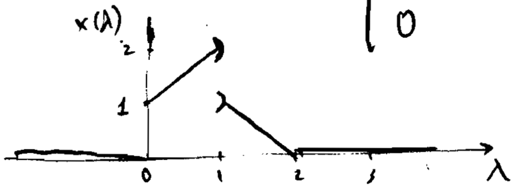
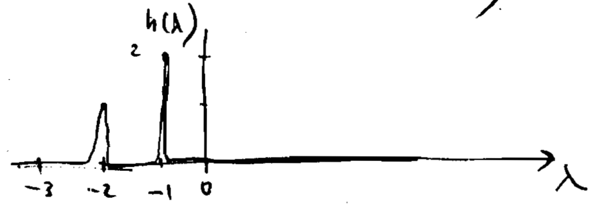
HW2 (cont.)

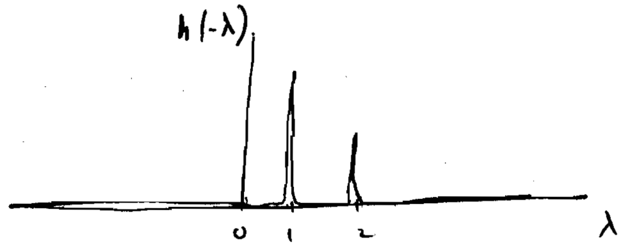
2.8 Find & sketch the convolution of

$$x(t) = \begin{cases} t+1 & 0 \le t \le 1 \\ 2-t & 1 < t \le 2 \\ 0 & \text{elsewhere} \end{cases} \qquad h(t) = \delta(t+2) + 2\delta(t+1)$$





$$y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} d\lambda \; x(\lambda) \underbrace{h(t-\lambda)}_{\text{it is } h(\lambda) \text{ reversed and shifted by } t}$$



$0 \le t < 1$: one overlapping point b/w $h(t-\lambda)$ and $x(\lambda)$.

$1 \le t$: none.

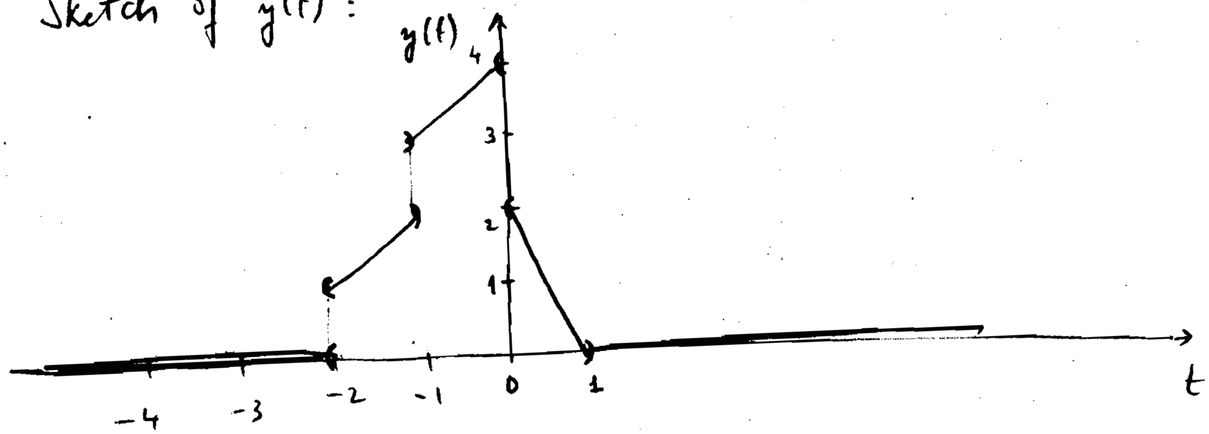
$-1 < t < 0$: 2 overlapping points " " " "

