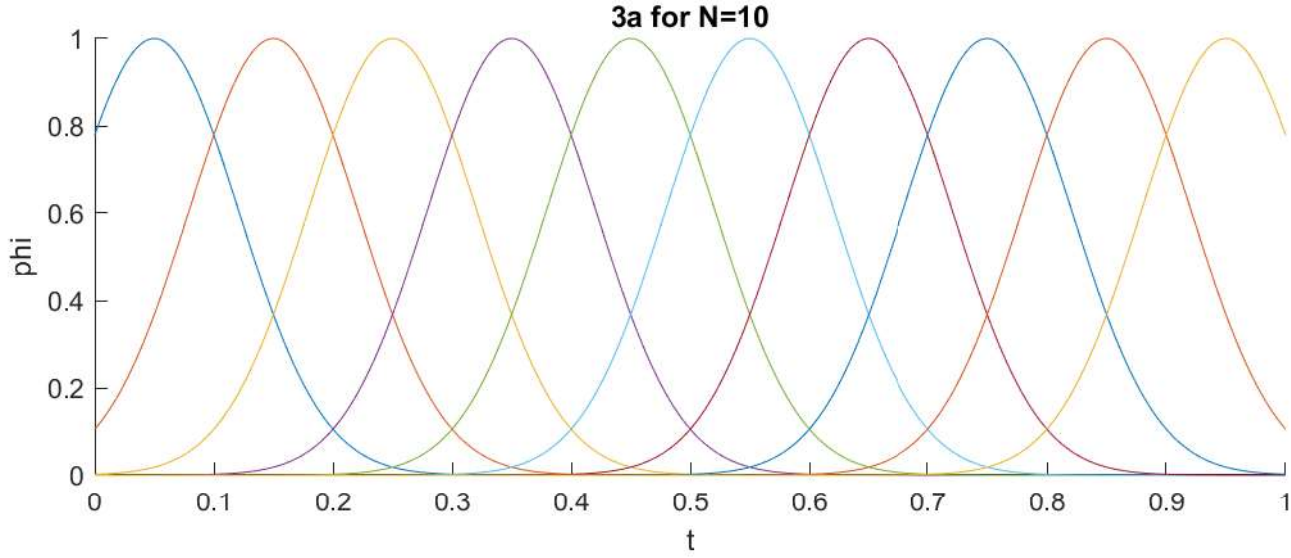
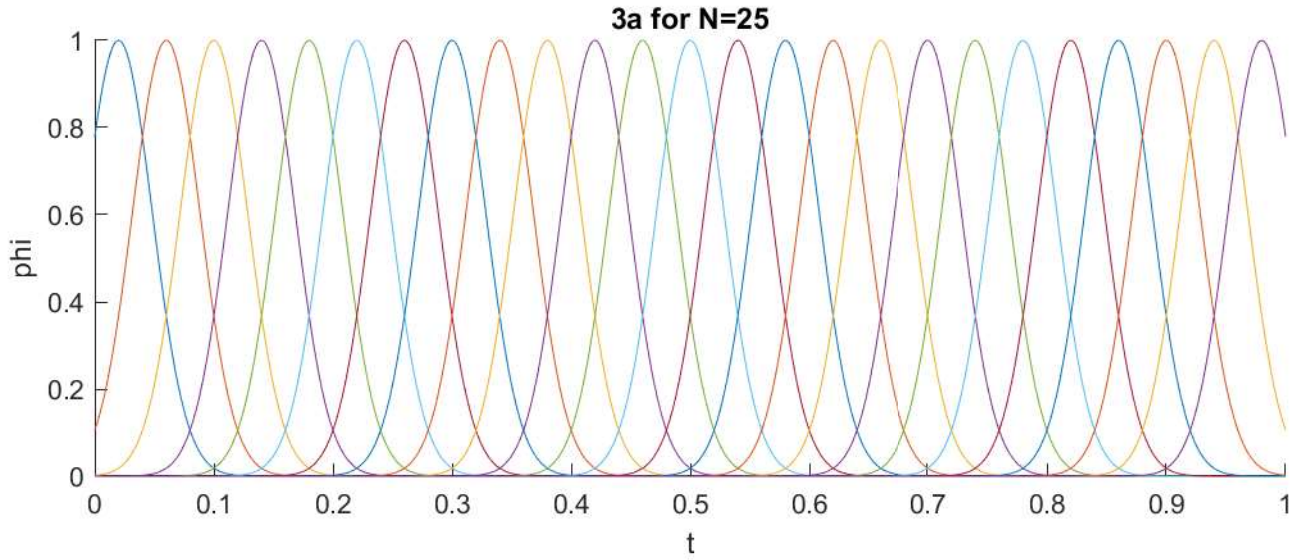
