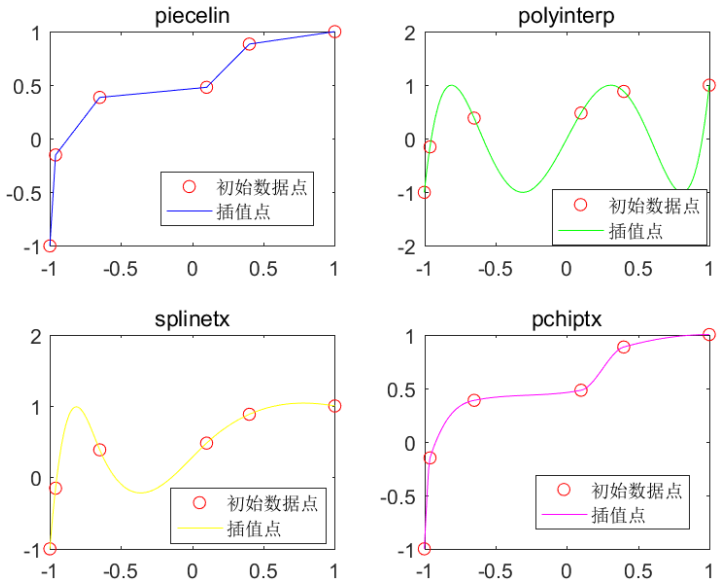
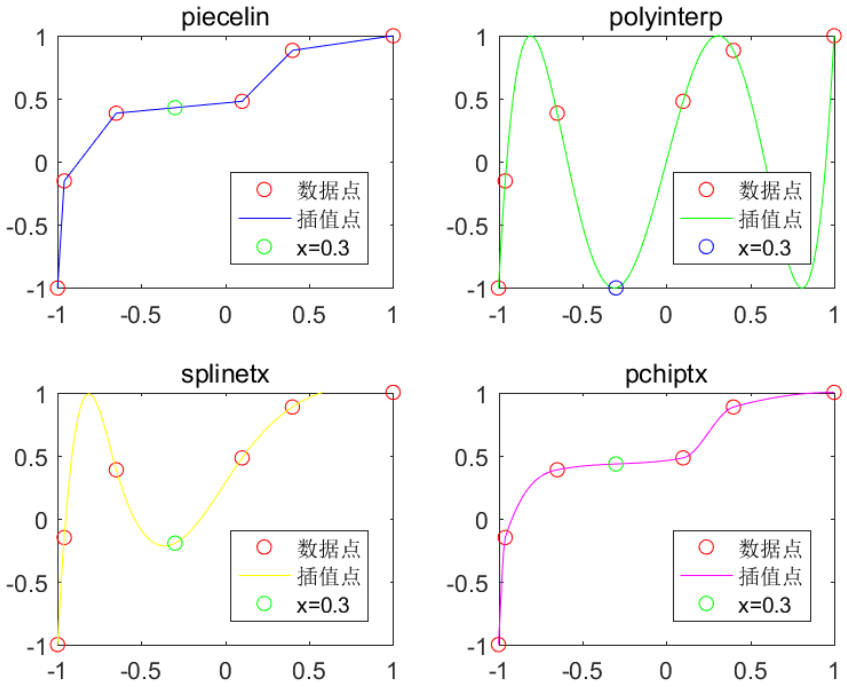
3.3

