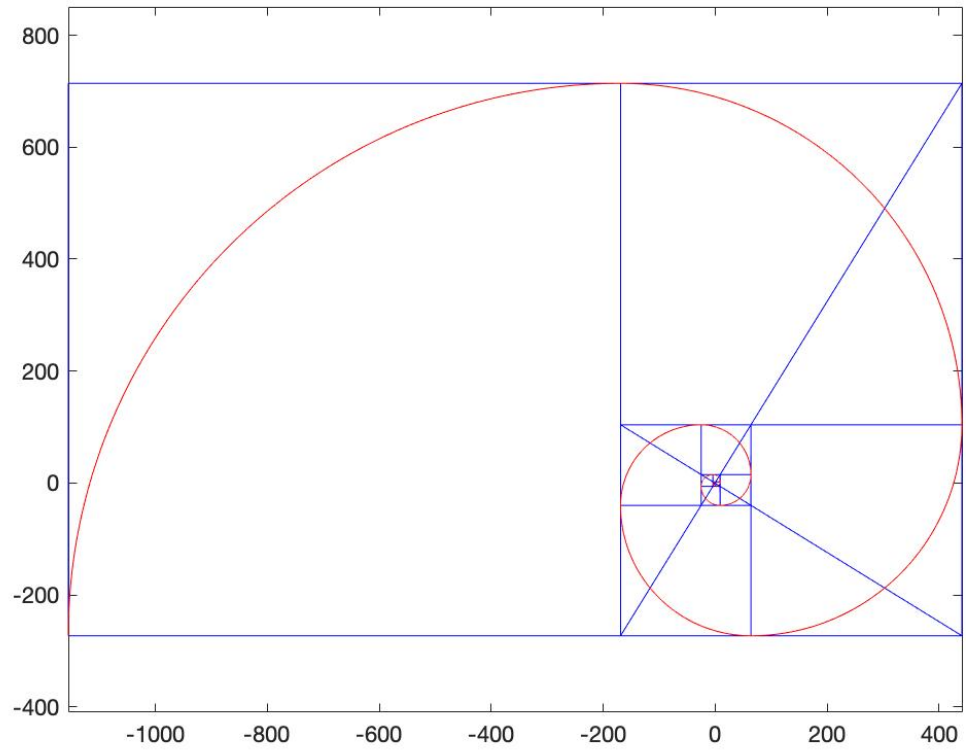


Problem1

MatLab code is in Matlab file as CADmidP1.m.



Problem 3

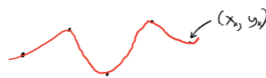
All Matlab code of this problem are in CADmidP3

1.

Answer :Lagrange fitting formed by n orders equation of x, and calculating the n+1 unknowns with n+1 constraints.

Spline fitting adopt 3rd order and thus will be more gentle than Lagrange fitting.

Lagrange polynomials :



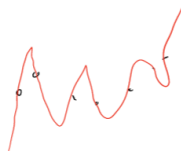
$$y(x) = \sum_{k=0}^N l_k(x) y_k$$

$$l_k(x) = \begin{cases} 1 & \text{if } x = x_k \\ 0 & \text{if } x \neq x_k \end{cases}$$

$$l_k(x) = \prod_{\substack{0 \leq m \leq N \\ m \neq k}} \frac{(x - x_m)}{(x_k - x_m)}$$

$$= \frac{(x - x_0)(x - x_1) \dots (x - x_{k-1})(x - x_{k+1}) \dots (x - x_N)}{(x_k - x_0)(x_k - x_1) \dots (x_k - x_{k-1})(x_k - x_{k+1}) \dots (x_k - x_N)}$$

↳ kth term is not in product



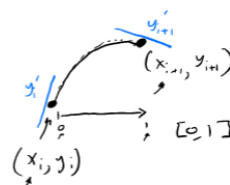
Spline fitting

Why 3rd order?