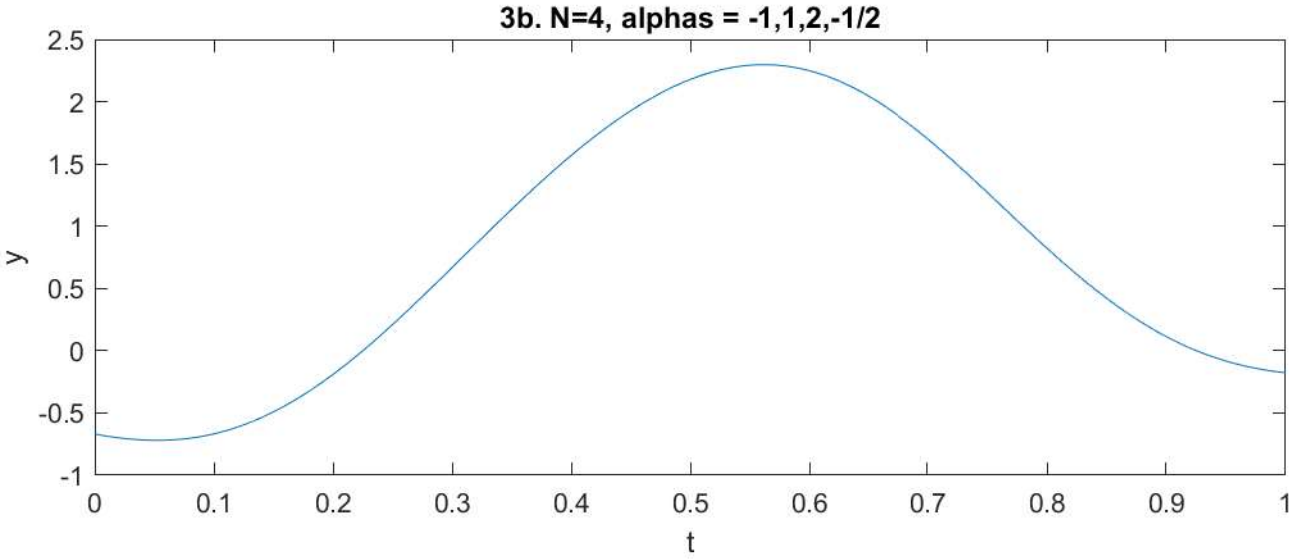
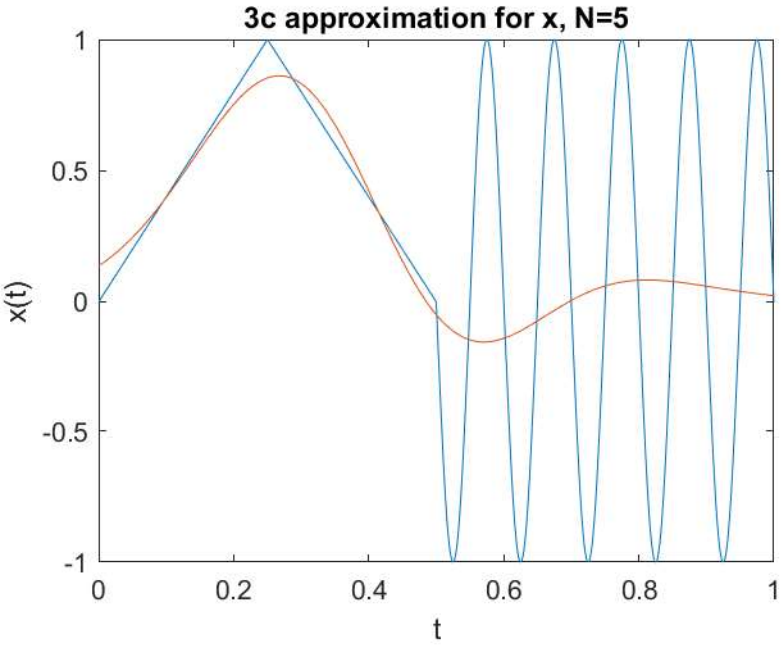
