Consider a continuous time signal $x_c(t)$, and assume th
$X_c(j\Omega) = 0$ for $|\Omega| > 20$ rads/sec. This signal is samp
at $\Omega_s = \frac{2\pi}{T} = 65$ rads/sec, where $T = \frac{2\pi}{65}$.
If $x(n) = x_c(nT) = \left(\frac{65}{2\pi}\right)^2 \frac{\sin(\frac{\pi}{6}n)}{\pi n} \frac{\sin(\frac{\pi}{2}n)}{\pi n}$,
find the reconstructed signal $x_r(t)$ using a low
filter $h(t)$ given by

$$h(t) = T\frac{\pi}{10} \frac{\sin(10t)}{\pi t} \cdot \frac{\sin 80t)}{\pi t}$$

use the formula

$$x_r(t) = \sum_{n=-\infty}^{\infty} x(n)\, h(t-nT).$$

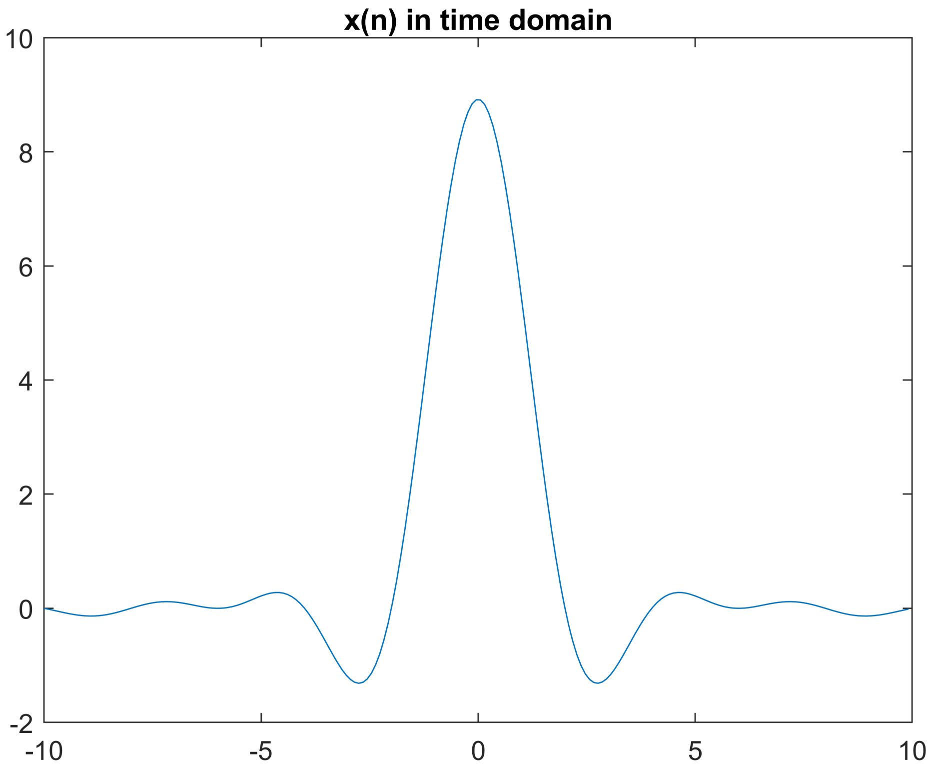
The sampling frequency is deffinitely more than twice the maximum frequency of x, so it can be sampled properly.

```
% Generate plot of x
T = 2*pi/65;
n = -10:T:10;

% generate plot of x(n)
x = ((1/T)^2)*(sin(pi*n/6).*sin(pi*n/2))./((pi*n).^2);
% replace all NaN values with the value of x when n is zero
x(isnan(x)) = 4225/(48*pi^2)
```

```
x = 1×207
   -0.0000   -0.0149   -0.0308   -0.0471   -0.0635   -0.0794   -0.0942   -0.1074 ···
```

