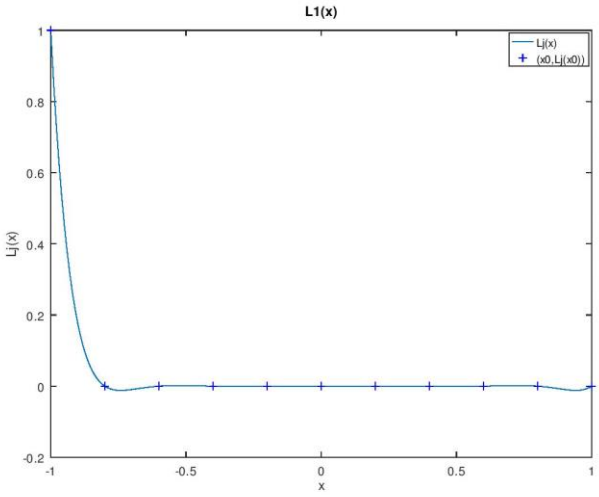
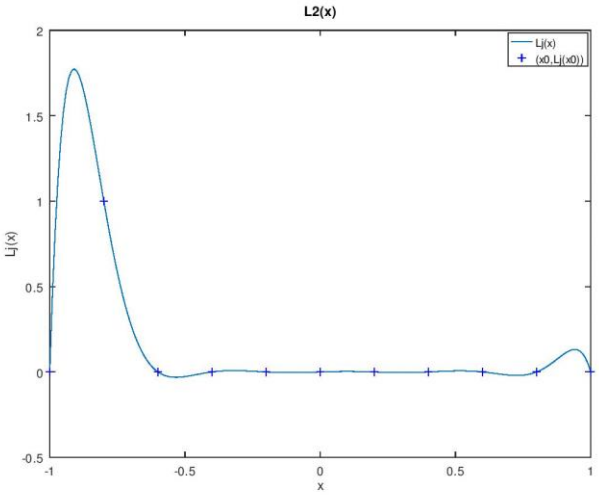
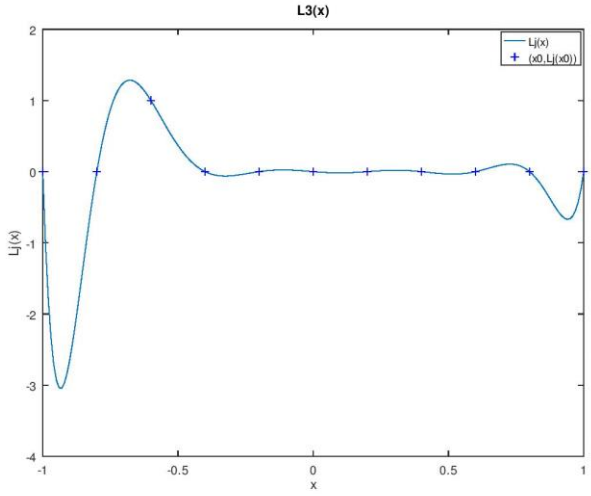
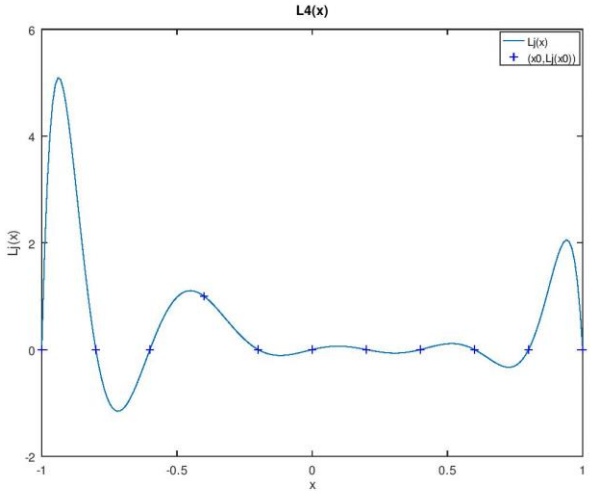
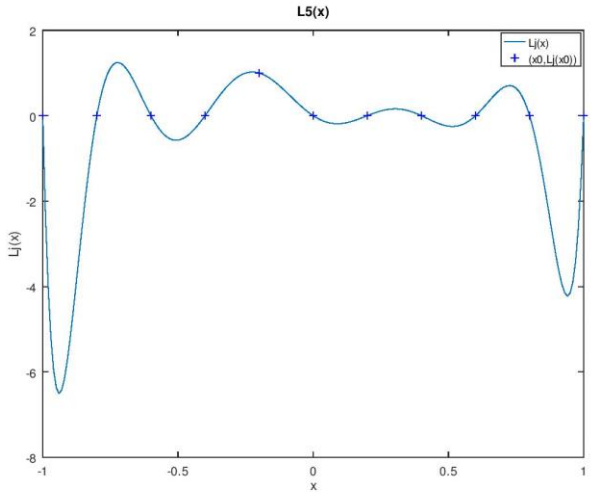
```
HW1    A
clear all
clc



function [y]=lagrange(x,x0,y0)
   #x0,y0:已知數據點
   n=size(x0',1);
   y=0;
   for j=1:n
      Lj=1;
      Ljx0=1;
      for i=1:n
         if i==j #避免除以零的情況
            continue
         endif
         Lj.*= (x-x0(i))/(x0(j)-x0(i));
         Ljx0.*= (x0-x0(i))/(x0(j)-x0(i));
      endfor
      figure(j)
      plot(x,Lj,x0,Ljx0,"b+")
      xlabel("x");
      ylabel("Lj(x)");
      legend("Lj(x)","(x0,Lj(x0))");
      title(["L",dec2base(j, 10),"(x)"]);
      print ("-djpg",["A_L",dec2base(j, 10),".jpg"]);
      Lj*=y0(j);
      y+=Lj;
   endfor
endfunction
xi=[-1:0.2:1];
yi=[0.0385,0.0588,0.1000,0.2000,0.5000,1.0000,0.5000,0.2000,0.1000,0.0588,0.0385];
x=[-1:0.01:1];
y=lagrange(x,xi,yi);
figure(12)
plot(x,y,xi,yi,"b+")
xlabel("x");
ylabel("f(x)");
legend("f(x)","(x0,y0)");
title("Lagrange polynomial");
print("-djpg","A_Lagrange polynomial");
```

