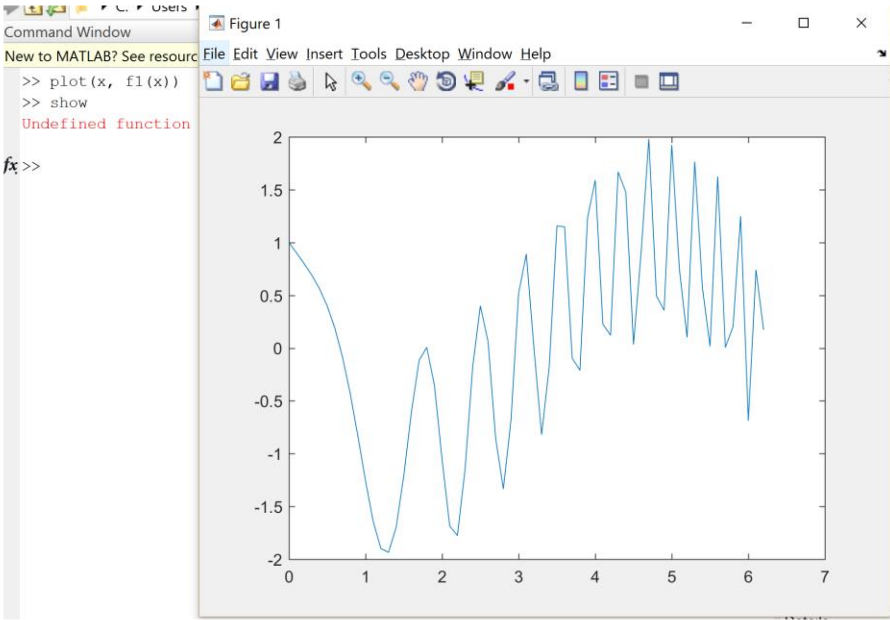
Sufficient Output

Q1

b1:

```
>> f1 = @(x) cos(2.*x.^2) - sin(x)

f1 =

    @(x)cos(2.*x.^2)-sin(x)
```



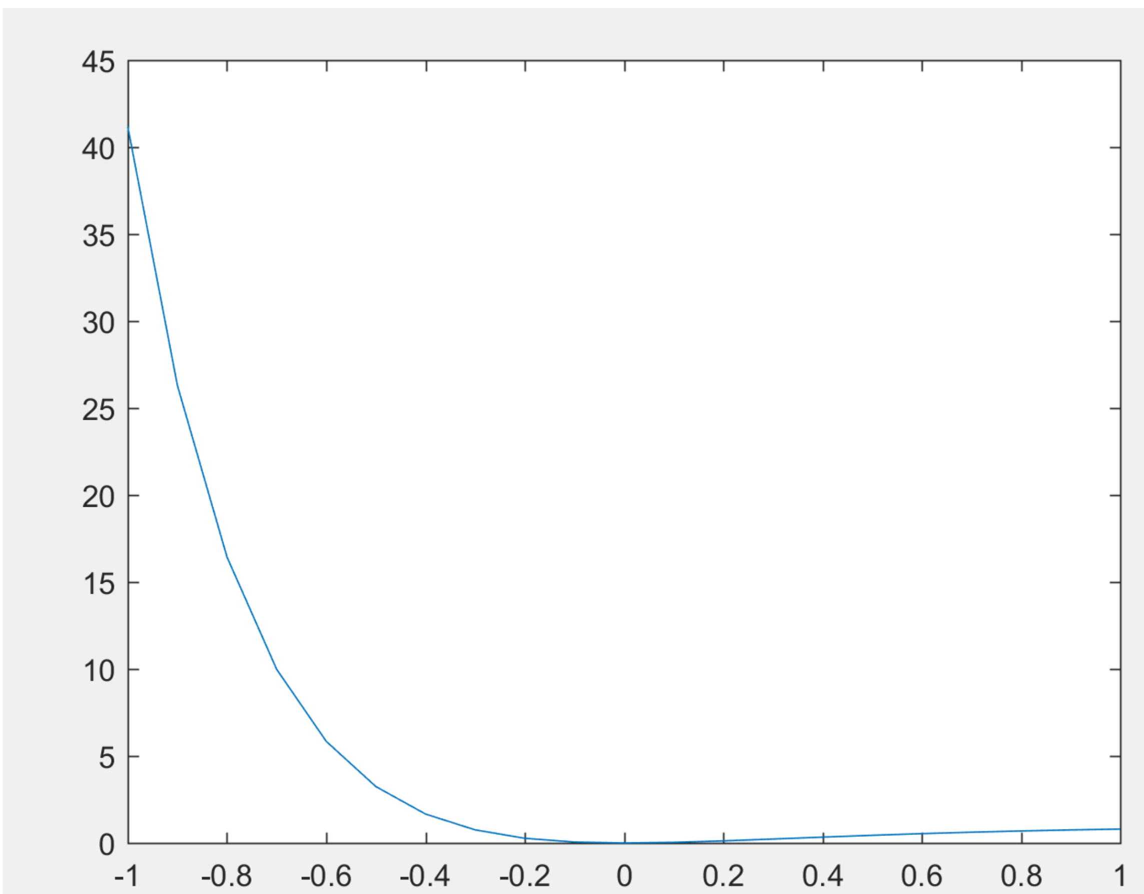

```
>> [b, iteration] = fzerotx(f1, [0,2*pi])

b =

    0.6708


iteration =

    10

>> [b, iteration] = fzerotx(f1, [1,5])

b =

    2.4204


iteration =

    11
```