$$y = ax^3 + bx^2 + cx + d$$

4 b.c.'s to solve 3rd order polynomial coeffs

$$y_1, y_2, y'_1, y'_2$$



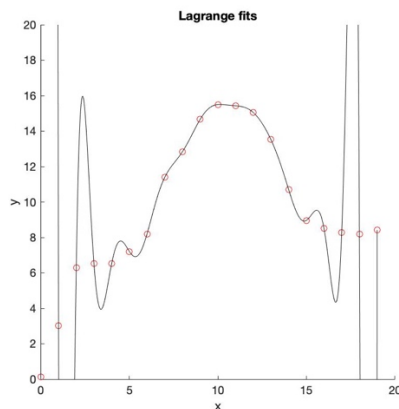
$$y_1 = f(0)$$

$$y_2 = f(1)$$

$$y'_1 = f'(0)$$

$$y'_2 = f'(1)$$

2. All Matlab code of this problem are in CADmidP3&&2



3. All Matlab code of this problem are in CADmidP3&&3

Overshot = 2.543947688454147e+07

Code:

```
yline = [];
```

```
for realx = 0:0.01:19
```

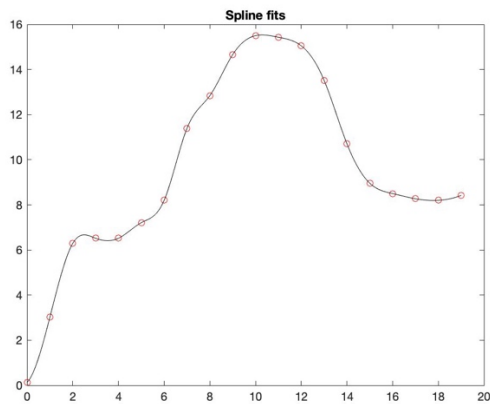
```
    newy = (y(ceil(realx)+1)-y(floor(realx)+1))*(realx-
```

```

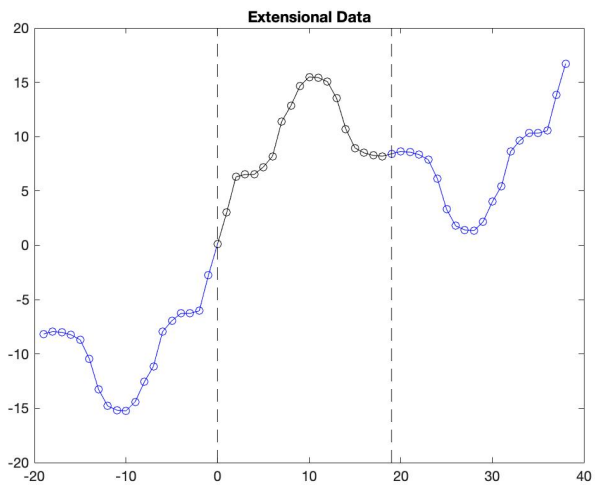
floor(realx))/1+y(floor(realx)+1);
    yline = [yline, newy];
end
%overshot for langrange
overshot_ysquare = (yline-lagrange_y).^2;
overshot_sum =sum(overshot_ysquare);

```

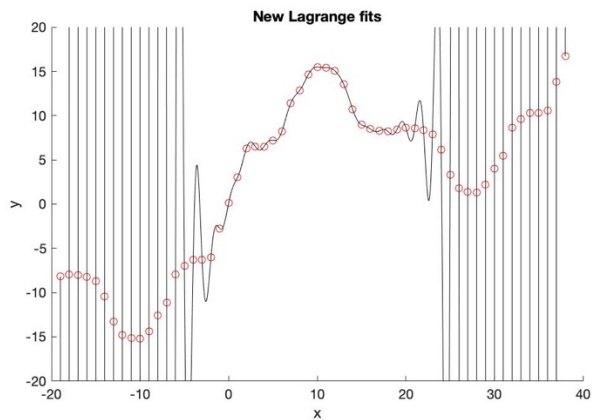
4. All Matlab code of this problem are in CADmidP3&&4
Overshot_spline = 27.442942466182550



5. All Matlab code of this problem are in CADmidP3&&5

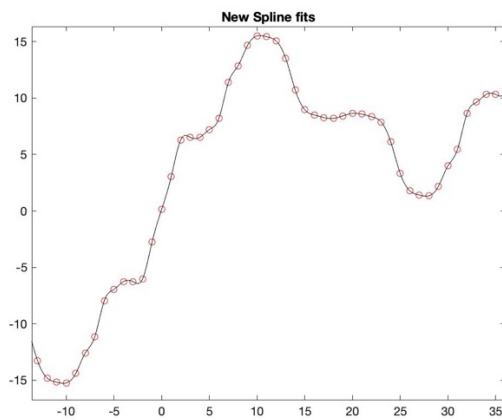


6. All Matlab code of this problem are in CADmidP3&&6
A: New Lagrange fits
New overshoot of Lagrange = 77.733178764393070



B:New spline fits

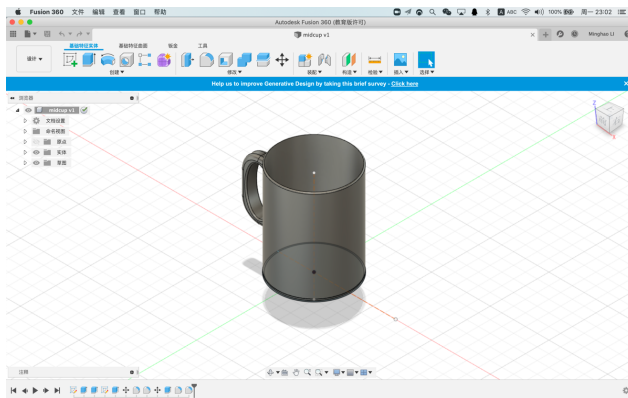
New overshoot of spline = 19.633775314668526



Answer: This overshoot is the deviation between fitting line and original line. And we can compare the outcomes in Problem3-3 Problem3-4 with the outcome in Problem 3-6A and Problem 3-6B. Both the overshoot of spline fit and Lagrange fit are decreased remarkably, which means the deviation between the fitting lines and original lines are smaller. Thus the reflection improve the quality of either fit.

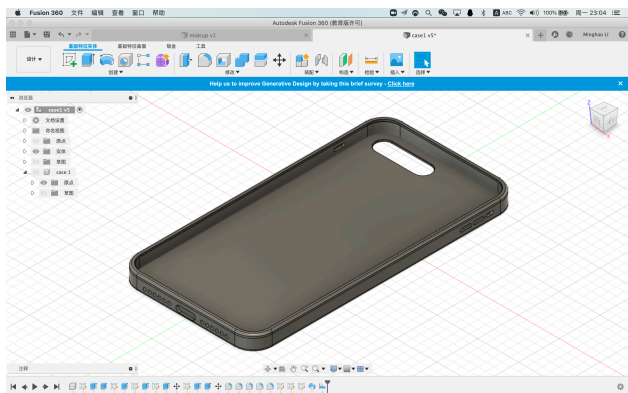
A: cup

<https://a360.co/3aZvSql>



B: phone case

<https://a360.co/3b2c7VW>



C: pingpong blade

<https://a360.co/3dtlwrvh>

