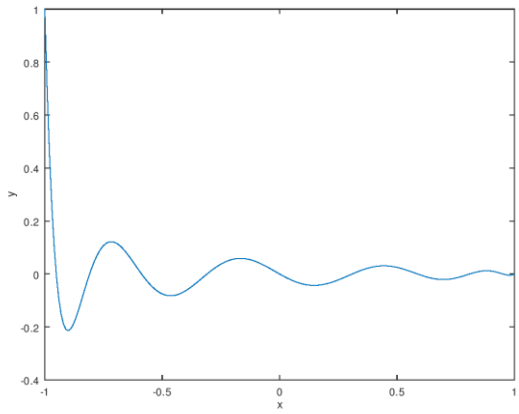
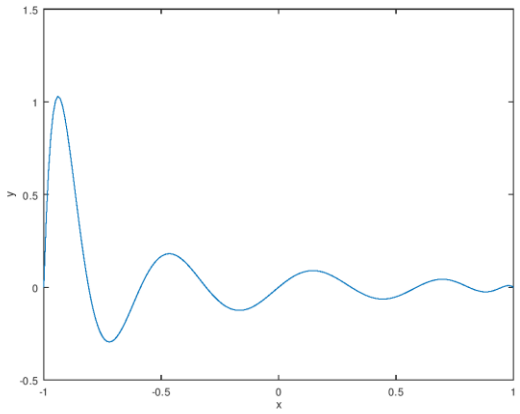
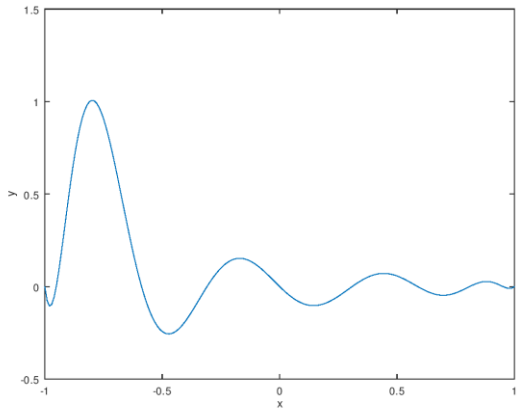
A.1

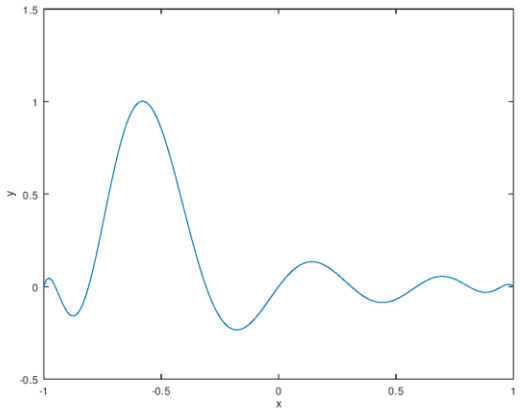
```
x=[-1:0.01:1];
x0=[-1:0.2:1];
n=size(x0,2);
for i=1:n
p=1;
for j=1:n
if j==i
continue;
endif;
p=p.*(x-x0(j))/(x0(i)-x0(j));
figure(i)
plot(x,p);
xlabel('x')
ylabel('y')
endfor;
endfor;
```