Q1 b2

```
>> [b, iteration] = fzerotx(f2, [0,5])

b =

     3.141592653589792e+00


iteration =

    64
```

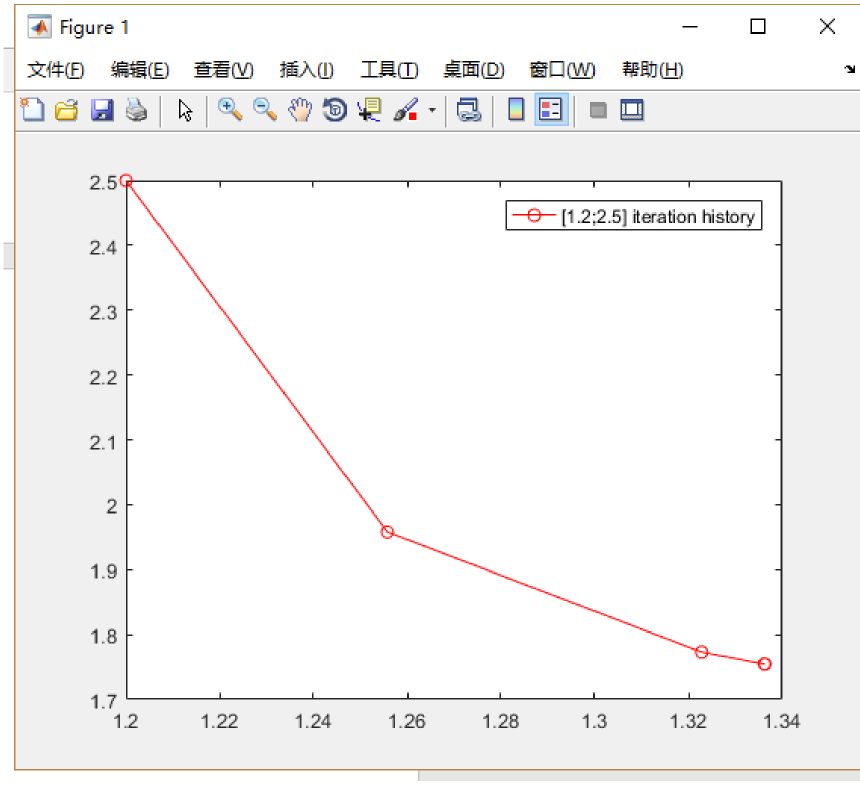
Q1b3

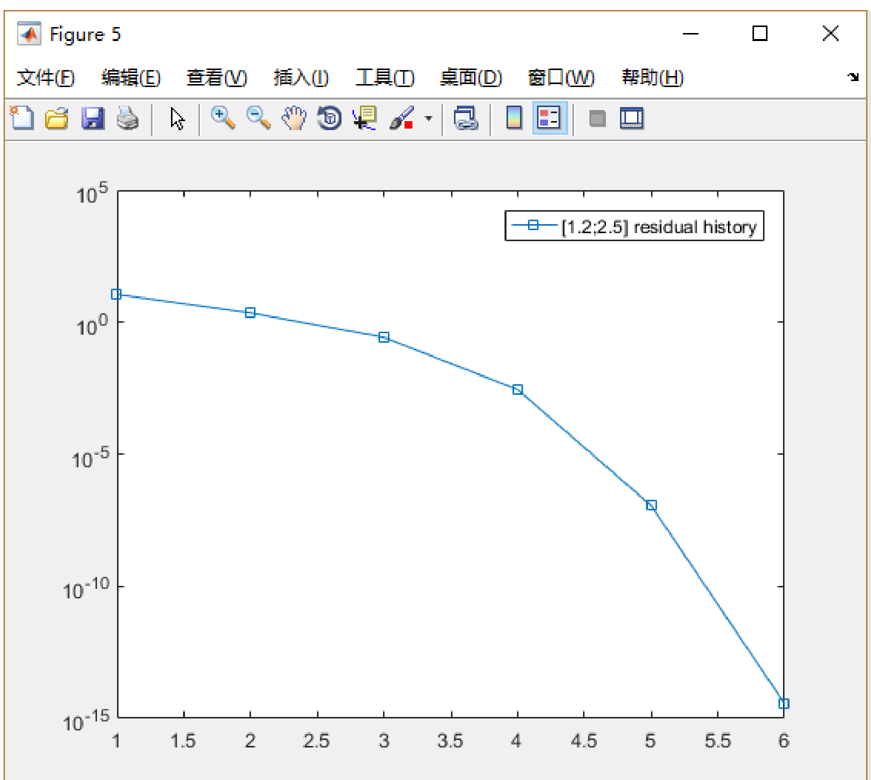
```
>> [b, iteration] = fzerotx(f3, [-1,1])
Error using fzerotx (line 29)
Function must change sign on the interval
```



Q3c Sufficient Output (convergence history is referred as residual history)

