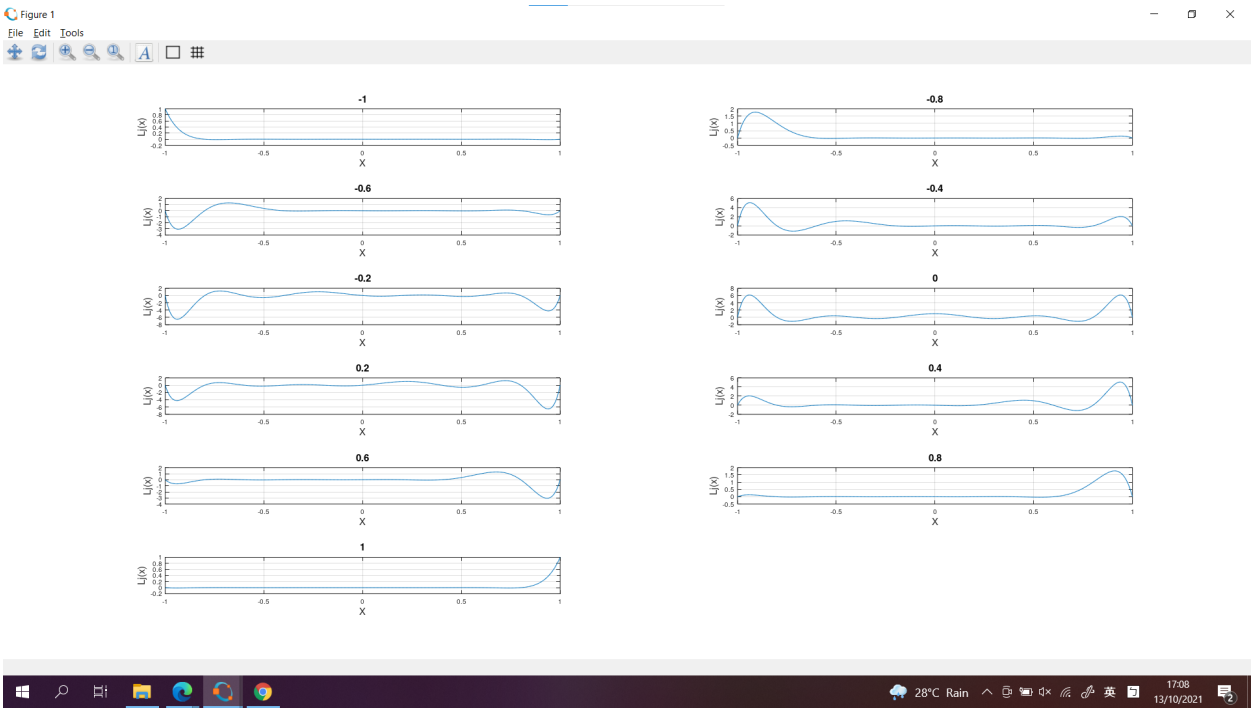
hw1 B09505021 Numerical Analysis

A.1

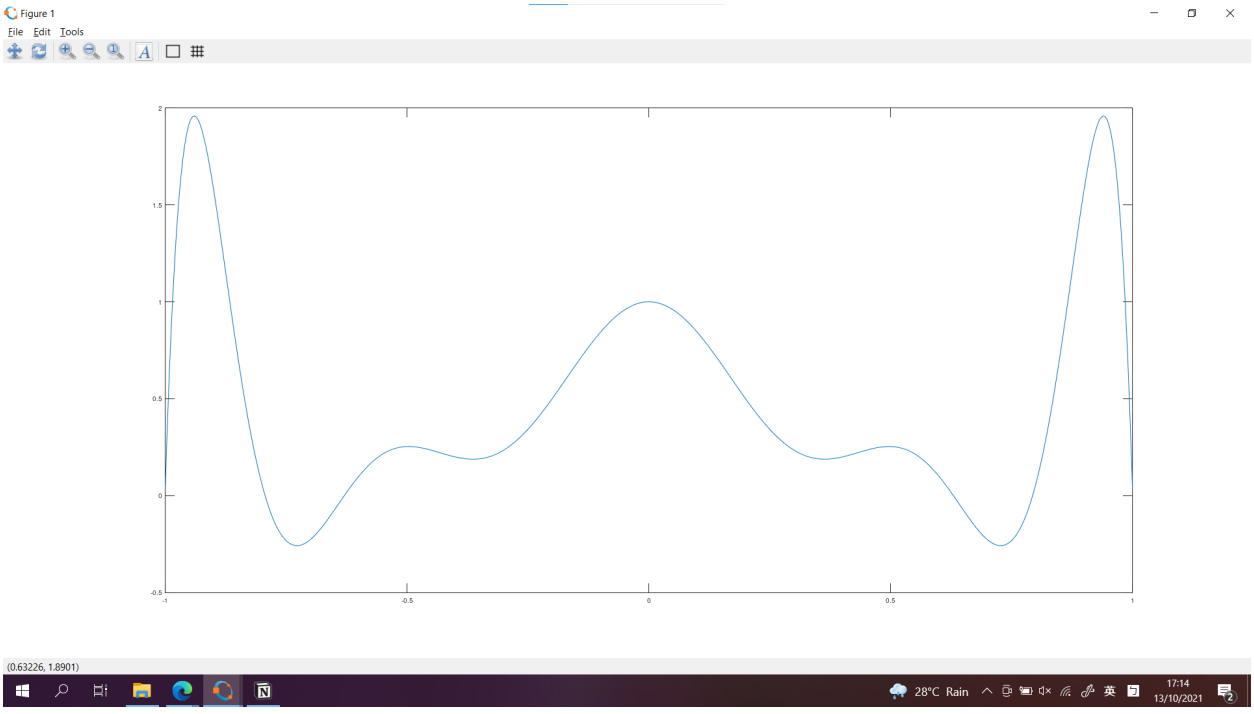
```
filename = "hw1AB.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
x0 = datax;
y0 = datay;
x = linspace(-1, 1, 500)
d = size(x0, 1);
y = zeros(d, 500);
y = y+1;

for j = 1:d
  for i = 1:d
    if j == i
      continue;
          #skip and continue the loop
    endif
    y(j, :) .*= ((x-x0(i))/(x0(j)-x0(i)));
  endfor
endfor

for k = 1:1:d
  subplot(6, 2, k)
  plot(x, y(k, :))
  set(gca,'FontSize',10);
  xlabel("X",'FontSize',15);
  ylabel("Lj(x)",'FontSize',15);
  title(x0(k),'FontSize',15);