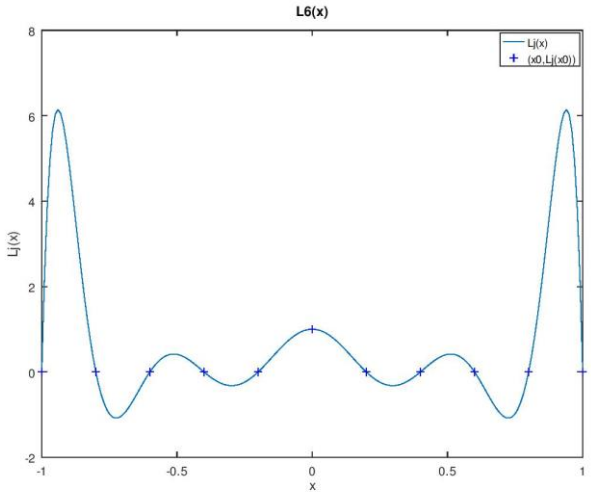

L1(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

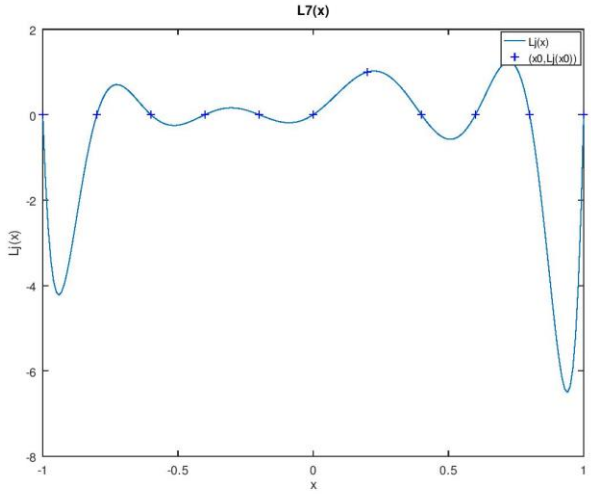

L2(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

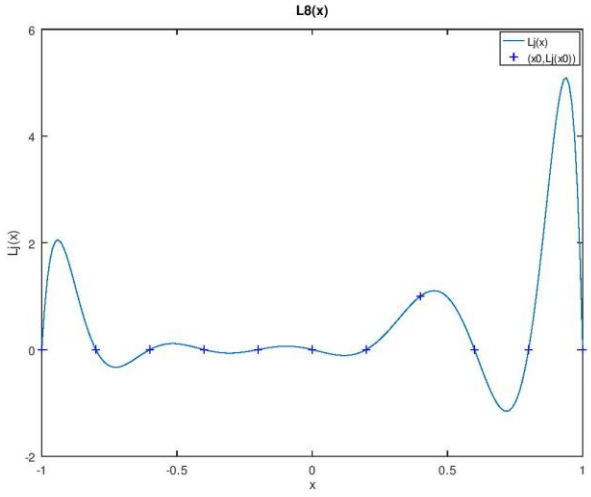

L3(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

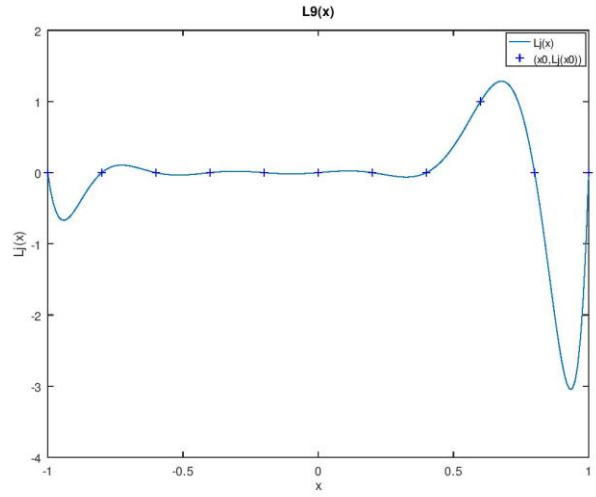

L4(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

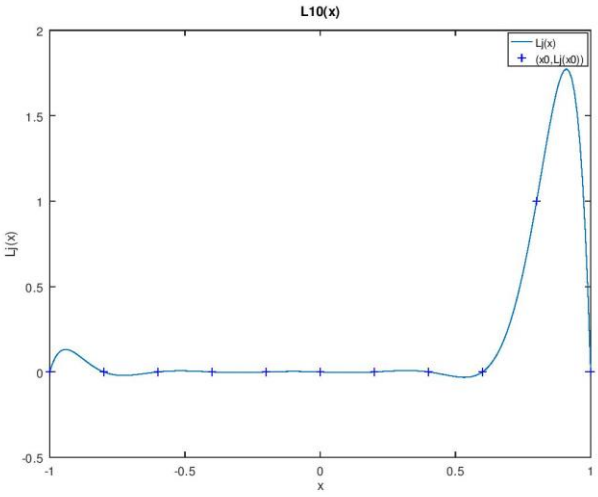