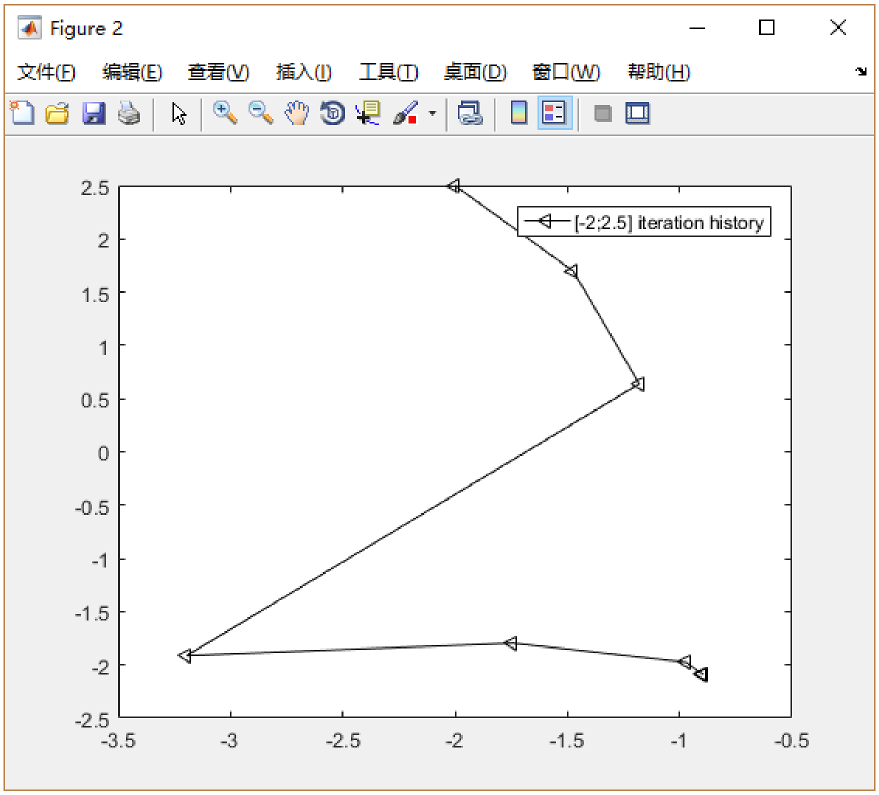
Initial guess x1 = [1.2, 2.5]