（a）拟合结果如图所示



(b)在 x = -0.3 处，四个插值函数的值为：

0.429960, -0.998997, -0.195695, 0.432182



（c）由于给出 6 个点，求解得：

系数矩阵的解为：

16.0018　　0.0007　　-20.0022　　-0.0007　　5.0004　　0.0000

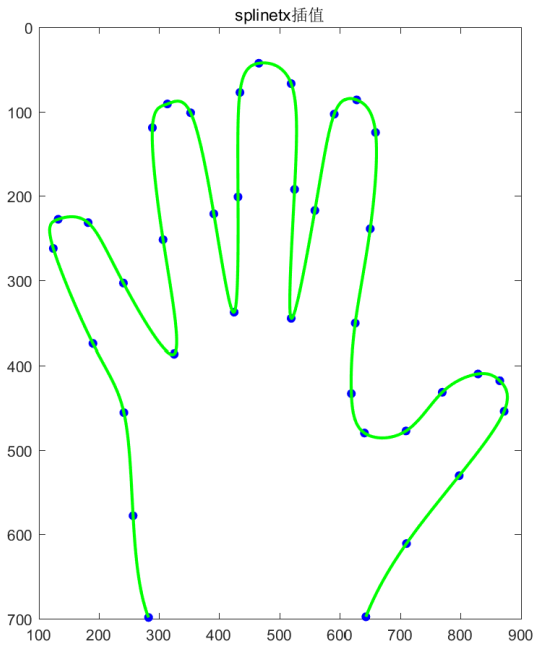
系数矩阵的解取整为：

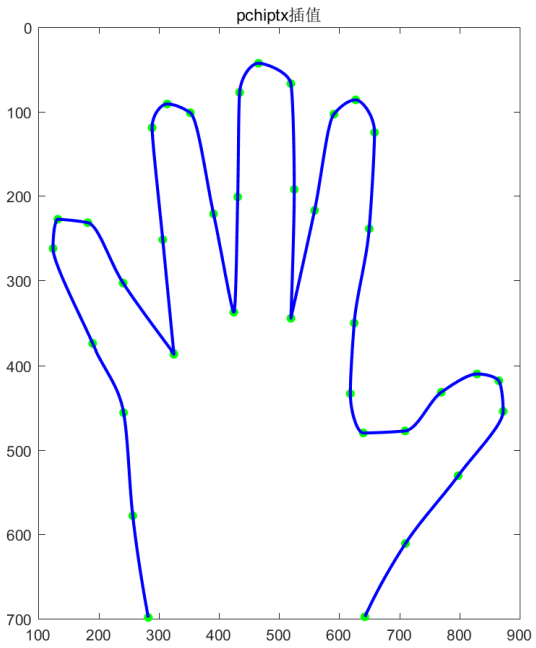
16　　0　　-20　　0　　5　　0

3.4

取点画图为：

左图为 splinetx，右图为 pchiptx





题目所给图片是使用 splinetx 画出的。

3.10

查阅有关资料，找到的一种分段二次插值的方法是以每三个节点为一个子区间。分段插值函数可以表示为：

$$\varphi_h(x)=\begin{cases} p^{(0)}, & x\epsilon[x_0,x_1,x_2] \\ p^{(1)}, & x\epsilon[x_1,x_2,x_3] \\ \vdots & \\ p^{(n-2)}, & x\epsilon[x_{n-2},x_{n-1},x_n] \end{cases}$$

