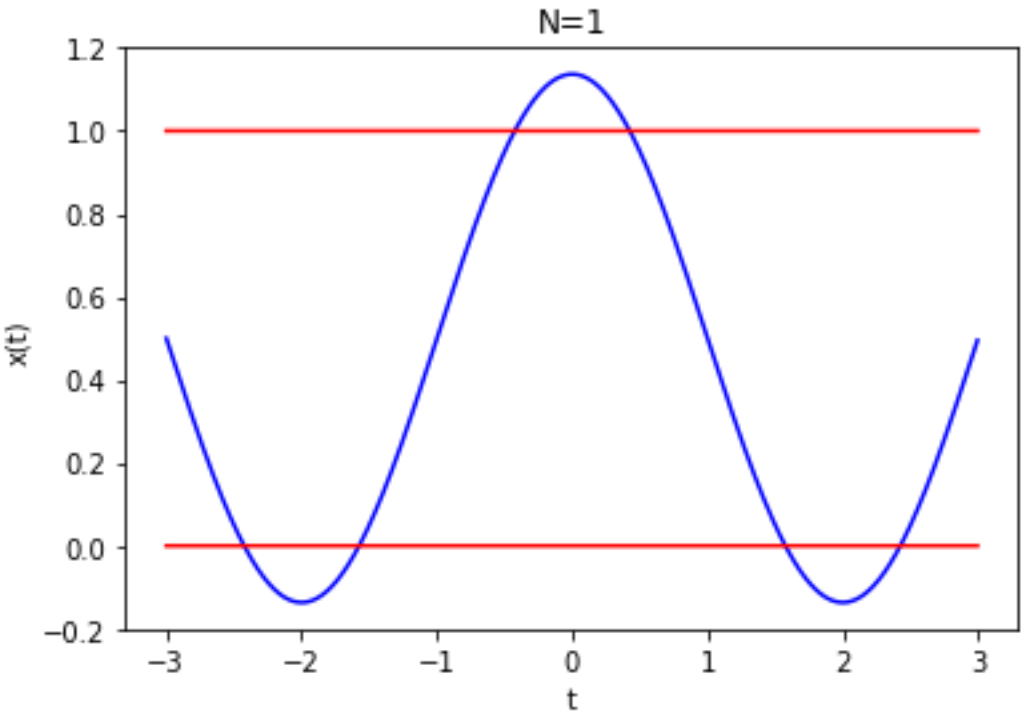
Problem 6

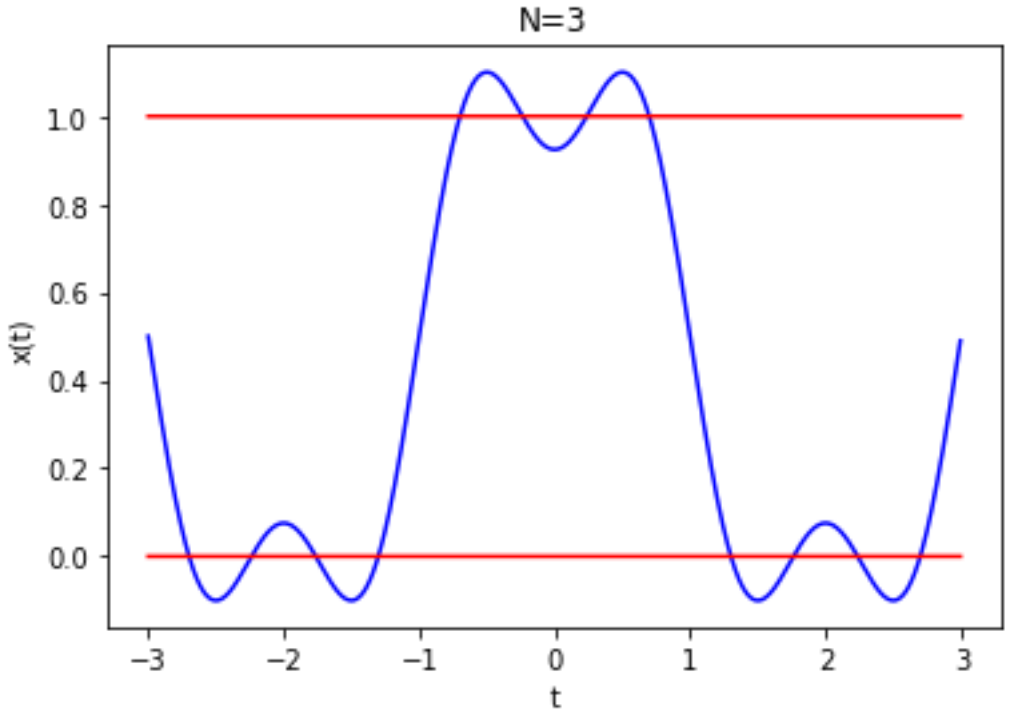
(b)