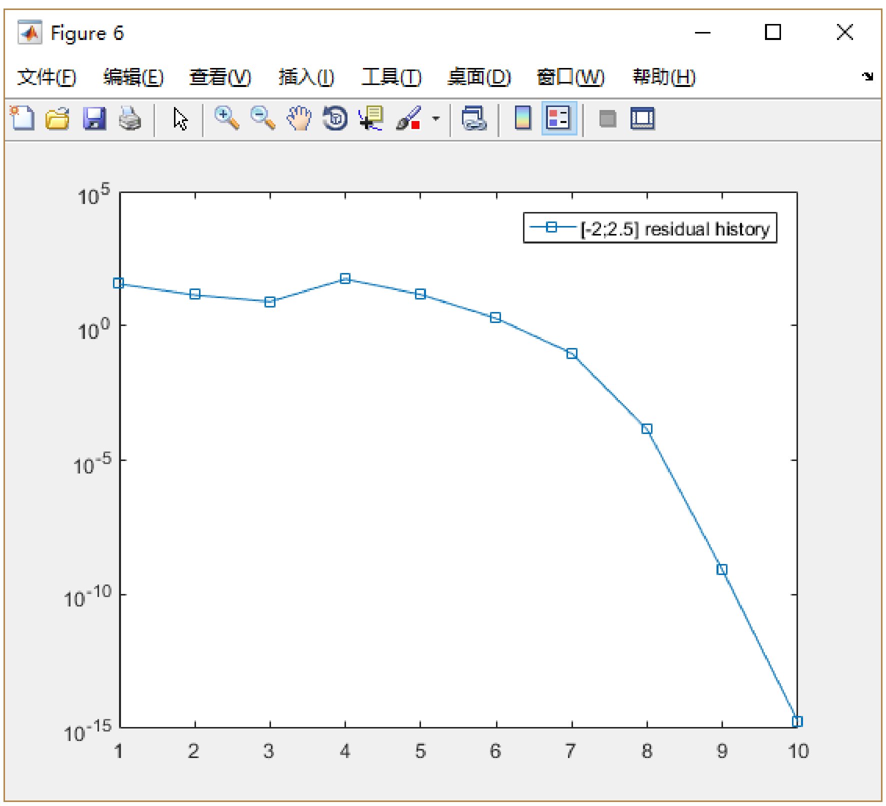




Graph Index: Q3c1

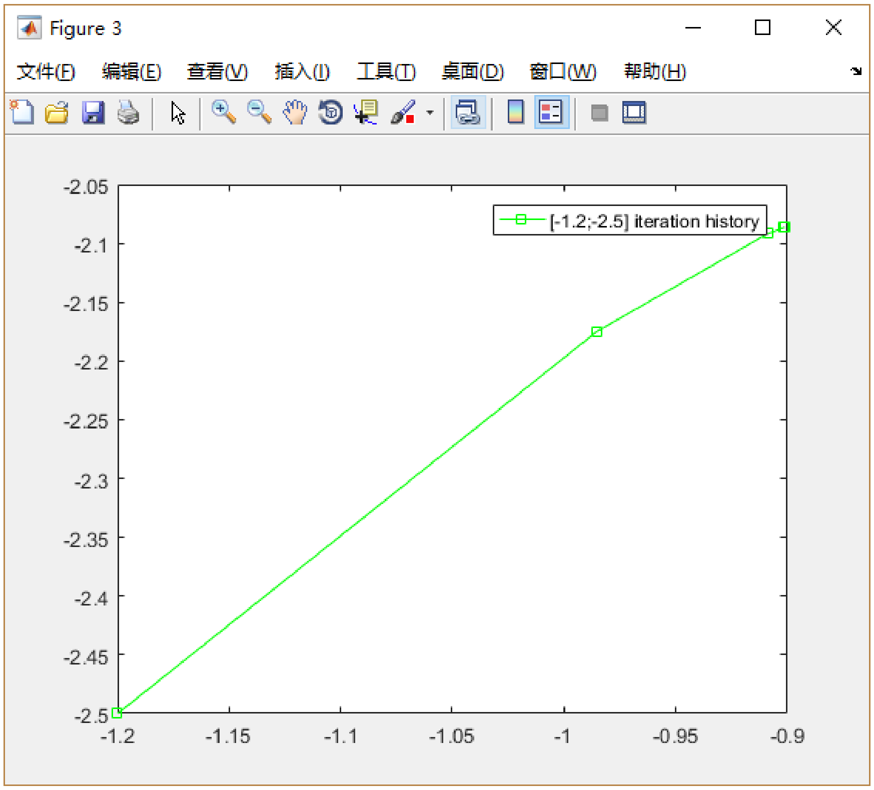
Initial guess x2 = [-2, 2.5]