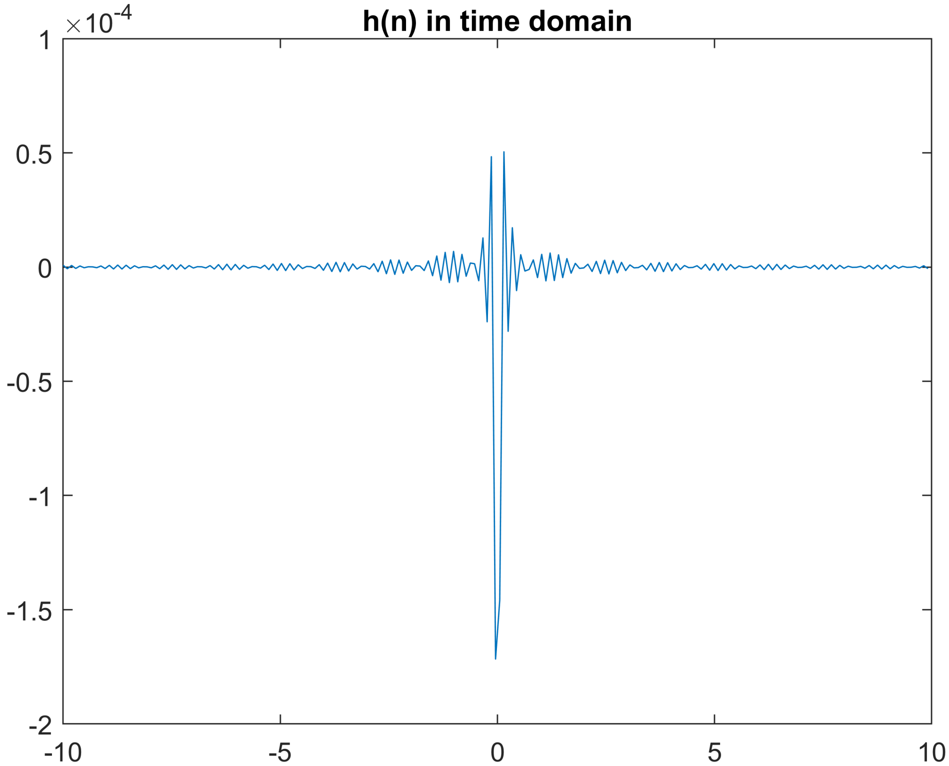
```
plot(n, x)
title("x(n) in time domain")
```



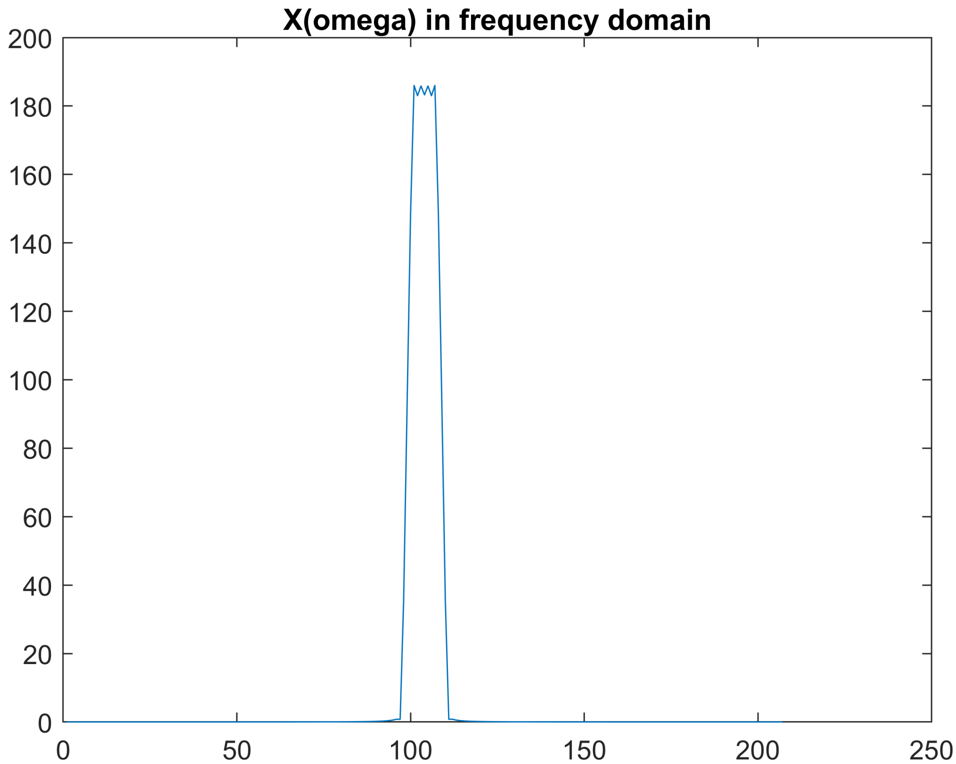

```
%Generate Plot of h
h = (pi*T/10)*(sin(10*n)/(pi*n)).*(sin(30*n)./(pi*n));
% This was manually calculated because I couldn't figure out how to convert this function to ma
h(isnan(h)) = 12/13 % the value of h when n is zero.
```

```
h = 1×207
10^-3 ×
    0.0008   -0.0008    0.0007   -0.0006    0.0005   -0.0003    0.0001    0.0001 ···
```