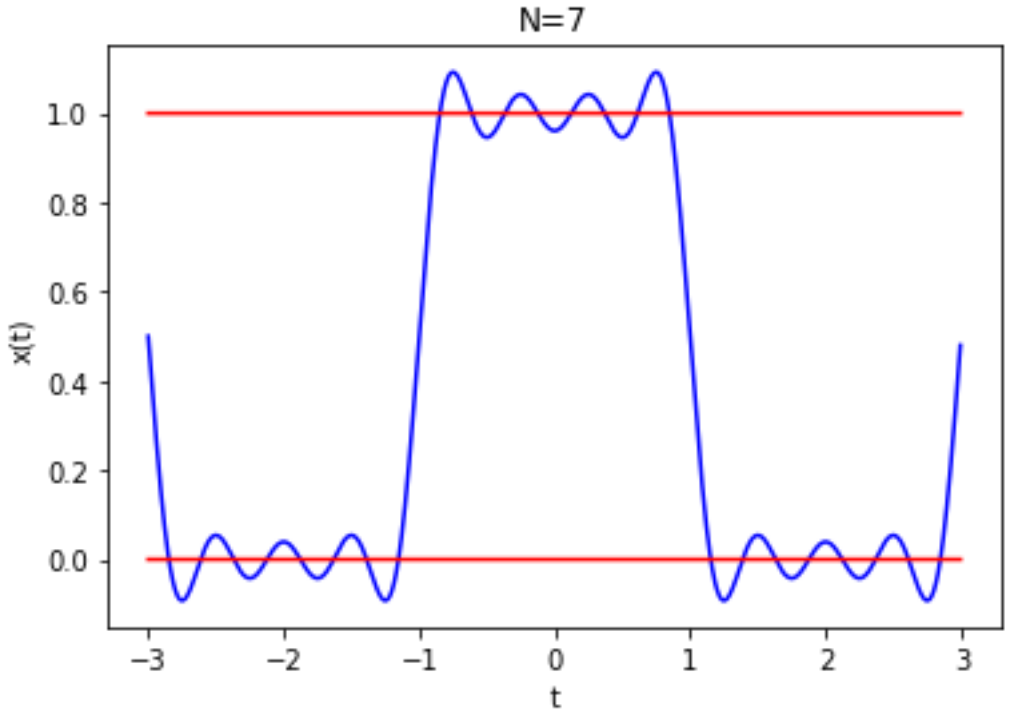
```
import matplotlib.pyplot as plt
import numpy as np

def fourier_series(t,N):

    im = 1j
    w0 = np.pi/2
    result = (1/4)*np.cos(w0*t*0)

    for k in range(1,N+1):
        result = result + (1/2)*np.cos(w0*t*k)*np.sin(w0*k)/(w0*k)           # Real part of ak*e^(jkwt)

    return result*2

t1 = np.arange(-3.0, 3.0, 0.005)

plt.figure(1)
xt = fourier_series(t1,1)
plt.plot(t1,xt,'b')
plt.plot(t1, t1*0,'r')
plt.plot(t1, t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=1')
print('Overshoot :',(np.max(xt)-1)*100,'%')

plt.figure(2)
xt = fourier_series(t1,3)
plt.plot(t1,xt,'b')
plt.plot(t1,t1*0,'r')
plt.plot(t1,t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=3')
print('Overshoot :',(np.max(xt)-1)*100,'%')
```