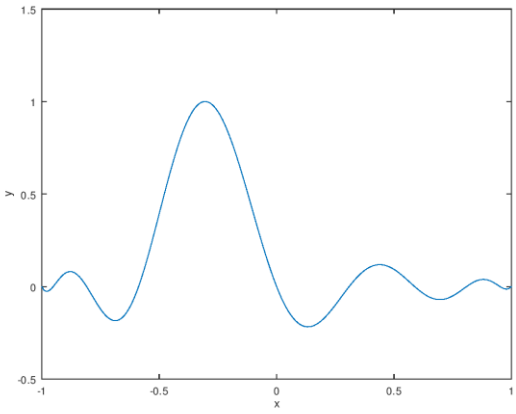
圖從左至右依序為 x0,x1,…,x10

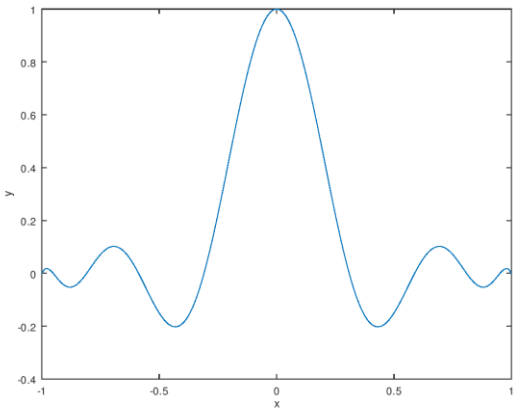


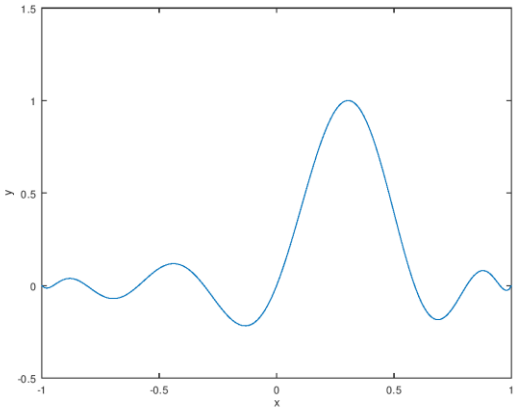


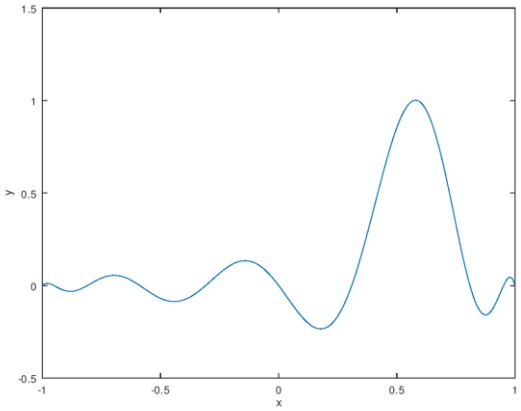


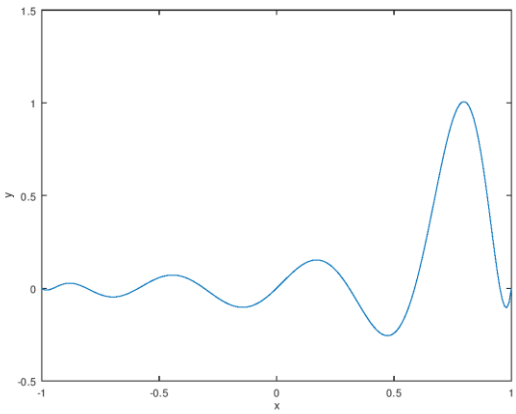


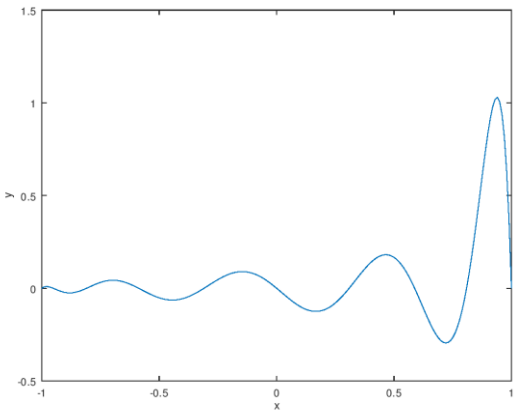

1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x

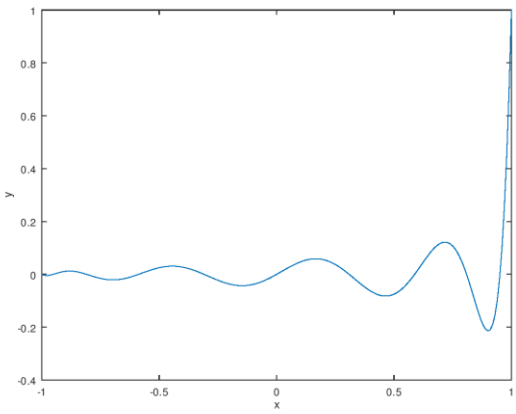

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x

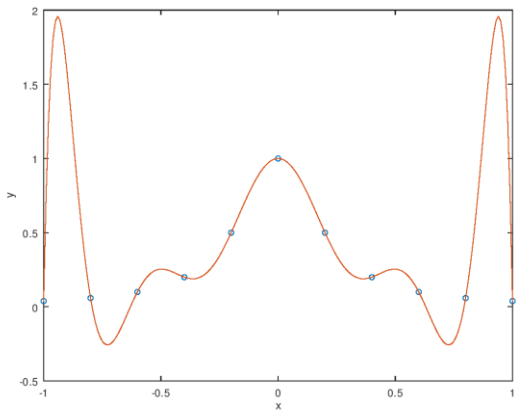

1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y
-1
-0.5
0
0.5
1
x

A.2

```
function y=LagrangePol(x,pointx,pointy)
n=size(pointx,2);
L=ones(n,size(x,2));
for i=1:n
for j=1:n
if (i~=j)
L(i,:)=L(i,:).*(x-pointx(j))/(pointx(i)-pointx(j));
end
end
end
y=0;
for i=1:n
y=y+pointy(i)*L(i,:);
end
end
x=[-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1];
y=[0.0385 0.0588 0.1 0.2 0.5 1 0.5 0.2 0.1 0.0588 0.0385];