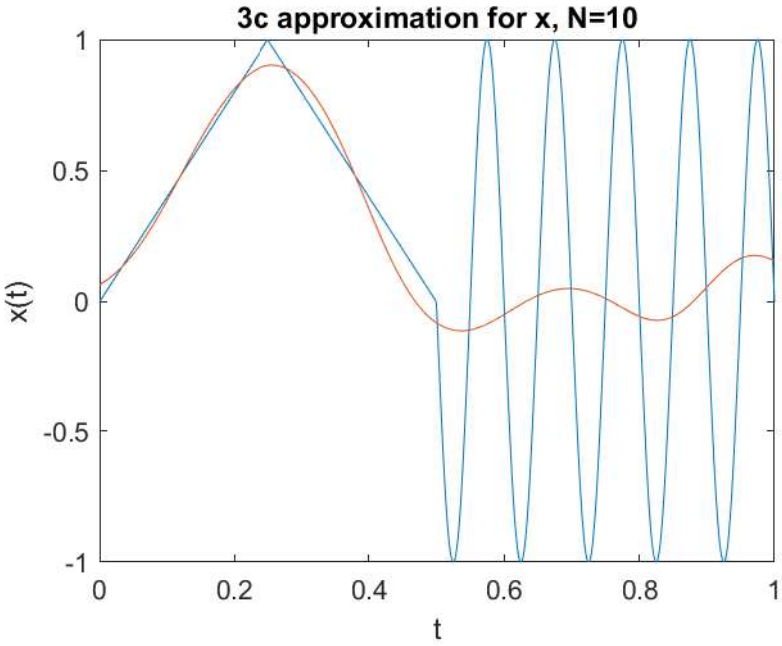
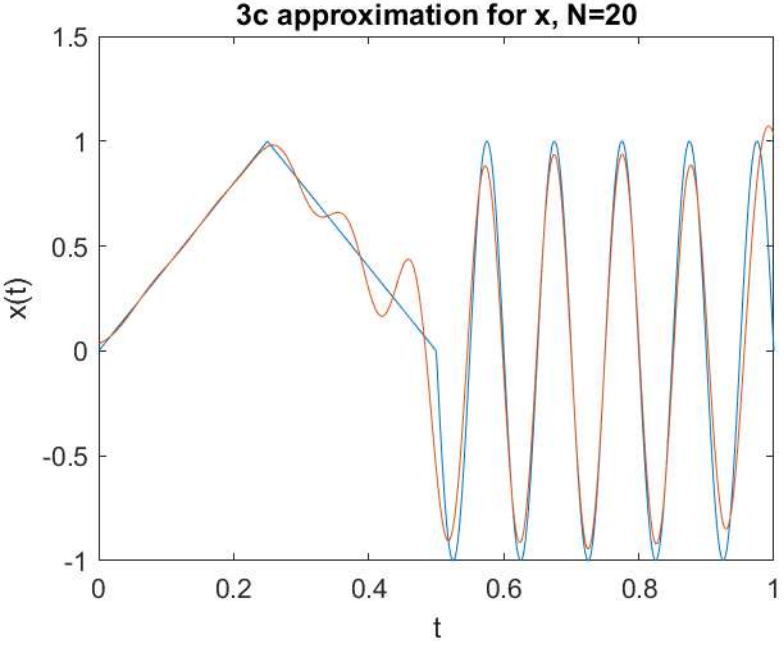