L5(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

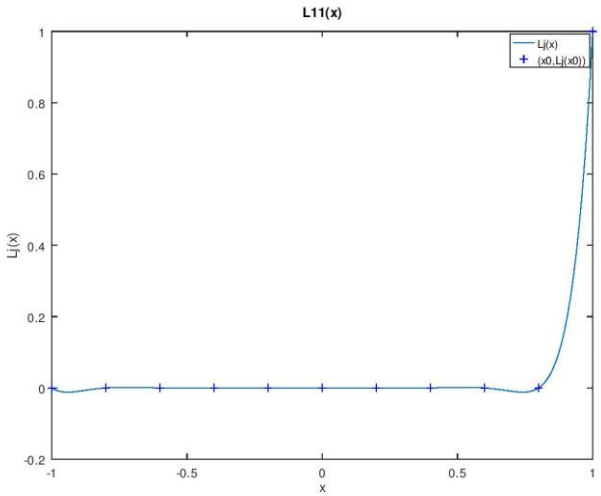

L6(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

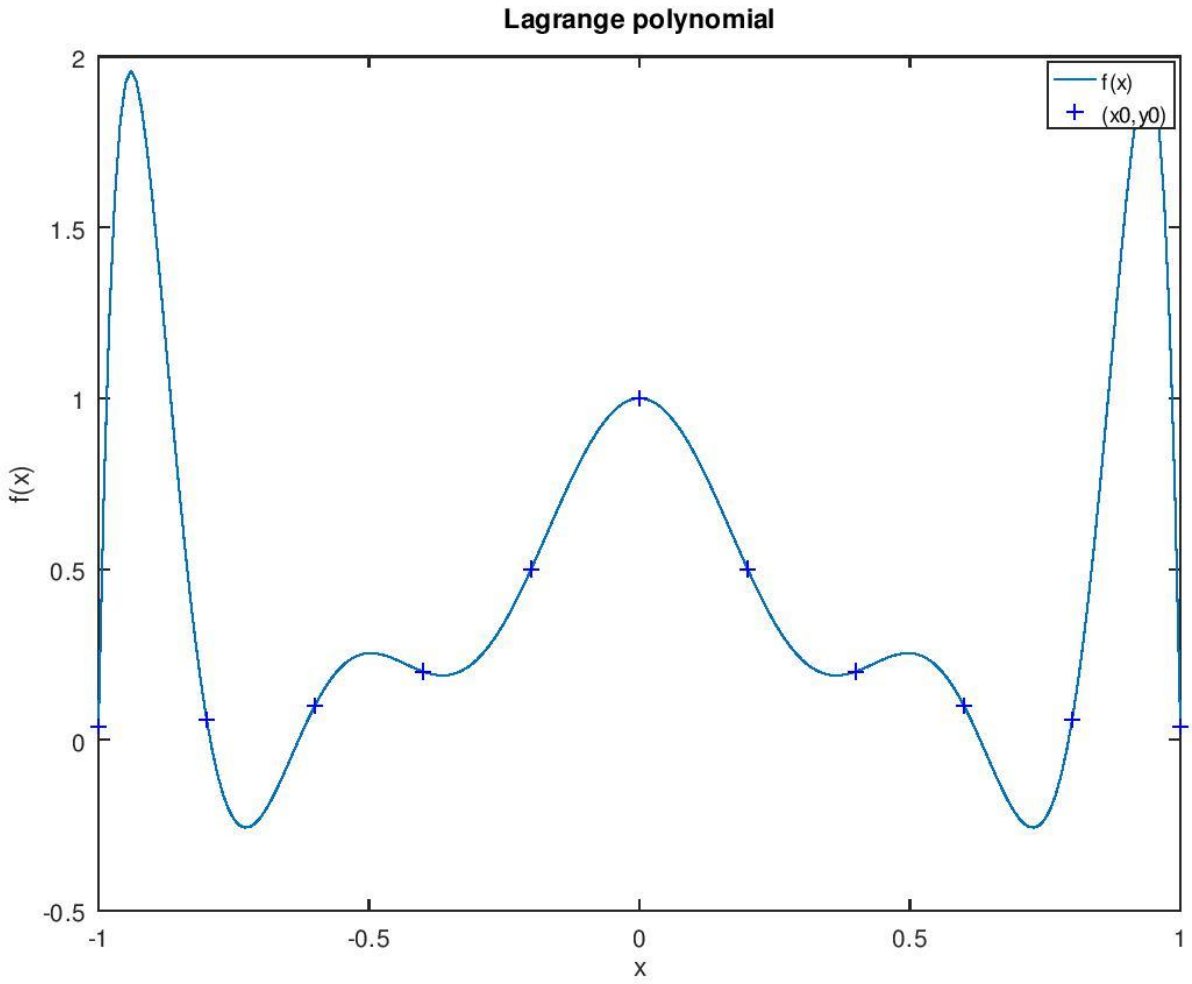

L7(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L8(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L9(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L10(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