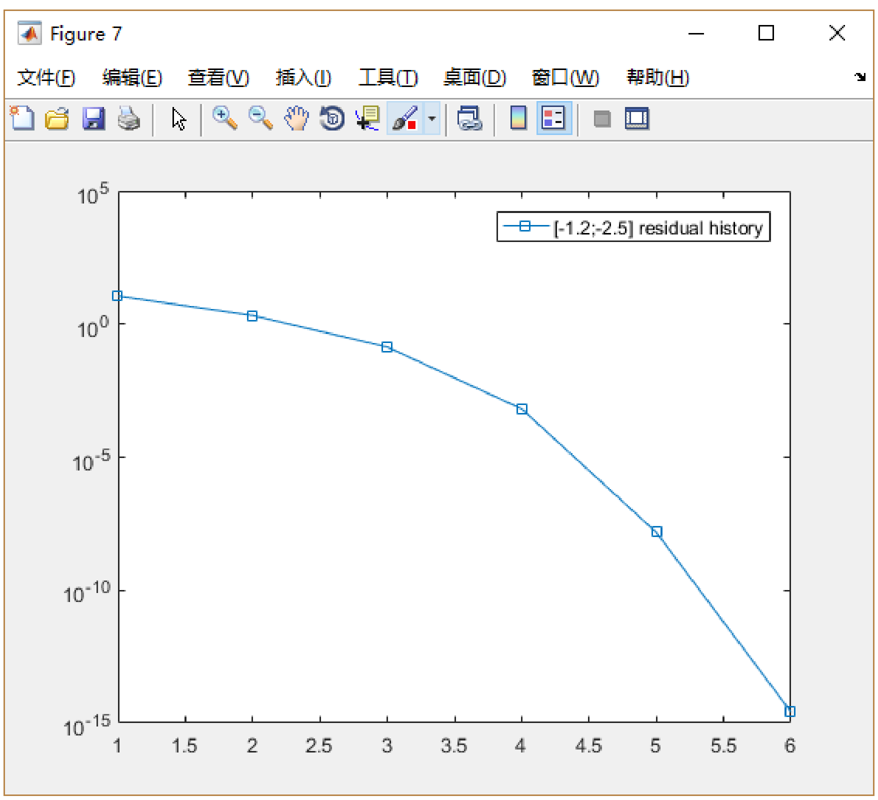




Graph Index: Q3c2

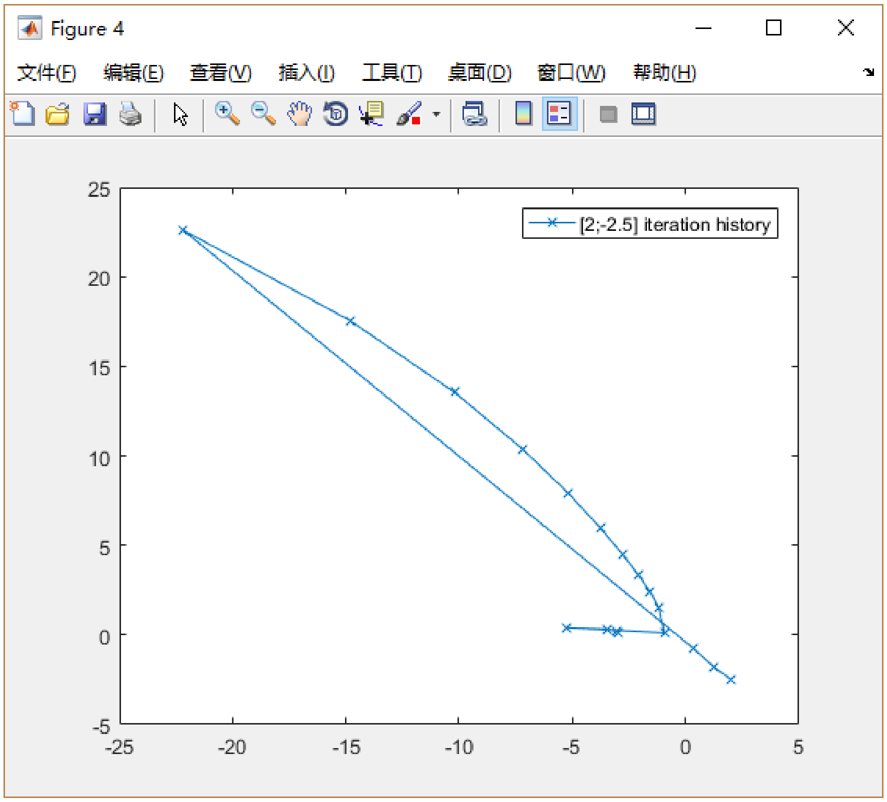
Initial guess x3 = [-1.2, -2.5]