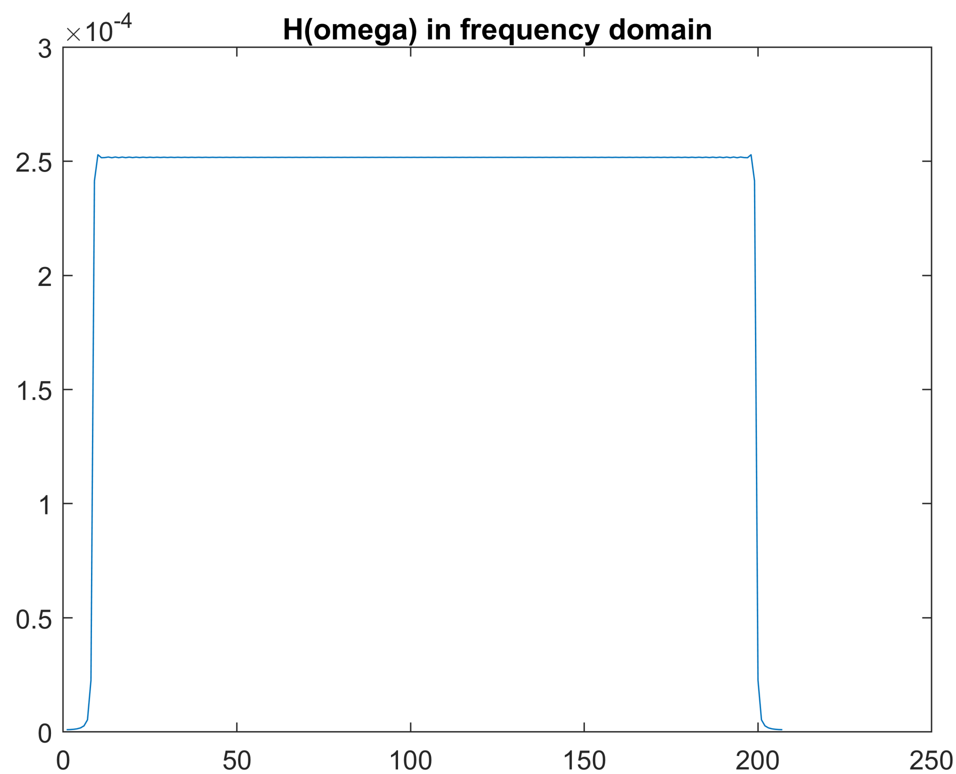
```
plot(n, h)
title("h(n) in time domain")
```