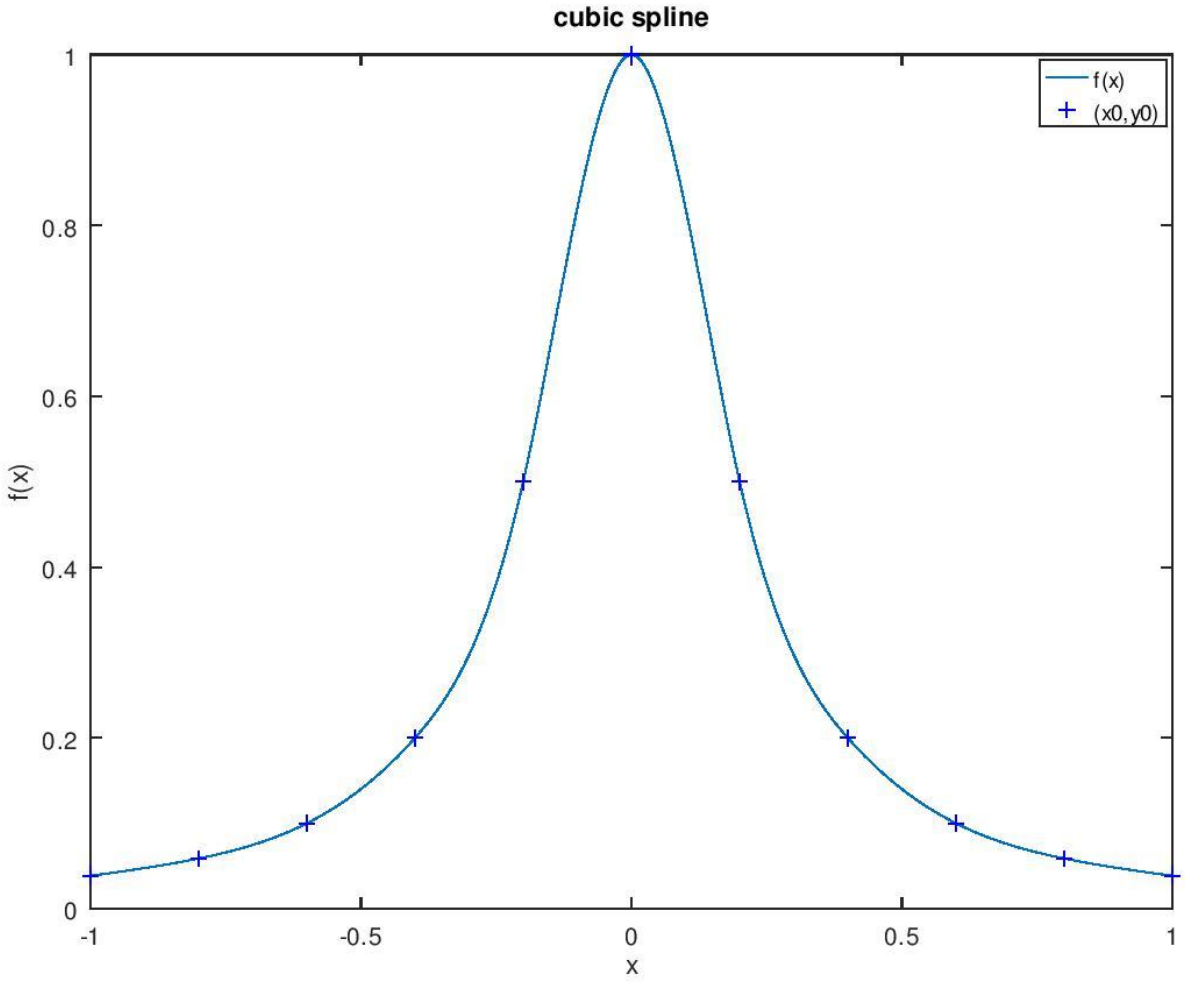

L11(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


Lagrange polynomial
f(x)
(x0,y0)
f(x)
x

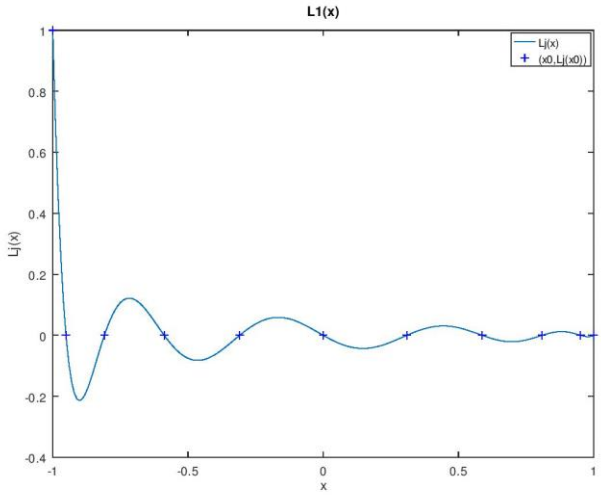
```
HW1_B
clear all
clc

xi=[-1.0000,-0.8000,-0.6000,-0.4000,-0.2000,-0.0000,0.2000,0.4000,0.6000,0.8000,1.0000];
yi=[0.0385,0.0588,0.1000,0.2000,0.5000,1.0000,0.5000,0.2000,0.1000,0.0588,0.0385];
n=size(xi',1);
A=zeros(n,n);
R=zeros(n,1); #A*sov=R
for i=1:n
    if (i==1 | i==n)
    A(i,i)=1;
    R(i)=0;
    continue
    endif
    A(i,i-1)=(xi(i)-xi(i-1))/6;
    A(i,i)=(xi(i+1)-xi(i-1))/3;
    A(i,i+1)=(xi(i+1)-xi(i))/6;
    R(i)=(yi(i+1)-yi(i))/(xi(i+1)-xi(i))-(yi(i)-yi(i-1))/(xi(i)-xi(i-1));