  grid on;
end
```



A.2

```
function [y] = lagrange(x, x0, y0)
  # x-value we want to compute
  # y-computed value
  # x0-inputs
  n = size(x0, 1);
  # size of X0 in one dimension
  y=0;
  for j = 1:n
    p = 1;
    for i = 1:n
      if j == i
        continue;
        #skip and continue the loop
      endif
      p .*= (x-x0(i))/(x0(j)-x0(i));
    endfor
    y += y0(j) * p;
  endfor
endfunction
```

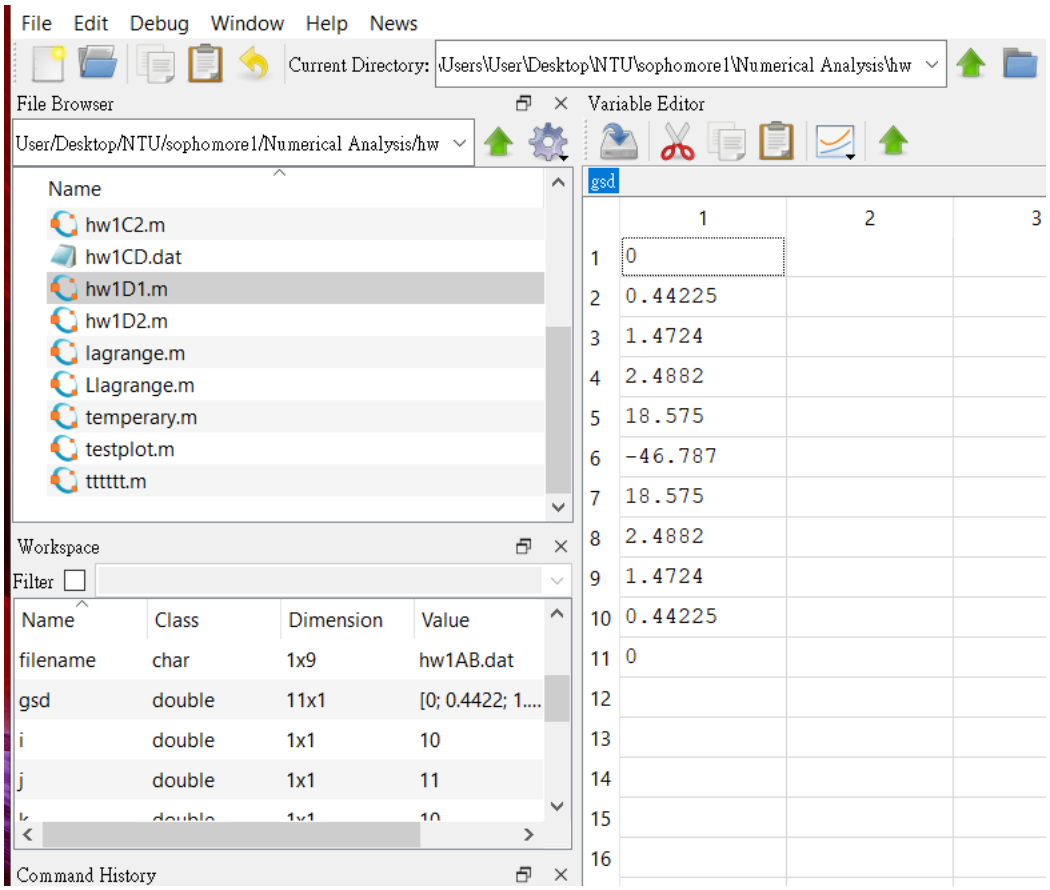
```
filename = "hw1AB.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
x0 = datax;
y0 = datay;
x = linspace(-1, 1, 500)

y = lagrange(x, x0, y0);

figure
plot(x, y)
```