plot(x,y,"o","markersize",5)
hold on;
t=[-1:0.01:1];
plot(t,LagrangePol(t,x,y))
xlabel('x')
ylabel('y')
print -dpng partA_2.png
```



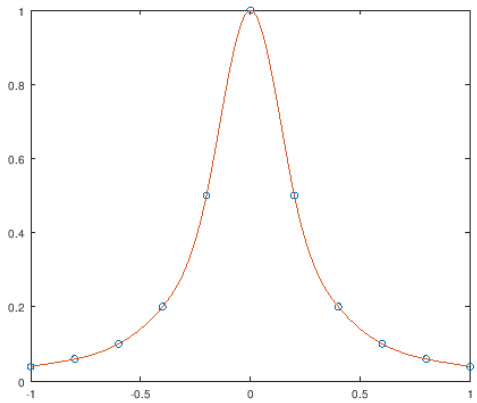
B.1

```
a=[0.4/3 0.1/3 0 0 0 0 0 0 0;
        0.1/3 0.4/3 0.1/3 0 0 0 0 0 0;
        0 0.1/3 0.4/3 0.1/3 0 0 0 0 0;
        0 0 0.1/3 0.4/3 0.1/3 0 0 0 0;
        0 0 0 0.1/3 0.4/3 0.1/3 0 0 0;
        0 0 0 0 0.1/3 0.4/3 0.1/3 0 0;
        0 0 0 0 0 0.1/3 0.4/3 0.1/3 0;
        0 0 0 0 0 0 0.1/3 0.4/3 0.1/3;
        0 0 0 0 0 0 0 0.1/3 0.4/3;]
y=[0.0385 0.0588 0.1 0.2 0.5 1 0.5 0.2 0.1 0.0588 0.0385];
x=[-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1];
b=zeros(9,1);
for i=1:9
b(i)=((y(i+2)-y(i+1))/(x(i+2)-x(i+1))-(y(i+1)-y(i))/(x(i+1)-x(i)));
end
r=pinv(a)*b
```

answer:g''(xi)= [0.41374 1.48003 2.48615 18.57539 -46.78769 18.57539 2.48615 1.48003 0.41374] , g''(x0) = g''(x10) = 0