endfor
sov=A\R #second order value

figure(1)
x=[];
y=[];
for i=1:n-1
   x_now=xi(i):0.01:xi(i+1);
   di=xi(i+1)-xi(i);
   y_now=sov(i)/6 *((xi(i+1)-x_now).^3/di-di*(xi(i+1)-x_now))...
   + sov(i+1)/6 *((x_now-xi(i)).^3/di-di*(x_now-xi(i)))...
   + yi(i)*(xi(i+1)-x_now)/di + yi(i+1)*(x_now-xi(i))/di;
   x=[x,x_now];
   y=[y,y_now];
endfor
plot(x,y,xi,yi,"b+")
xlabel("x");
ylabel("f(x)");
legend("f(x)","(x0,y0)");
title("cubic spline");
print("-djpg","B_cubic spline");
```

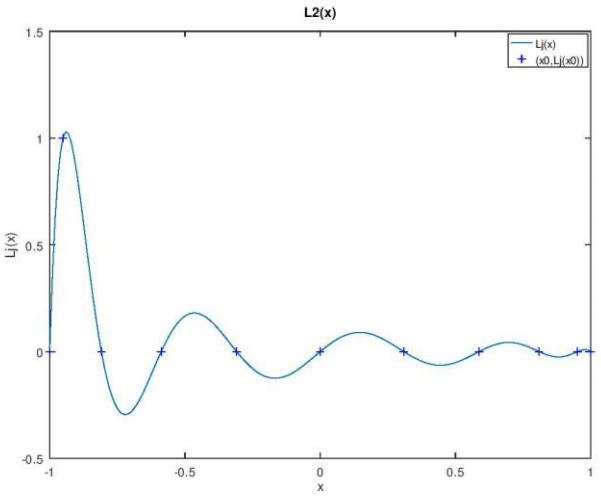
sov

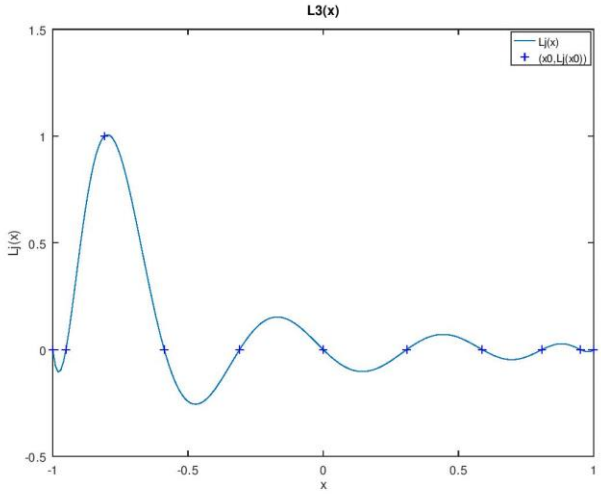
	1
1	0
2	0.41374
3	1.48
4	2.4861
5	18.575
6	-46.788
7	18.575
8	2.4861
9	1.48
10	0.41374
11	0
12	