B.1

```
filename = "hw1AB.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
```

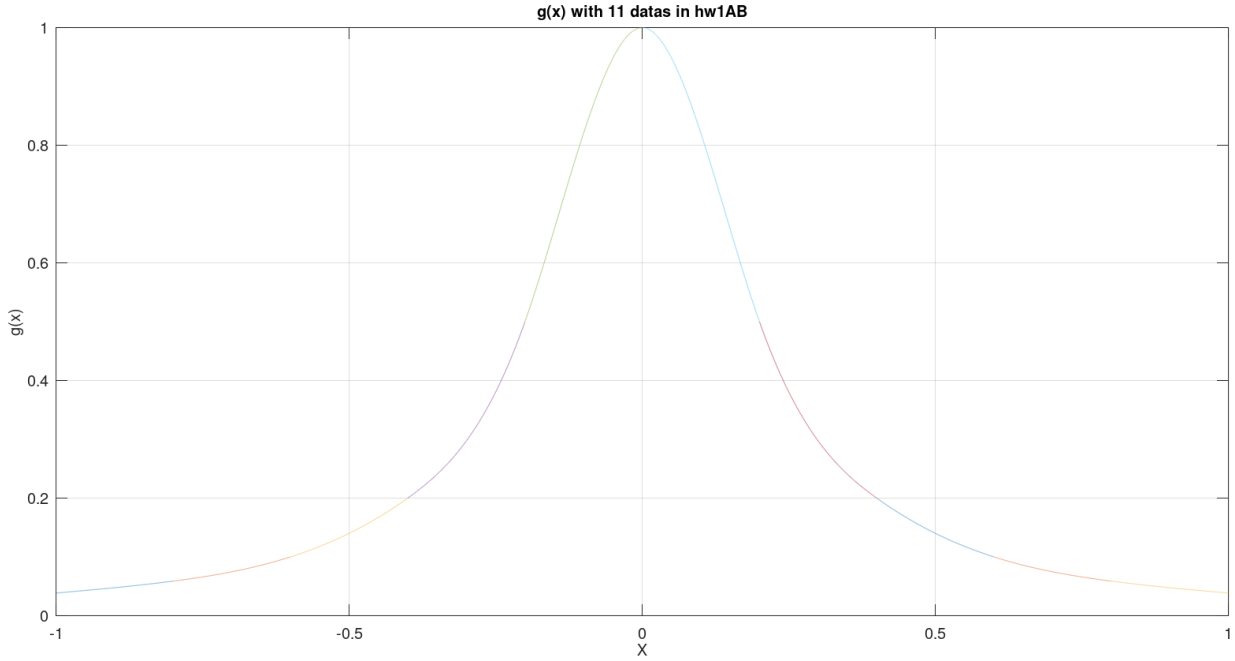
```
x0 = datax;
y0 = datay;
n = size(x0, 1)
matrix = zeros(n, n);
f = zeros(n, 1);
delta = zeros(n, 1);
gsd = zeros(n, 1);

for i = 1:n-1
  delta(i, 1) = x0(i+1)-x0(i);
endfor

for k = 1+1:n-1
  for j = 1:n
    if k == j+1
      matrix(k, j) = delta(j, 1)./6
    elseif k == j
      matrix(k, j) = (delta(j, 1).+delta(j-1, 1))./3;
    elseif k == j-1
      matrix(k, j) = delta(j-1, 1)./6;
    endif
  endfor
endfor

for q = 1+1:n-1
   f(q, 1) = (y0(q+1).-y0(q))./delta(q, 1).-(y0(q).-y0(q-1))./delta(q, 1)
endfor

gsd = matrix\f;
gsd(1, 1) = 0;
gsd(n, 1) = 0;
```