B.2

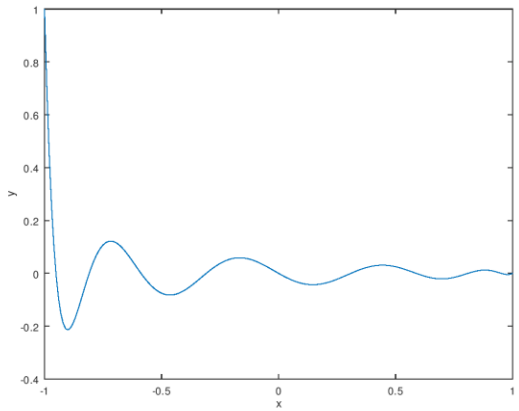
```
>> x=[-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1];
>> y=[0.0385 0.0588 0.1 0.2 0.5 1 0.5 0.2 0.1 0.0588 0.0385];
>> xx=-1:0.01:1;
>> yy=spline(x,y,xx);
>> plot(x,y,"o",xx,yy)
>> print "-S500,400" -dpng output.png
```

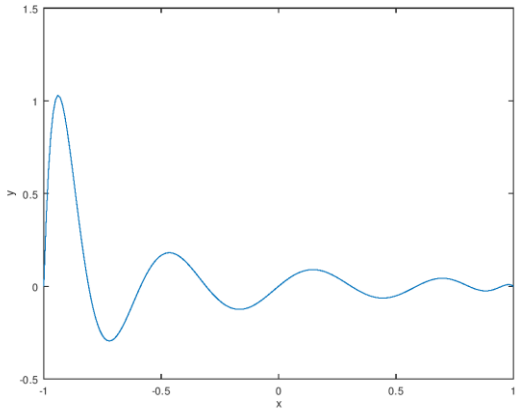


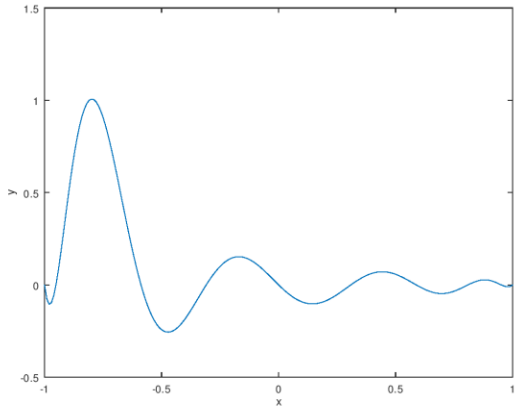
C.1

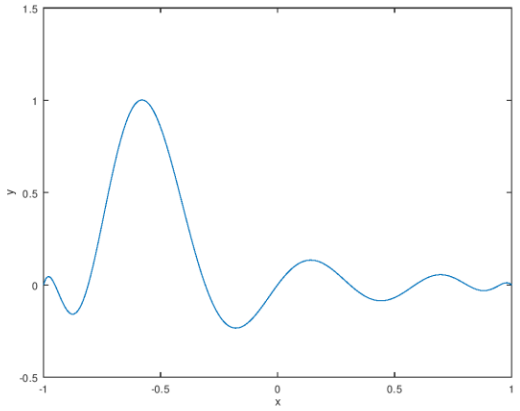
```
x=[-1:0.01:1];
x0=[-1 -0.9511 -0.8090 -0.5878 -0.3090 0 0.3090 0.5878 0.8090 0.9511 1];
n=size(x0,2);
for i=1:n
p=1;
for j=1:n
if j==i
continue;
endif;
p=p.*(x-x0(j))/(x0(i)-x0(j));
figure(i)
plot(x,p);
xlabel('x')
ylabel('y')
endfor;
endfor;
```