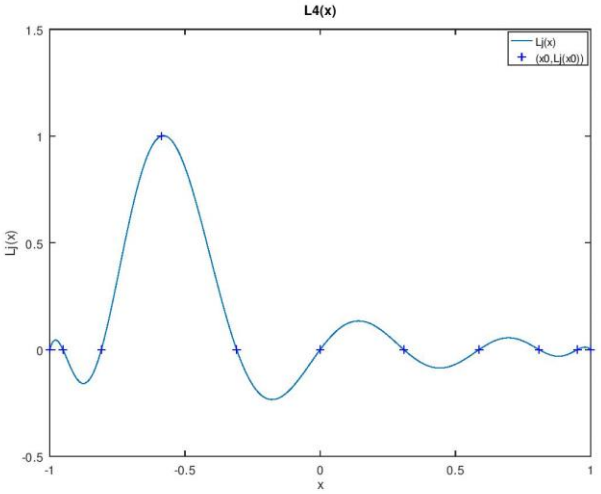


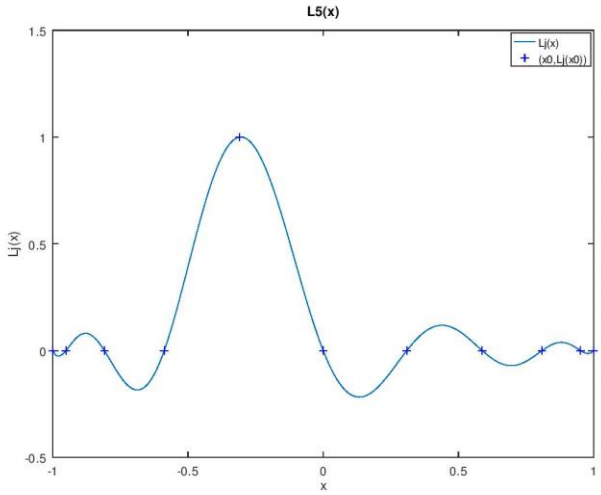
```
HW1_C
clear all
clc



function [y]=lagrange(x,x0,y0)
   #x0,y0:已知數據點
   n=size(x0',1);
   y=0;
   for j=1:n
      Lj=1;
      Ljx0=1;
      for i=1:n
         if i==j #避免除以零的情況
            continue
         endif
         Lj.*= (x-x0(i))/(x0(j)-x0(i));
         Ljx0.*= (x0-x0(i))/(x0(j)-x0(i));
      endfor
      figure(j)
      plot(x,Lj,x0,Ljx0,"b+")
      xlabel("x");
      ylabel("Lj(x)");
      legend("Lj(x)","(x0,Lj(x0))");
      title(["L",dec2base(j, 10),"(x)"]);
      print ("-djpg",["C_L",dec2base(j, 10),".jpg"]);
      Lj*=y0(j);
      y+=Lj;
   endfor
endfunction
xi=[-1.0000,-0.9511,-0.8090,-0.5878,-0.3090,0.0000,0.3090,0.5878,0.8090,0.9511,1.0000];
yi=[0.0385,0.0424,0.0576,0.1038,0.2952,1.0000,0.2952,0.1038,0.0576,0.0424,0.0385];
x=[-1:0.01:1];
y=lagrange(x,xi,yi);
figure(12)
plot(x,y,xi,yi,"b+")
xlabel("x");
ylabel("f(x)");
legend("f(x)","(x0,y0)");
title("Lagrange polynomial");
print("-djpg","C_Lagrange polynomial");
```