B.2

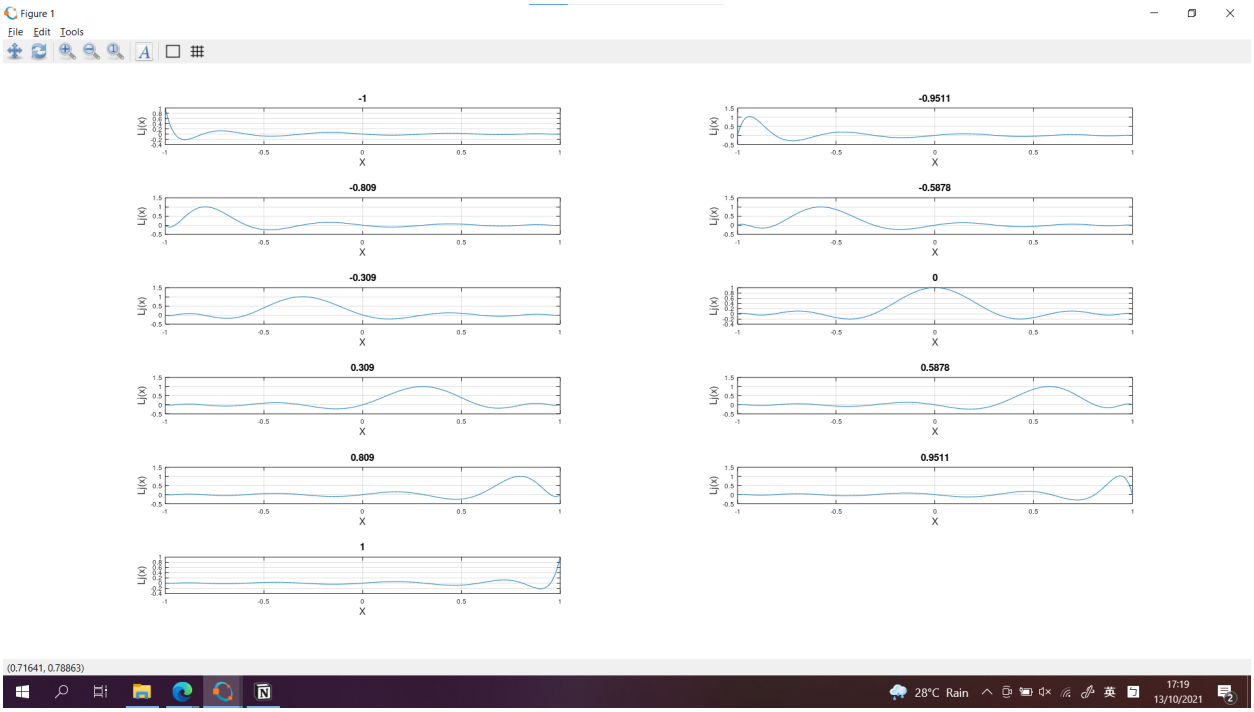
```
filename = 'hw1AB.dat'
[xj,yj]=textread(filename,'%f %f','HeaderLines',1)

n=length(xj);
g=zeros(n-2,n-2);
f=zeros(n-2,1);
G=zeros(n-2,1);
h=zeros(n-1,1);

for o=1:n-1;
  h(o)=xj(o+1)-xj(o);
endfor;

for i=1:n-2;
  for j=1:n-2;
    if j==i-1;
      g(i,j)=h(i)./6;
    endif;
    if j==i;
      g(i,j)=(h(i+1).+h(i))./3;
    endif;
    if j==i+1;
      g(i,j)=h(i+1)./6;
    endif;
  endfor;
endfor;

for k=1:n-2;
  f(k,1)=((yj(k+2).-yj(k+1))./h(k+1)).-((yj(k+1).-yj(k))./h(k));
endfor;

G=g\f;

x=-1:0.0001:-0.8001;
x1=-0.8:0.0001:-0.6001;
x2=-0.6:0.0001:-0.4001;
x3=-0.4:0.0001:-0.2001;
x4=-0.2:0.0001:-0.0001;
x5=0:0.0001:0.1999;
x6=0.2:0.0001:0.3999;
x7=0.4:0.0001:0.5999;
x8=0.6:0.0001:0.8;
x9=0.8001:0.0001:1;

c=1;
c1=1;
c2=1;
c3=1;
c4=1;
c5=1;
c6=1;
c7=1;
c8=1;
c9=1;

  c .*=G(1)./6.*(((x.-xj(1)).^3)./h(1).-(h(1).*(x.-xj(1)))) .+ ((yj(1).*(xj(2).-x).+yj(2).*(x.-xj(1)))./h(1));
  c1 .*=(G(1)./6).*(((xj(3).-x1).^3)./h(2).-(h(2).*(xj(3).-x1))).+(G(2)./6).*(((x1.-xj(2)).^3)./h(2).-(h(2).*(x1.-xj(2)))).+((yj(2).*(xj(3)
  c2 .*=(G(2)./6).*(((xj(4).-x2).^3)./h(3).-(h(3).*(xj(4).-x2))).+(G(3)./6).*(((x2.-xj(3)).^3)./h(3).-(h(3).*(x2.-xj(3)))).+((yj(3).*(xj(4)