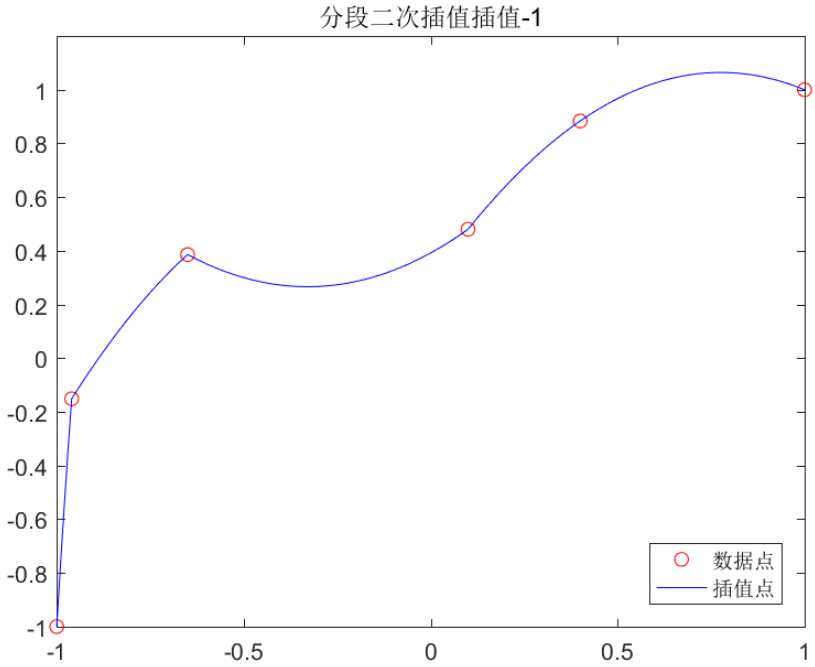
每一个插值函数表达式：

$$P_2^{(i)}(x)=f(x_i)\frac{(x-x_{i+1})(x-x_{i+2})}{(x_i-x_{i+1})(x_i-x_{i+2})}+f(x_{i+1})\frac{(x-x_i)(x-x_{i+2})}{(x_{i+1}-x_i)(x_{i+1}-x_{i+2})}+$$

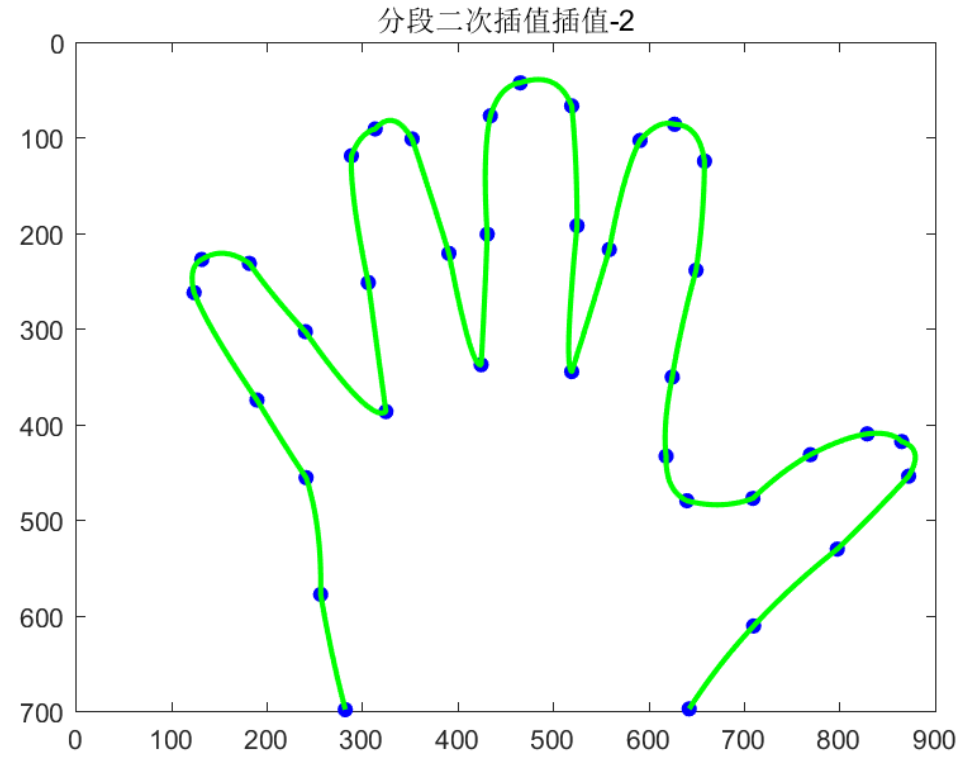
$$f(x_{i+2})\frac{(x-x_i)(x-x_{i+1})}{(x_{i+2}-x_i)(x_{i+2}-x_{i+1})}$$

根据这个表达式，可以编程计算。

将 3.3 的数据带入，其结果为：



将 3.4 的数据使用分段二次插值，其结果为：



代码附录:

%SOURCE CODE:3-3

```
clear,clc;
close all;
x = [-1.00 -0.96 -0.65 0.10 0.40 1.00];
y = [-1.0000 -0.1512 0.3860 0.4802 0.8838 1.0000];
xx = -1:0.01:1; %以0.01为步长取插值点
%使用四种方法进行插值
y1 = piecelin(x,y,xx);
y2 = polyinterp(x,y,xx);
y3 = splinetx(x,y,xx);
y4 = pchiptx(x,y,xx);
k = find(abs(xx+0.3)<0.001);
figure
%显示图像
subplot(2,2,1),plot(x,y,'ro',xx,y1,'b',xx(k),y1(k),'go');title('piece
lin');
axis([-1 1 -1 1])
legend('数据点','插值点','x=0.3','Location','southeast')
subplot(2,2,2),plot(x,y,'ro',xx,y2,'g',xx(k),y2(k),'bo');title('polyi
nterp');
axis([-1 1 -1 1])
legend('数据点','插值点','x=0.3','Location','southeast')
subplot(2,2,3),plot(x,y,'ro',xx,y3,'y',xx(k),y3(k),'go');title('splin
etx');
axis([-1 1 -1 1])
legend('数据点','插值点','x=0.3','Location','southeast')
subplot(2,2,4),plot(x,y,'ro',xx,y4,'m',xx(k),y4(k),'go');title('pchip
tx');
axis([-1 1 -1 1])
legend('数据点','插值点','x=0.3','Location','southeast')
%saveas(gcf,'3-3-1.png')
fprintf('在x=0.3处的插值结果分别是：\n')
fprintf('%f, %f, %f, %f \n',y1(k),y2(k),y3(k),y4(k))

%计算系数
V = vander(x);
c = V\y';
fprintf('系数矩阵的解为：\n')
disp(c')
```

```
fprintf('系数矩阵的解取整为：\n')
disp(round(c)')
```

%SOURCE CODE:3-4

```
clear;
close all
figure('position',get(0,'screensize'))
axes('position',[0 0 1 1])
%读入图片进行取点
hand = imread('hand.png');
imshow(hand);
%[x,y] = ginput;
%导入之前保存的手取点的矩阵
load('hand_point.mat')
n = length(x);
s = (1:n)';
t = (1:.05:n)';
u1 = splinetx(s,x,t);
v1 = splinetx(s,y,t);
u2 = pchiptx(s,x,t);
v2 = pchiptx(s,y,t);
clf reset
subplot(1,2,1),
axis([0 900 0 700]),
plot(x,y,'.',u1,v1,'g-','LineWidth',2,...
                    'MarkerEdgeColor','b',...
                   'MarkerFaceColor','b',...
                   'MarkerSize',20);
title('splinetx插值')
set(gca,'YDir','reverse') %将坐标轴翻转一下
subplot(1,2,2),
axis([0 900 0 700]),
plot(x,y,'.',u2,v2,'b-','LineWidth',2,...
                    'MarkerEdgeColor','g',...
                   'MarkerFaceColor','g',...
                   'MarkerSize',20);
title('pchiptx插值');
set(gca,'YDir','reverse');
saveas(gcf,'newHand.png')
```

%SOURCE CODE:3-10

```
clear,clc;
close all;
x = [-1.00 -0.96 -0.65 0.10 0.40 1.00];
y = [-1.0000 -0.1512 0.3860 0.4802 0.8838 1.0000];
xx = -1:0.01:1; %以0.01为步长取插值点
sq = sqinterp(x,y,xx);
plot(x,y,'ro',xx,sq,'b')
axis([-1 1 -1 1.2])
title('分段二次插值插值-1')
legend('数据点','插值点','Location','southeast')
saveas(gcf,'分段二次插值插值-1.png')

clear;
%使用3-4
load('hand_point.mat')
n = length(x);
s = 1:n;
t = 1:.05:n;
xx = sqinterp(s,x,t);
yy = sqinterp(s,y,t);
figure
axis equal
%axis([0 900 0 900]);
plot(x,y,'.',xx,yy,'g-','LineWidth',2,...
                    'MarkerEdgeColor','b',...
                   'MarkerFaceColor','b',...
                   'MarkerSize',20);
title('分段二次插值插值-2')
set(gca,'YDir','reverse') %将坐标轴翻转一下
saveas(gcf,'分段二次插值插值-2.png')
```