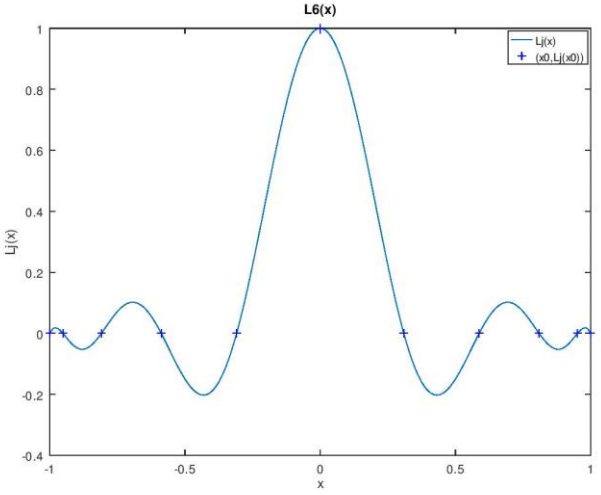

L1(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

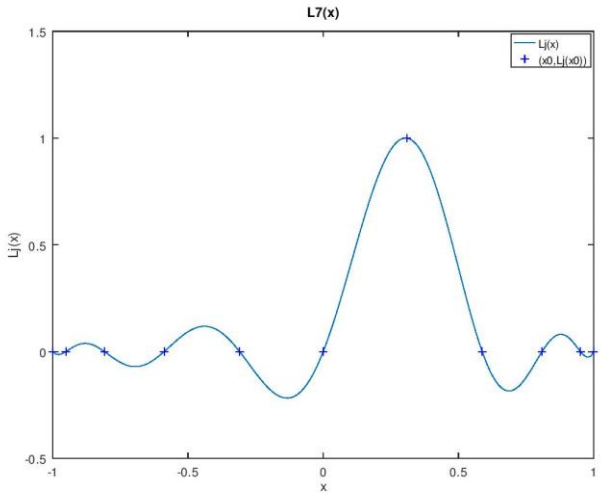

L2(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

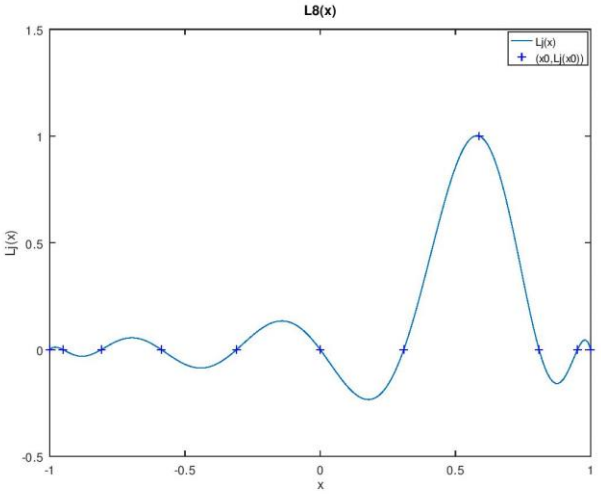

L3(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

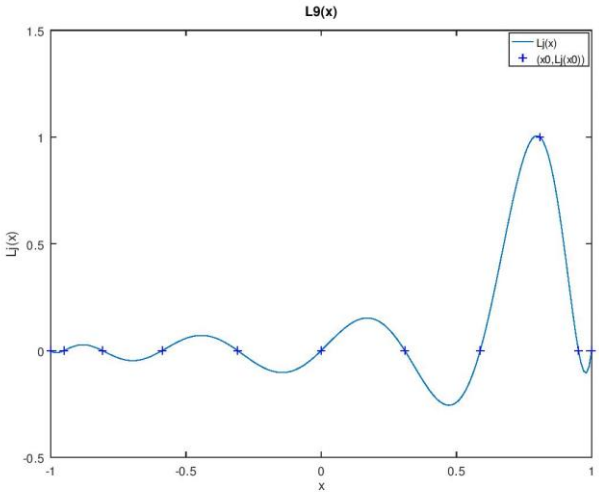

L4(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

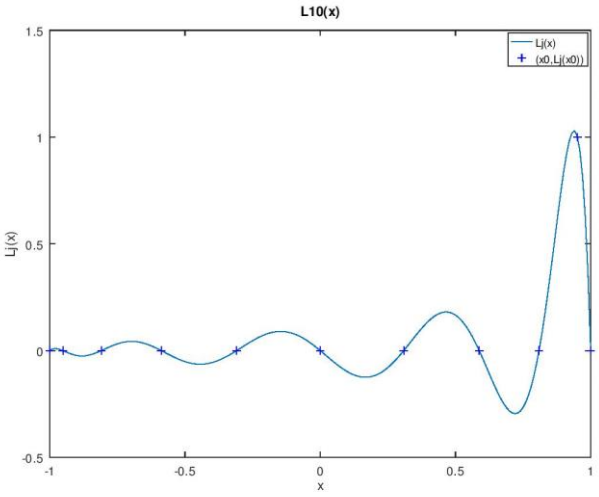

L5(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

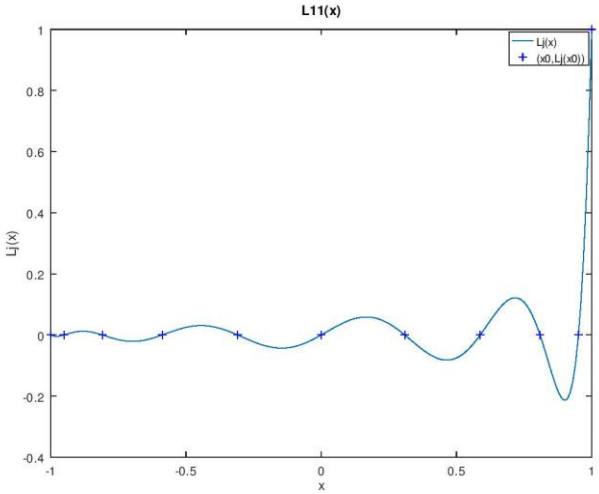

L6(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x

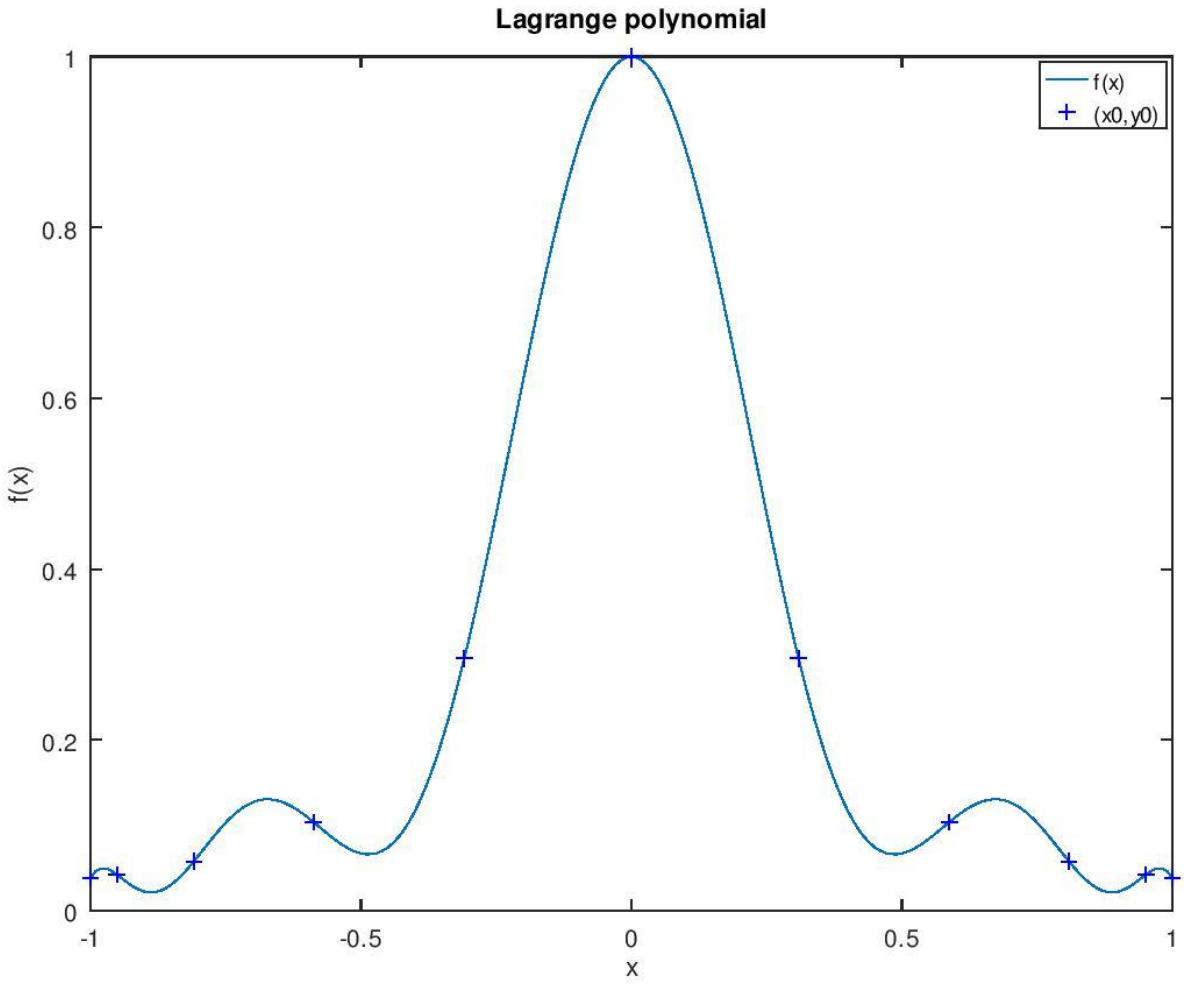

L7(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L8(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L9(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L10(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


L11(x)
Lj(x)
(x0,Lj(x0))
Lj(x)
x


Lagrange polynomial
f(x)
(x0,y0)
f(x)
x

```
HW1_D
clear all
clc