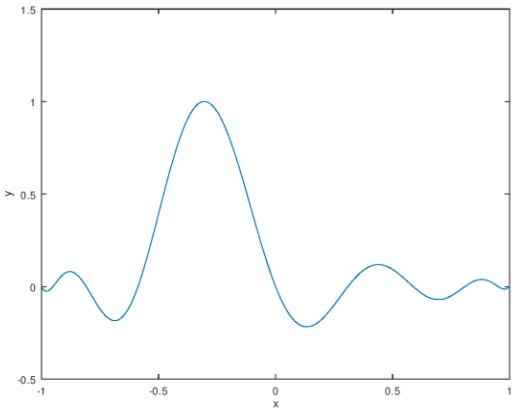
圖從左至右依序為 x0,x1,…,x10

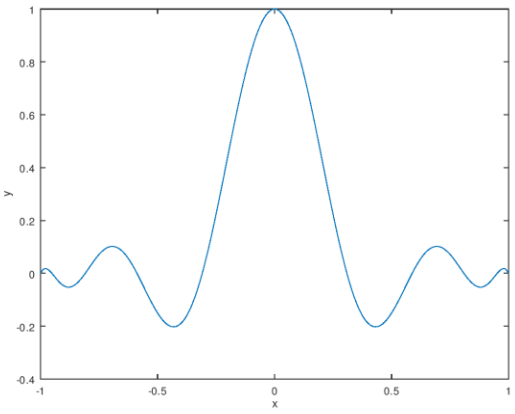


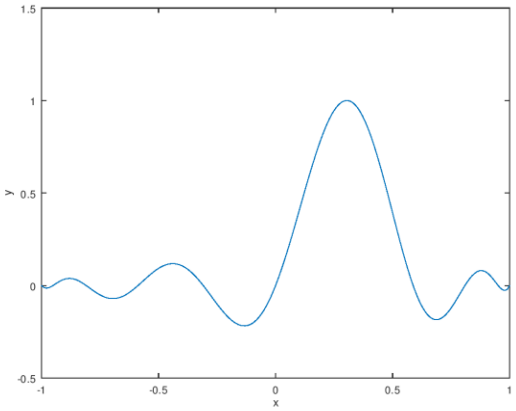


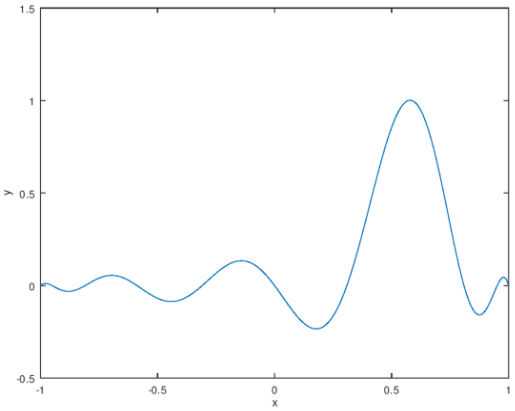


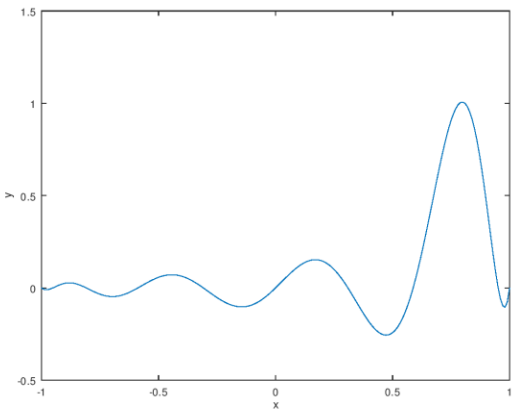


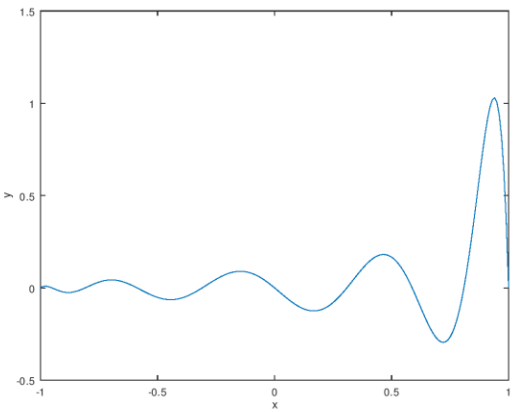

1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x

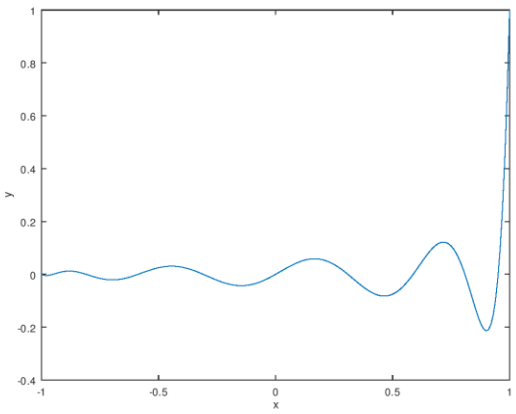

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x

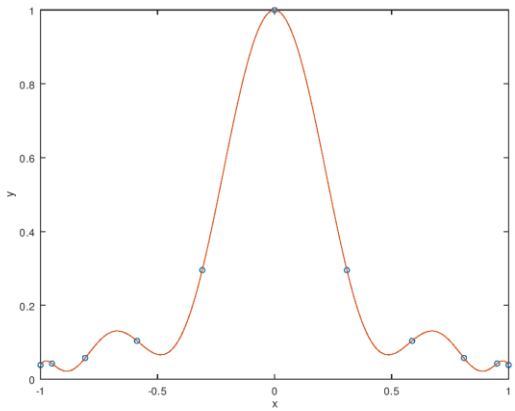

1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1.5
1
0.5
0
-0.5
y
-1
-0.5
0
0.5
1
x


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
y
-1
-0.5
0
0.5
1
x

C.2

```
x=[-1 -0.9511 -0.8090 -0.5878 -0.3090 0 0.3090 0.5878 0.8090 0.9511 1];
y=[0.0385 0.0424 0.0576 0.1038 0.2952 1 0.2952 0.1038 0.0576 0.0424 0.0385];
function y=LagrangePol(x,pointx,pointy)
n=size(pointx,2);
L=ones(n,size(x,2));
for i=1:n
for j=1:n
if(i~=j)
L(i,:)=L(i,:).*(x-pointx(j))/(pointx(i)-pointx(j));
end
end
end
y=0;
for i=1:n