  c3 .*=(G(3)./6).*(((xj(5).-x3).^3)./h(4).-(h(4).*(xj(5).-x3))).+(G(4)./6).*(((x3.-xj(4)).^3)./h(4).-(h(4).*(x3.-xj(4)))).+((yj(4).*(xj(5)
  c4 .*=(G(4)./6).*(((xj(6).-x4).^3)./h(5).-(h(5).*(xj(6).-x4))).+(G(5)./6).*(((x4.-xj(5)).^3)./h(5).-(h(5).*(x4.-xj(5)))).+((yj(5).*(xj(6)
  c5 .*=(G(5)./6).*(((xj(7).-x5).^3)./h(6).-(h(6).*(xj(7).-x5))).+(G(6)./6).*(((x5.-xj(6)).^3)./h(6).-(h(6).*(x5.-xj(6)))).+((yj(6).*(xj(7)
  c6 .*=(G(6)./6).*(((xj(8).-x6).^3)./h(7).-(h(7).*(xj(8).-x6))).+(G(7)./6).*(((x6.-xj(7)).^3)./h(7).-(h(7).*(x6.-xj(7)))).+((yj(7).*(xj(8)
  c7 .*=(G(7)./6).*(((xj(9).-x7).^3)./h(8).-(h(8).*(xj(9).-x7))).+(G(8)./6).*(((x7.-xj(8)).^3)./h(8).-(h(8).*(x7.-xj(8)))).+((yj(8).*(xj(9)
  c8 .*=(G(8)./6).*(((xj(10).-x8).^3)./h(9).-(h(9).*(xj(10).-x8))).+(G(9)./6).*(((x8.-xj(9)).^3)./h(9).-(h(9).*(x8.-xj(9)))).+((yj(9).*(xj(
  c9 .*=(G(9)./6).*(((xj(11).-x9).^3)./h(10).-(h(10).*(xj(11).-x9))) .+ ((yj(10).*(xj(11).-x9).+yj(11).*(x9.-xj(10)))./h(10));


y=c;
y1=c1;
y2=c2;
y3=c3;
y4=c4;
y5=c5;
y6=c6;
y7=c7;
y8=c8;
y9=c9;

plot(x,y,x1,y1,x2,y2,x3,y3,x4,y4,x5,y5,x6,y6,x7,y7,x8,y8,x9,y9);
```

```
set(gca,'FontSize',20);
xlabel("X",'FontSize',20);
ylabel("g(x)",'FontSize',20);
title("g(x) with 11 datas in hw1AB",'FontSize',20);
grid on;
```