3a for N=10
phi
t
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.2
0.4
0.6
0.8

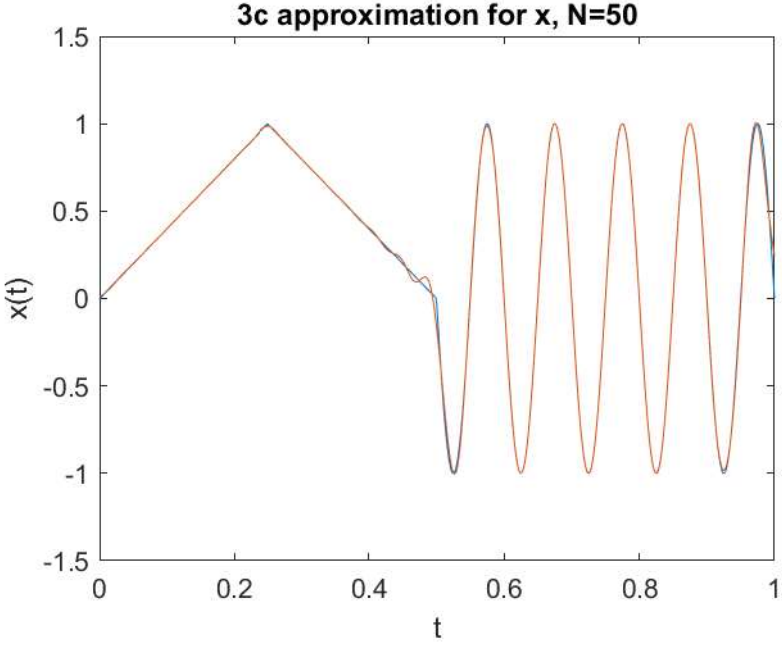

3a for N=25
phi
t
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.2
0.4
0.6
0.8


3b. N=4, alphas = -1,1,2,-1/2
y
t
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
-1
-0.5
0.5
1
1.5
2
2.5