y=y+pointy(i)*L(i,:);
end
end
plot(x,y,"o","markersize",5)
hold on;
t=[-1:0.1:1];
plot(t,LagrangePol(t,x,y))
xlabel('x')
ylabel('y')
print -dpng output.png
```



D.1

```
x=[-1 -0.9511 -0.8090 -0.5878 -0.3090 0 0.3090 0.5878 0.8090 0.9511 1];
y=[0.0385 0.0424 0.0576 0.1038 0.2952 1 0.2952 0.1038 0.0576 0.0424 0.0385];
a=zeros(9,9);
for i=2:8
a(i,i-1)=(x(i+1)-x(i))/6;
a(i,i)=(x(i+2)-x(i))/3;
```

```
a(i,i+1)=(x(i+2)-x(i+1))/6;
end
a(1,1)=0.063666667;
a(1,2)= 0.0236833;
a(9,8)=0.023683333;
a(9,9)=0.063667;

b=zeros(9,1)
for i=1:9
b(i)=((y(i+2)-y(i+1))/(x(i+2)-x(i+1))-(y(i+1)-y(i))/(x(i+1)-x(i)));
end
r=pinv(a)*b
```

answer: g’’(xi)=
[-0.13415 1.50964 -2.10886 16.64580 -30.46762 16.64580 -2.10886 1.50964 -0.13415] , g’’(x0)=g’’(x10)=0

D.2

```
x=[-1 -0.9511 -0.8090 -0.5878 -0.3090 0 0.3090 0.5878 0.8090 0.9511 1];
y=[0.0385 0.0424 0.0576 0.1038 0.2952 1 0.2952 0.1038 0.0576 0.0424 0.0385];
xx=-1:0.01:1;
yy=spline(x,y,xx);
plot(x,y,”o”,xx,yy)
xlabel(‘x’)
ylabel(‘y’)
print –dpng output.png
```