C.1

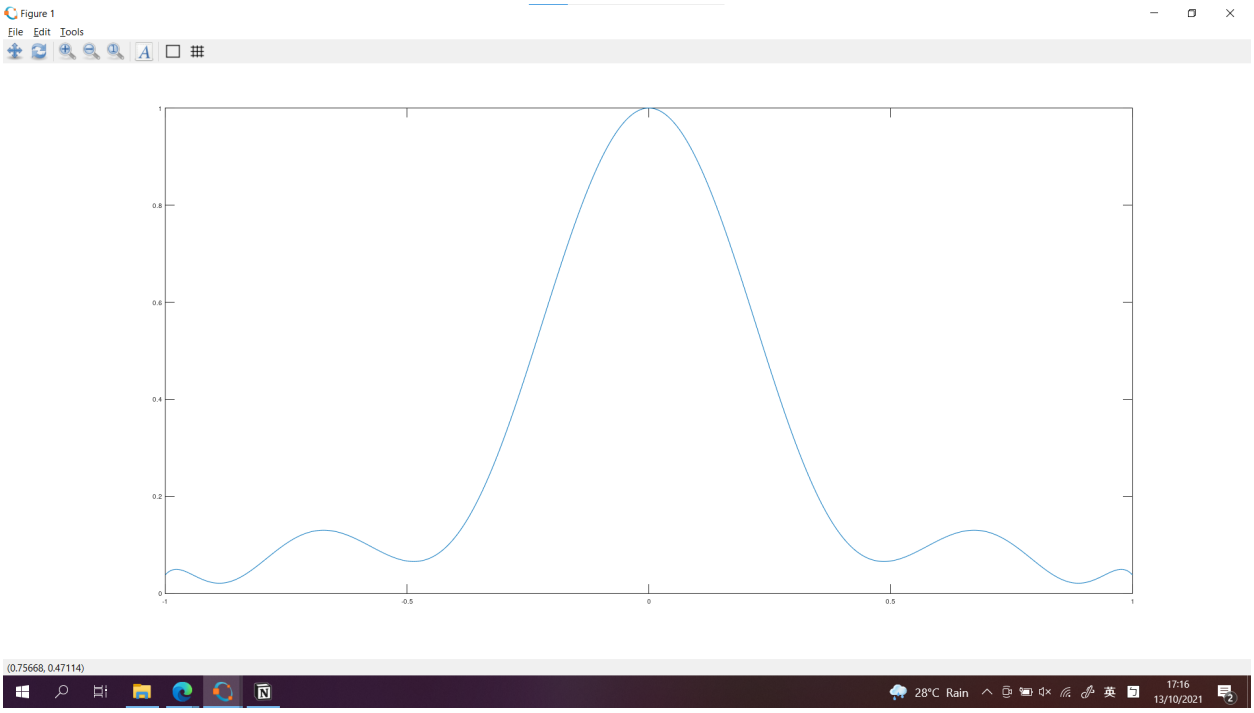
```
filename = "hw1CD.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
x0 = datax;
y0 = datay;
x = linspace(-1, 1, 500)
d = size(x0, 1);
y = zeros(d, 500);
y = y+1;

for j = 1:d

  for i = 1:d
    if j == i
      continue;
          #skip and continue the loop
    endif
    y(j, :) .*= ((x-x0(i))/(x0(j)-x0(i)));
  endfor
endfor

for k = 1:1:d
  subplot(6, 2, k)
  plot(x, y(k, :))
  set(gca,'FontSize',10);
  xlabel("X",'FontSize',15);
  ylabel("Lj(x)",'FontSize',15);
  title(x0(k),'FontSize',15);
  grid on;
end
```



C.2

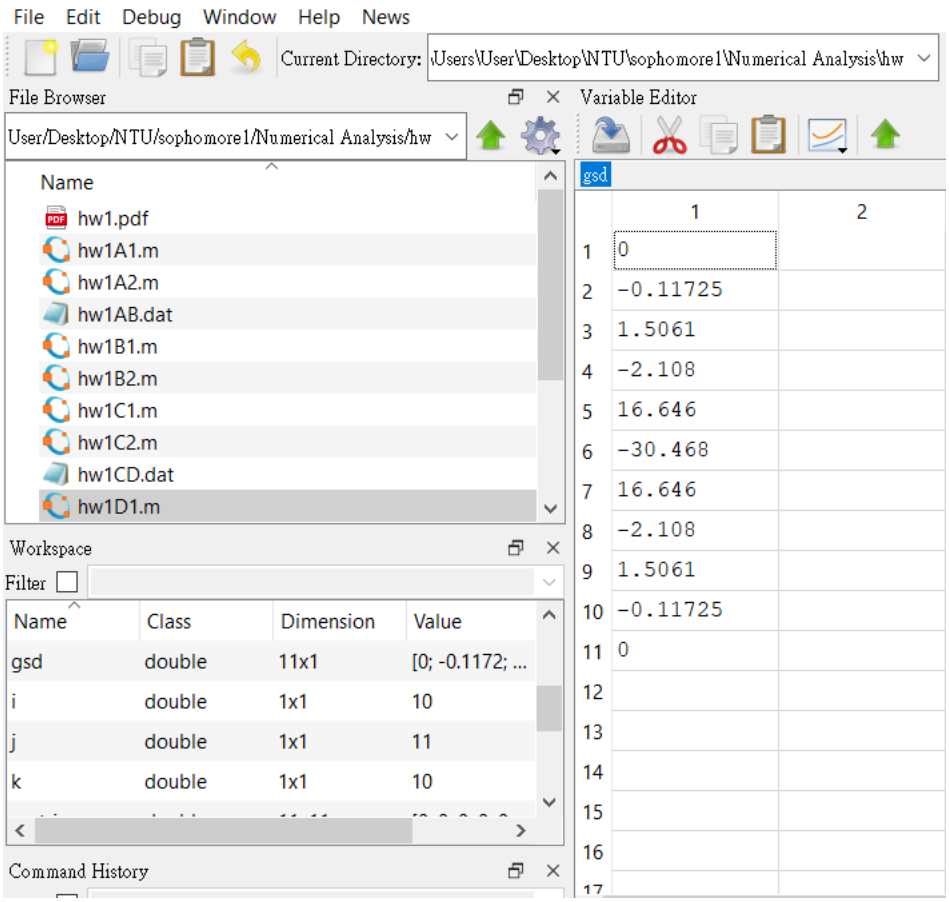
```
function [y] = lagrange(x, x0, y0)
  # x-value we want to compute
  # y-computed value
  # x0-inputs
  n = size(x0, 1);
  # size of X0 in one dimension
  y=0;
  for j = 1:n
    p = 1;
    for i = 1:n
      if j == i
        continue;
        #skip and continue the loop
      endif
      p .*= (x-x0(i))/(x0(j)-x0(i));
    endfor
    y += y0(j) * p;
  endfor
endfunction
```

```
filename = "hw1CD.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
x0 = datax;
y0 = datay;
x = linspace(-1, 1, 500)

y = lagrange(x, x0, y0);

figure
plot(x, y)
```