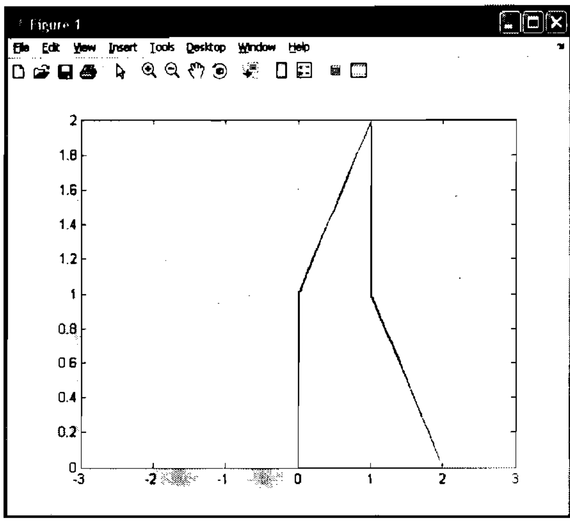
$-2 < t \le -1$: 1 overlapping point

$t < -2$: no overlapping point

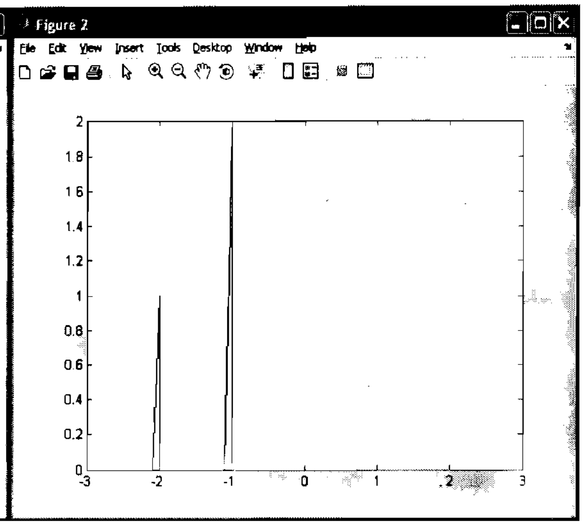
$$y(t) = \begin{cases} 0 & t < -2 & = 0 \\ \int_{-\infty}^{\infty} d\lambda\, x(\lambda)\, \delta(t-\lambda+2) & -2 \le t \le -1 & = x(t+2) = t+3 \quad \text{since } 0 \le t+2 \le 1 \\ \int_{-\infty}^{\infty} d\lambda\, x(\lambda) \left[\delta(t-\lambda+2) + 2\delta(t-\lambda+1)\right] & -1 < t < 0 & = x(t+2) + 2x(t+1) = -t + 2(t+2) = t+4 \\ \int_{-\infty}^{\infty} d\lambda\, x(\lambda)\, 2\delta(t-\lambda+1) & 0 \le t \le 1 & = 2x(t+1) = 2(1-t) = 2-2t \\ 0 & t > 1 & = 0 \end{cases}$$

Sketch of $y(t)$:

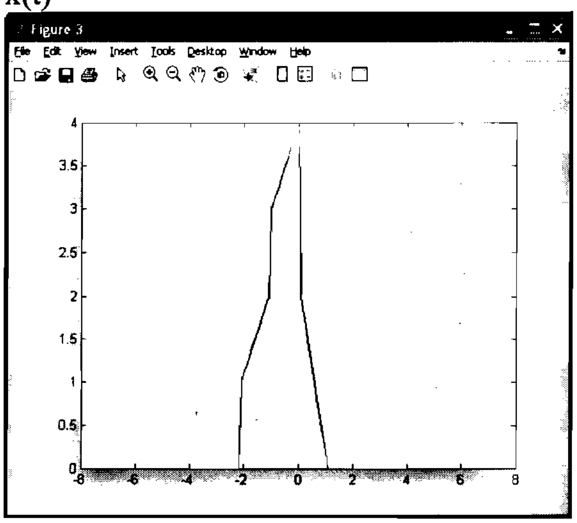




x(t)



h(t)



y(t)=x(t)*y(t) (* is the convolution)

```
%Check for problem 2.8

%defining input signal x(t)
t1=-3:0.1:0;
x1=zeros(1,length(t1));
t2=0:0.1:1;
x2=t2+1;
t3=1:0.1:2;
x3=2-t3;
t4=2:.1:3;
x4=zeros(1,length(t4));
t=[t1 t2 t3 t4];
x=[x1 x2 x3 x4];
figure(1), plot(t,x)

%defining impulse response function h(t)
s1=-3:.1:-2;
s2=-2:0.1:-1;
s3=-1:0.1:3;
h=[zeros(1,length(s1)-1) 1 zeros(1,length(s2)-1) 2 zeros(1,length(s3)) ];
s=[s1 s2 s3];
figure(2), plot(s,h)

%calculate the convolution between x(t) and h(t)

y=conv(x,h);
w=1:length(y);
w1=(w-63)*.1;
figure(3), plot(w1,y)
```