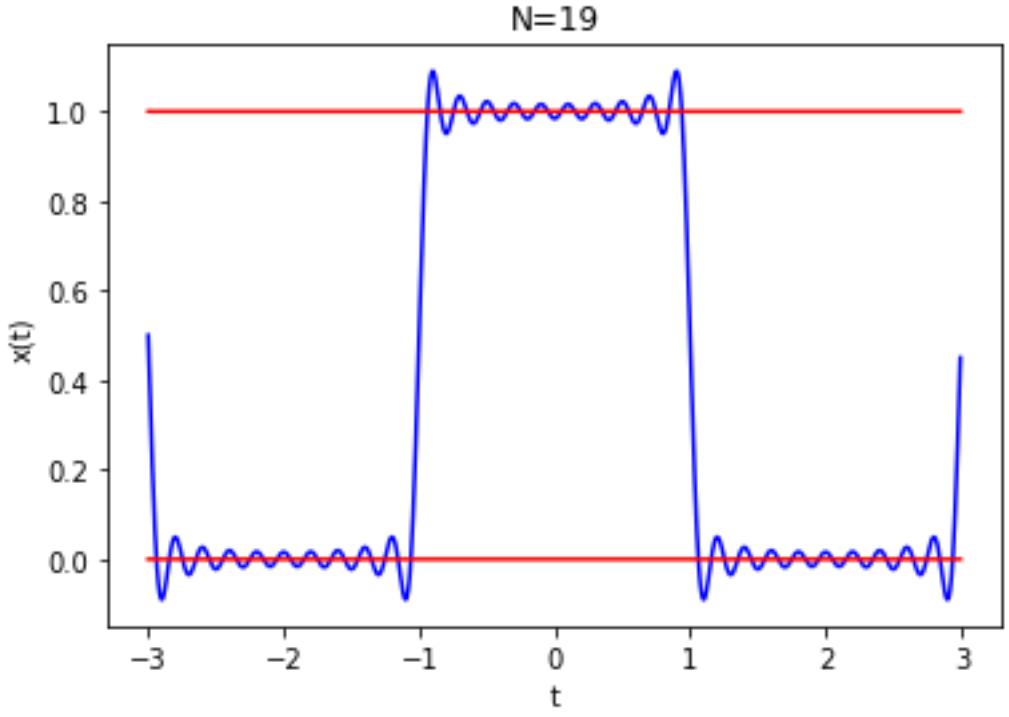
```
plt.figure(3)
xt = fourier_series(t1,7)
plt.plot(t1,xt,'b')
plt.plot(t1,t1*0,'r')
plt.plot(t1,t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=7')
print('Overshoot :',(np.max(xt)-1)*100,'%')

plt.figure(4)
xt = fourier_series(t1,19)
plt.plot(t1,xt,'b')
plt.plot(t1,t1*0,'r')
plt.plot(t1,t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=19')
print('Overshoot :',(np.max(xt)-1)*100,'%')

plt.figure(5)
xt = fourier_series(t1,43)
plt.plot(t1,xt,'b')
plt.plot(t1,t1*0,'r')
plt.plot(t1,t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=43')
print('Overshoot :',(np.max(xt)-1)*100,'%')

plt.figure(6)
xt = fourier_series(t1,79)
plt.plot(t1,xt,'b')
plt.plot(t1,t1*0,'r')
plt.plot(t1,t1*0+1,'r')
plt.ylabel('x(t)')
plt.xlabel('t')
plt.title('N=73')
print('Overshoot :',(np.max(xt)-1)*100,'%')
```