D.1

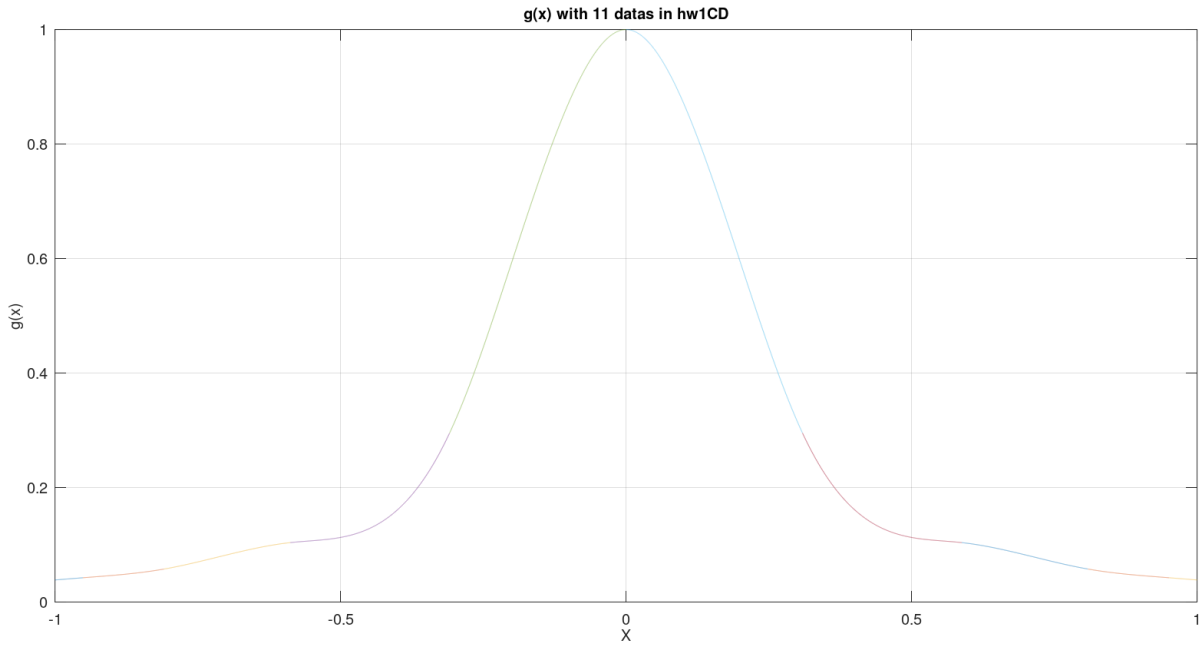
```
filename = "hw1CD.dat";
[datax, datay] = textread(filename, "%f %f", 'headerlines', 1);
x0 = datax;
y0 = datay;
n = size(x0, 1)
matrix = zeros(n, n);
f = zeros(n, 1);
delta = zeros(n, 1);
gsd = zeros(n, 1);

for i = 1:n-1
  delta(i, 1) = x0(i+1)-x0(i);
endfor

for k = 1+1:n-1
  for j = 1:n
    if k == j+1
      matrix(k, j) = delta(j, 1)./6
    elseif k == j
      matrix(k, j) = (delta(j, 1).+delta(j-1, 1))./3;
    elseif k == j-1
      matrix(k, j) = delta(j-1, 1)./6;
    endif
  endfor
endfor

for q = 1+1:n-1
   f(q, 1) = (y0(q+1).-y0(q))./delta(q, 1).-(y0(q).-y0(q-1))./delta(q-1, 1)
endfor

gsd = matrix\f;
gsd(1, 1) = 0;
gsd(n, 1) = 0;
```



