39) (a):



```
% Software Problem

N = 10;
a = [1;2]; % feedback coefs
b = [1]; % feedforward coefs
h = impz(b,a,N+1);
[[0:N]' h] % list the values
plotdsig(h); % use tool for quick DT plot
axis([0 10 -1024 1024]);
ylabel('h[n]');
```

```
ans =

     0     1
     1    -2
     2     4
     3    -8
     4    16
     5   -32
     6    64
     7  -128
     8   256
     9  -512
    10  1024
```