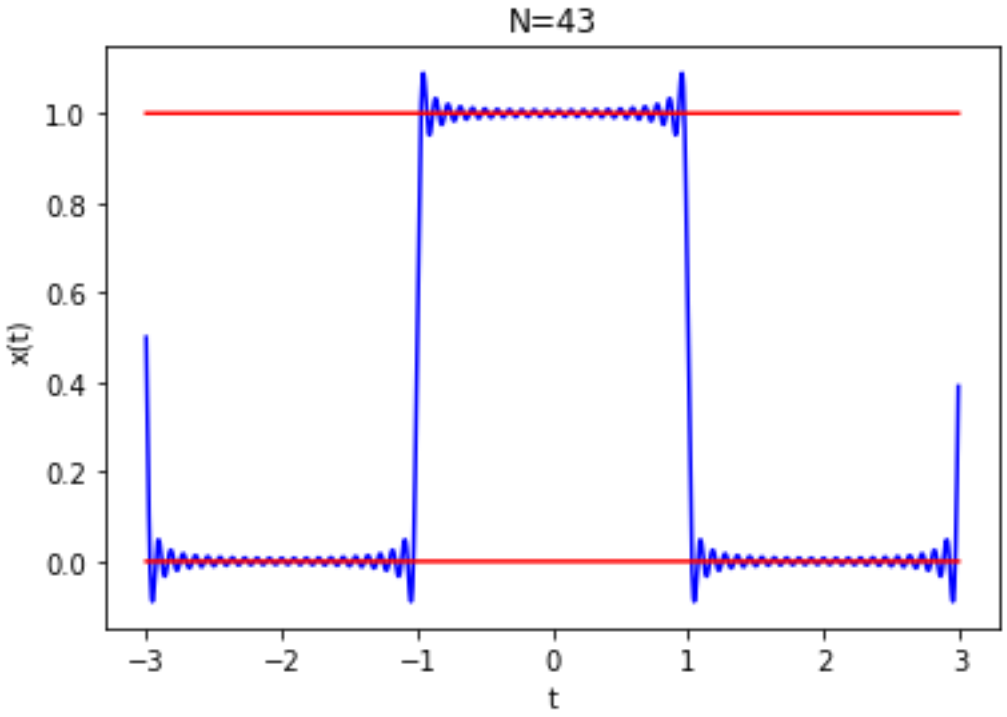
Problem 6

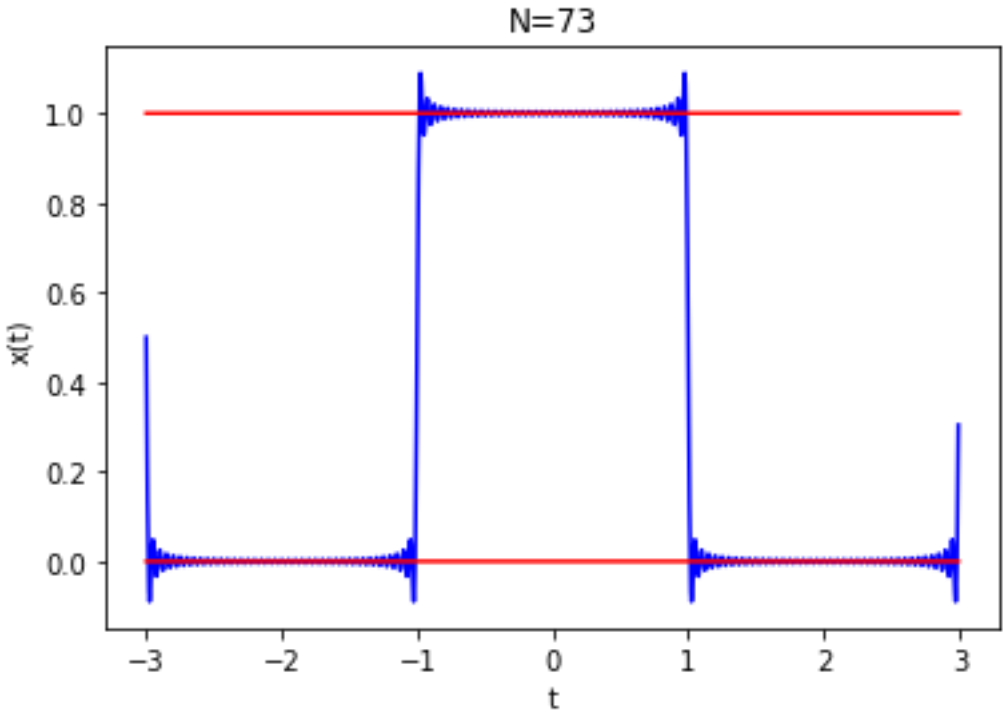

N=1
x(t)
t
1.2
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−3
−2
−1
0
1
2
3


N=3
x(t)
t
1.0
0.8
0.6
0.4
0.2
0.0
−3
−2
−1
0
1
2
3


N=7
1.0
0.8
0.6
0.4
0.2
0.0
x(t)
−3
−2
−1
0
1
2
3
t


N=19
1.0
0.8
0.6
0.4
0.2
0.0
x(t)
−3
−2
−1
0
1
2
3
t





Problem 6(c)

```
Overshoot : 13.66197723675815 %
Overshoot : 10.021087743807078 %
Overshoot : 9.211256668902411 %
Overshoot : 8.990700980941813 %
Overshoot : 8.952560654181706 %
Overshoot : 8.951591573987706 %
```