D.2

```
filename = 'hw1CD.dat'
[xj,yj]=textread(filename,'%f %f','HeaderLines',1)

n=length(xj);
g=zeros(n-2,n-2);
f=zeros(n-2,1);
G=zeros(n-2,1);
h=zeros(n-1,1);
x=-1:0.0001:-0.9512;
x1=-0.9511:0.0001:-0.8091;
x2=-0.8090:0.0001:-0.5879;
x3=-0.5878:0.0001:-0.3091;
x4=-0.3090:0.0001:-0.0001;
x5=0:0.0001:0.3089;
x6=0.3090:0.0001:0.5877;
x7=0.5878:0.0001:0.8089;
x8=0.8090:0.0001:0.9511;
x9=0.9512:0.0001:1;

c=1;
c1=1;
c2=1;
c3=1;
c4=1;
c5=1;
c6=1;
c7=1;
c8=1;
c9=1;

for o=1:n-1;
```

```
  h(o)=xj(o+1)-xj(o);
endfor;

for i=1:n-2;
  for j=1:n-2;
    if j==i-1;
      g(i,j)=h(i)./6;
    endif;
    if j==i;
      g(i,j)=(h(i+1).+h(i))./3;
    endif;
    if j==i+1;
      g(i,j)=h(i+1)./6;
    endif;
  endfor;
endfor;

for k=1:n-2;
  f(k,1)=((yj(k+2).-yj(k+1))./h(k+1)).-((yj(k+1).-yj(k))./h(k));
endfor

G=g\f;

  c .*=G(1)./6.*(((x.-xj(1)).^3)./h(1).-(h(1).*(x.-xj(1)))) .+ ((yj(1).*(xj(2).-x).+yj(2).*(x.-xj(1)))./h(1));
  c1 .*=(G(1)./6).*(((xj(3).-x1).^3)./h(2).-(h(2).*(xj(3).-x1))).+(G(2)./6).*(((x1.-xj(2)).^3)./h(2).-(h(2).*(x1.-xj(2)))).+((yj(2).*(xj(3)
  c2 .*=(G(2)./6).*(((xj(4).-x2).^3)./h(3).-(h(3).*(xj(4).-x2))).+(G(3)./6).*(((x2.-xj(3)).^3)./h(3).-(h(3).*(x2.-xj(3)))).+((yj(3).*(xj(4)
  c3 .*=(G(3)./6).*(((xj(5).-x3).^3)./h(4).-(h(4).*(xj(5).-x3))).+(G(4)./6).*(((x3.-xj(4)).^3)./h(4).-(h(4).*(x3.-xj(4)))).+((yj(4).*(xj(5)
  c4 .*=(G(4)./6).*(((xj(6).-x4).^3)./h(5).-(h(5).*(xj(6).-x4))).+(G(5)./6).*(((x4.-xj(5)).^3)./h(5).-(h(5).*(x4.-xj(5)))).+((yj(5).*(xj(6)
  c5 .*=(G(5)./6).*(((xj(7).-x5).^3)./h(6).-(h(6).*(xj(7).-x5))).+(G(6)./6).*(((x5.-xj(6)).^3)./h(6).-(h(6).*(x5.-xj(6)))).+((yj(6).*(xj(7)
  c6 .*=(G(6)./6).*(((xj(8).-x6).^3)./h(7).-(h(7).*(xj(8).-x6))).+(G(7)./6).*(((x6.-xj(7)).^3)./h(7).-(h(7).*(x6.-xj(7)))).+((yj(7).*(xj(8)
  c7 .*=(G(7)./6).*(((xj(9).-x7).^3)./h(8).-(h(8).*(xj(9).-x7))).+(G(8)./6).*(((x7.-xj(8)).^3)./h(8).-(h(8).*(x7.-xj(8)))).+((yj(8).*(xj(9)
  c8 .*=(G(8)./6).*(((xj(10).-x8).^3)./h(9).-(h(9).*(xj(10).-x8))).+(G(9)./6).*(((x8.-xj(9)).^3)./h(9).-(h(9).*(x8.-xj(9)))).+((yj(9).*(xj(
  c9 .*=(G(9)./6).*(((xj(11).-x9).^3)./h(10).-(h(10).*(xj(11).-x9))) .+ ((yj(10).*(xj(11).-x9).+yj(11).*(x9.-xj(10)))./h(10));


y=c;
y1=c1;
y2=c2;
y3=c3;
y4=c4;
y5=c5;
y6=c6;
y7=c7;
y8=c8;
y9=c9;

plot(x,y,x1,y1,x2,y2,x3,y3,x4,y4,x5,y5,x6,y6,x7,y7,x8,y8,x9,y9);
set(gca,'FontSize',20);
xlabel("X",'FontSize',20);
ylabel("g(x)",'FontSize',20);
title("g(x) with 11 datas in hw1CD",'FontSize',20);
grid on;
```


g(x) with 11 datas in hw1CD
1
0.8
0.6
0.4
0.2
0
g(x)
-1
-0.5
0
0.5
1
X