3c approximation for x, N=5
x(t)
t
1
0.5
0
-0.5
-1
0
0.2
0.4
0.6
0.8
1


3c approximation for x, N=10
x(t)
t
1
0.5
0
-0.5
-1
0
0.2
0.4
0.6
0.8
1


3c approximation for x, N=20
x(t)
t
1.5
1
0.5
0
-0.5
-1
0
0.2
0.4
0.6
0.8
1

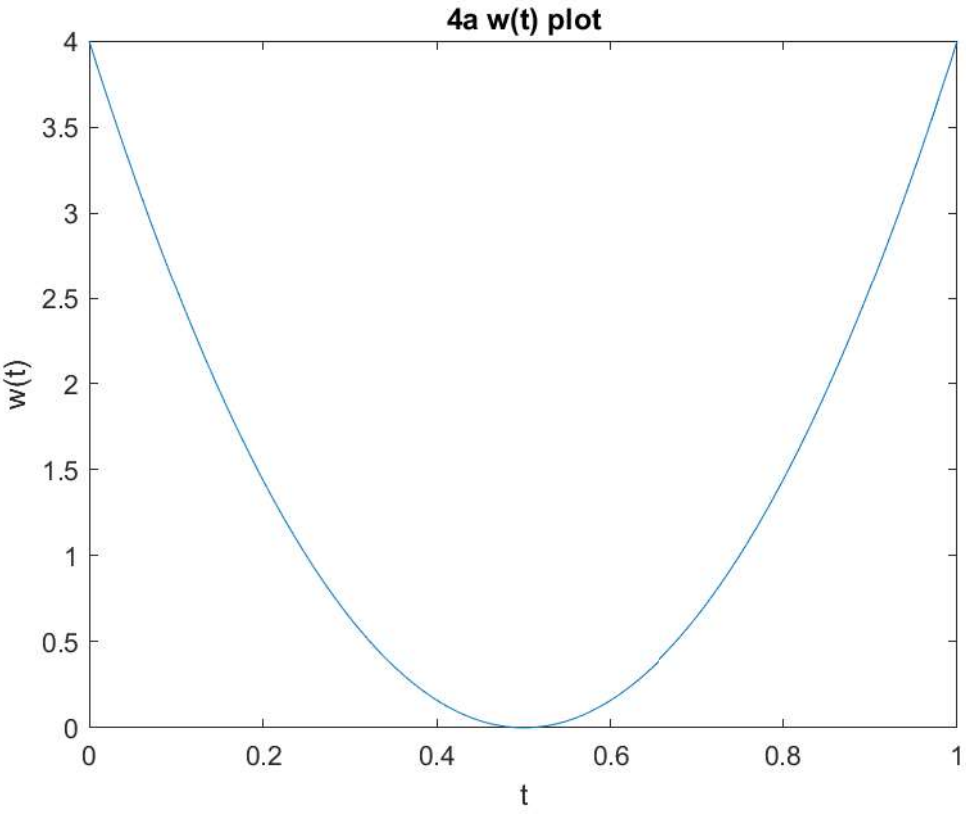

3c approximation for x, N=50
x(t)
t
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.2
0.4
0.6
0.8
1

```
phi  =  @(z)  exp(-z.^2);
x = @(z) (z<1/4).*(4*z) + (z>=1/4).*(z<1/2).*(-4*z+2)-(z>=1/2).*sin(20*pi*z);
t  =  linspace(0,  1,  1000);
hold off
figure(1);
clf

N=50;
t  =  linspace(0,1,1000);
y  =  zeros(size(t));
b = [];
for  jj  =  1:N %calculate b vector
    x_phik = @(z) x(z).*phi(N*z - jj + 1/2);
    b = [b integral(x_phik,0,1)];
end
b=b';
G = zeros(N,N);
for ii = 1:N %calculate gram matrix
    for jj = 1:N
        x_phik = @(z) phi(N*z - ii + 1/2) .* phi(N*z - jj +1/2);
        G(jj,ii) = integral(x_phik,0,1);
    end
end
alphas = G\b; %find coefficients

plot(t,x(t))
hold on
t  =  linspace(0,1,1000);
y  =  zeros(size(t));
for  jj  =  1:N %construct approximation with bases
    y  =  y  +  alphas(jj)*phi(N*t  -  jj  +  1/2);
end
plot(t,y)
title(sprintf('3c approximation for x, N=%d',N))
xlabel('t')
ylabel('x(t)')
```

```
hold off
t = linspace(0,1,1000);
w = @(z) 16.*(z-1/2).^2;
x = @(z) exp(z);
%plot(t,w(t));
N=3;
G = zeros(N,N);
b = zeros(N,1);
for i = 1:N %compute b vector
    ip = @(z) w(z) .* x(z) .* z.^(i-1);
    %ip = @(z) x(z) .* z.^(i-1);
    b(i) = integral(ip,0,1);
end
for i=1:N %compute gram matrix
    for j=1:N
        ip = @(z) w(z) .* z.^(i-1) .* z.^(j-1);
        %ip = @(z) z.^(i-1) .* z.^(j-1);
        G(i,j) = integral(ip,0,1);
    end
end
alpha = G\b;
hold off
plot(t, alpha(1) + alpha(2) .* t + alpha(3) .* t.^2);
hold on
plot(t, exp(t));
%final alpha values: 1.0095, 0.8547, 0.8436
```


4a w(t) plot
w(t)
t
0
0.5
1
1.5
2
2.5
3
3.5
4
0
0.2
0.4
0.6
0.8
1