xi=[-1.0000,-0.9511,-0.8090,-0.5878,-0.3090,0.0000,0.3090,0.5878,0.8090,0.9511,1.0000];
yi=[0.0385,0.0424,0.0576,0.1038,0.2952,1.0000,0.2952,0.1038,0.0576,0.0424,0.0385];
n=size(xi',1);
A=zeros(n,n);
R=zeros(n,1); #A*sov=R
for i=1:n
    if (i==1 | i==n)
    A(i,i)=1;
    R(i)=0;
    continue
    endif
    A(i,i-1)=(xi(i)-xi(i-1))/6;
    A(i,i)=(xi(i+1)-xi(i-1))/3;
    A(i,i+1)=(xi(i+1)-xi(i))/6;
    R(i)=(yi(i+1)-yi(i))/(xi(i+1)-xi(i))-(yi(i)-yi(i-1))/(xi(i)-xi(i-1));
endfor
sov=A\R #second order value

figure(1)
x=[];
y=[];
for i=1:n-1
   x_now=xi(i):0.01:xi(i+1);
   di=xi(i+1)-xi(i);
   y_now=sov(i)/6 *((xi(i+1)-x_now).^3/di-di*(xi(i+1)-x_now))...
   + sov(i+1)/6 *((x_now-xi(i)).^3/di-di*(x_now-xi(i)))...
   + yi(i)*(xi(i+1)-x_now)/di + yi(i+1)*(x_now-xi(i))/di;
   x=[x,x_now];
   y=[y,y_now];
endfor
plot(x,y,xi,yi,"b+")
xlabel("x");
ylabel("f(x)");
legend("f(x)","(x0,y0)");
title("cubic spline");
print("-djpg","D_cubic spline");
```

sov

	1
1	0
2	-0.13415
3	1.5096
4	-2.1089
5	16.646
6	-30.468
7	16.646
8	-2.1089
9	1.5096
10	-0.13415
11	0