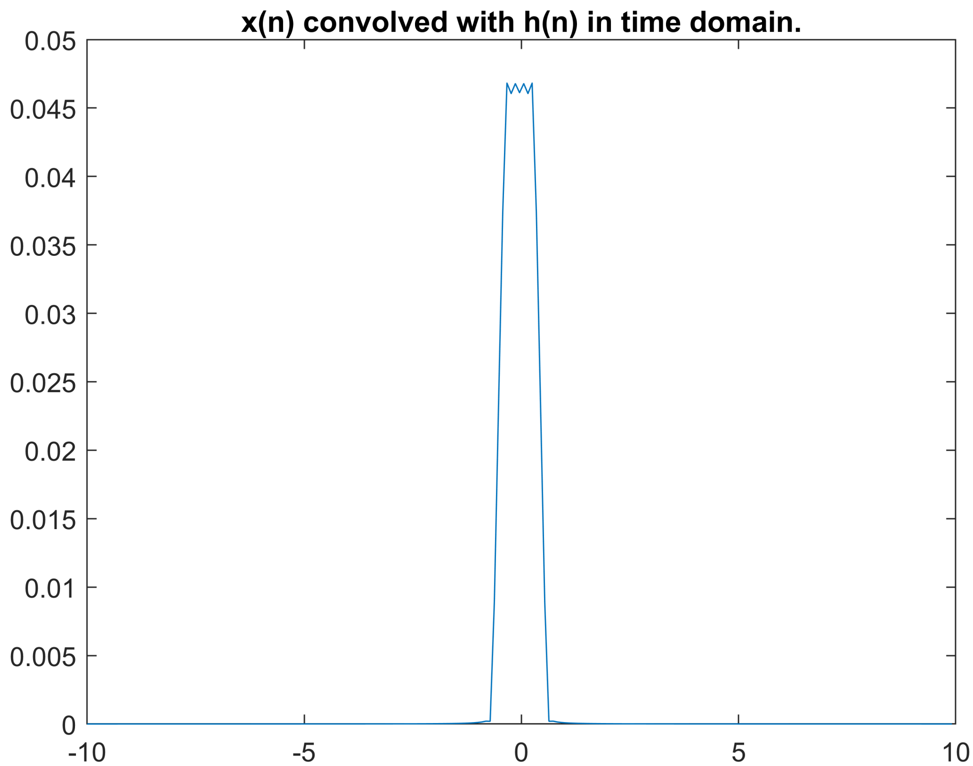

```
% Take the fft of h and x and plot them
X = fft(x);
H = fft(h);
plot(abs(fftshift(X)))
title("X(omega) in frequency domain")
```



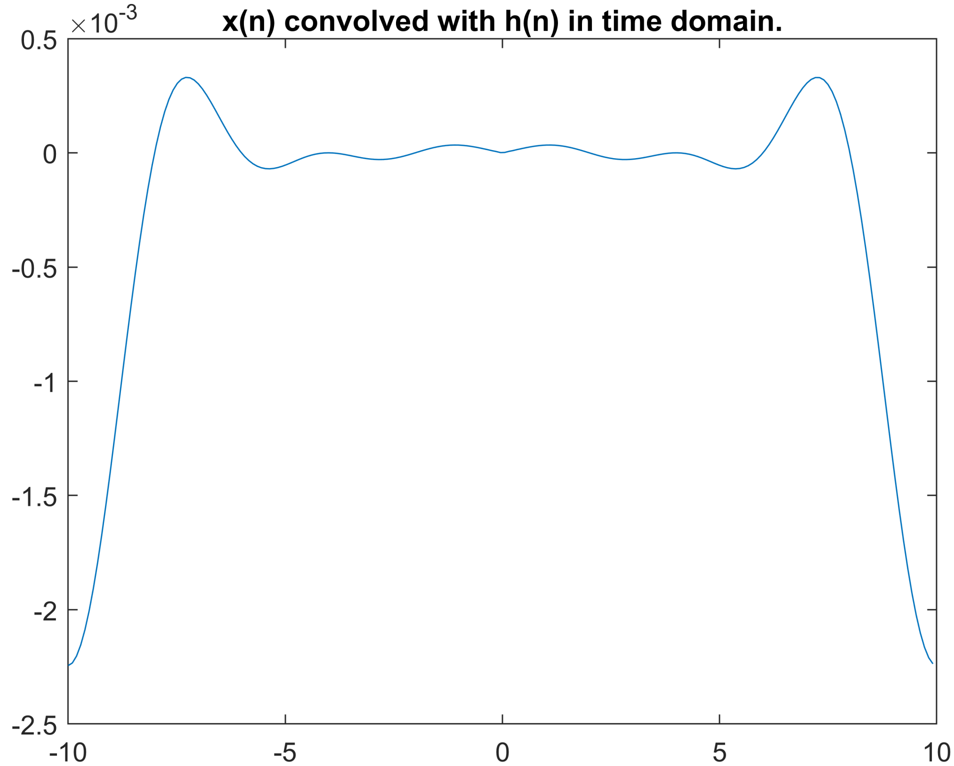

```
plot(abs(fftshift(H)))
title("H(omega) in frequency domain")
```



```
% convolve and plot the frequency result
X_r = X.*H;
plot(n,abs(fftshift(X_r)))
title("x(n) convolved with h(n) in time domain.")
```




```
% plot the convolution in the time domain
x_r = ifft(X_r);
plot(n,x_r)
title("x(n) convolved with h(n) in time domain.")
```


x(n) convolved with h(n) in time domain.
×10^-3
0.5
0
-0.5
-1
-1.5
-2
-2.5
-10
-5
0
5
10