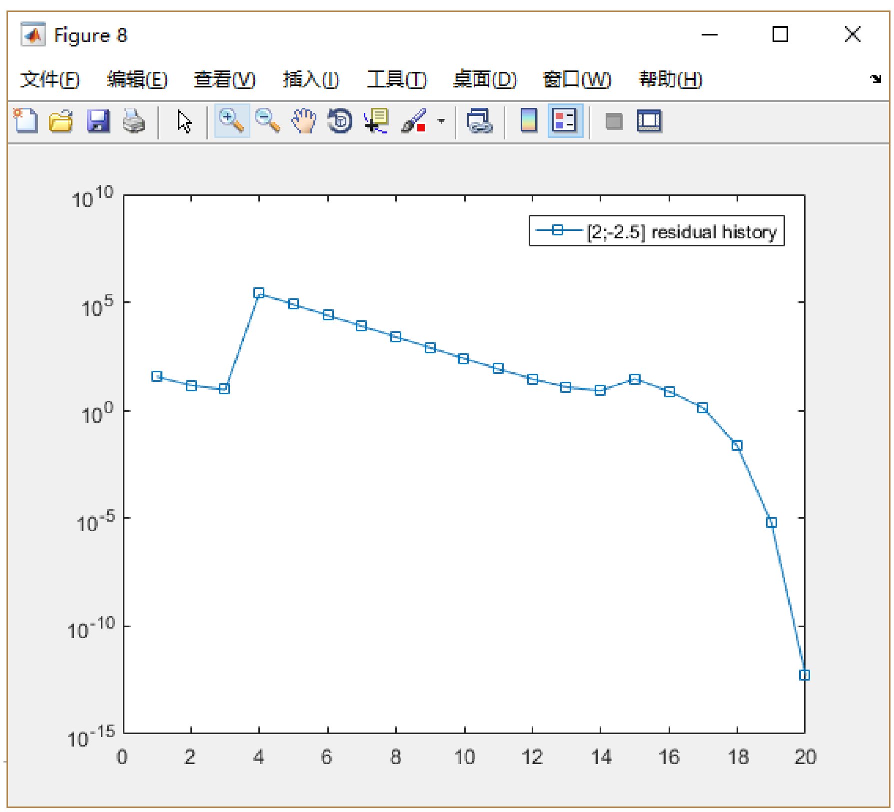




Graph Index: Q3c3

Initial guess x4 = [2, -2.5]

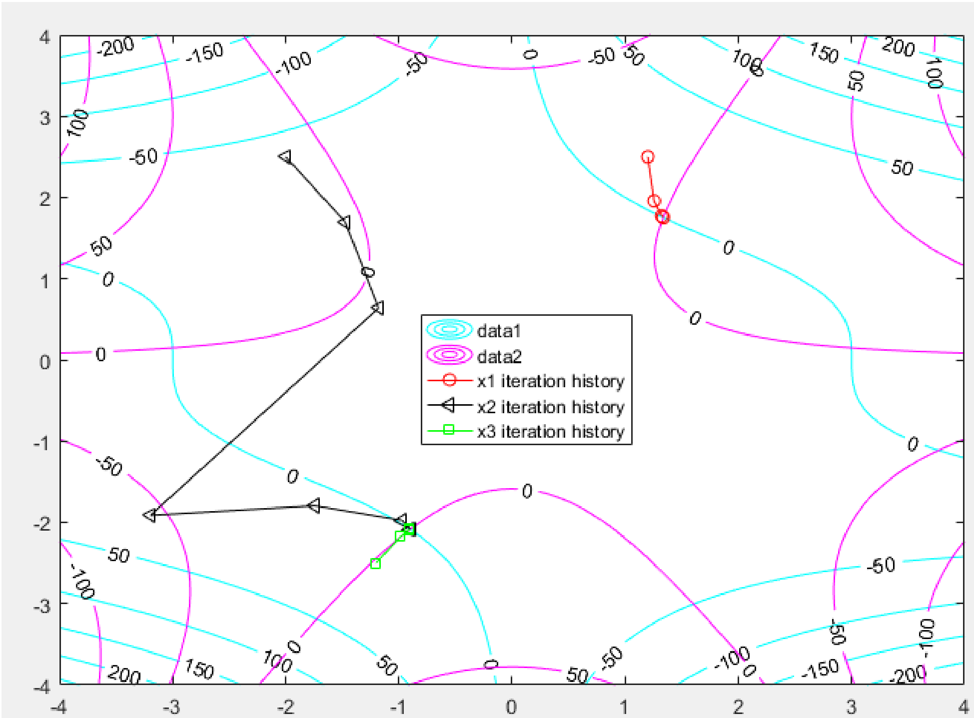




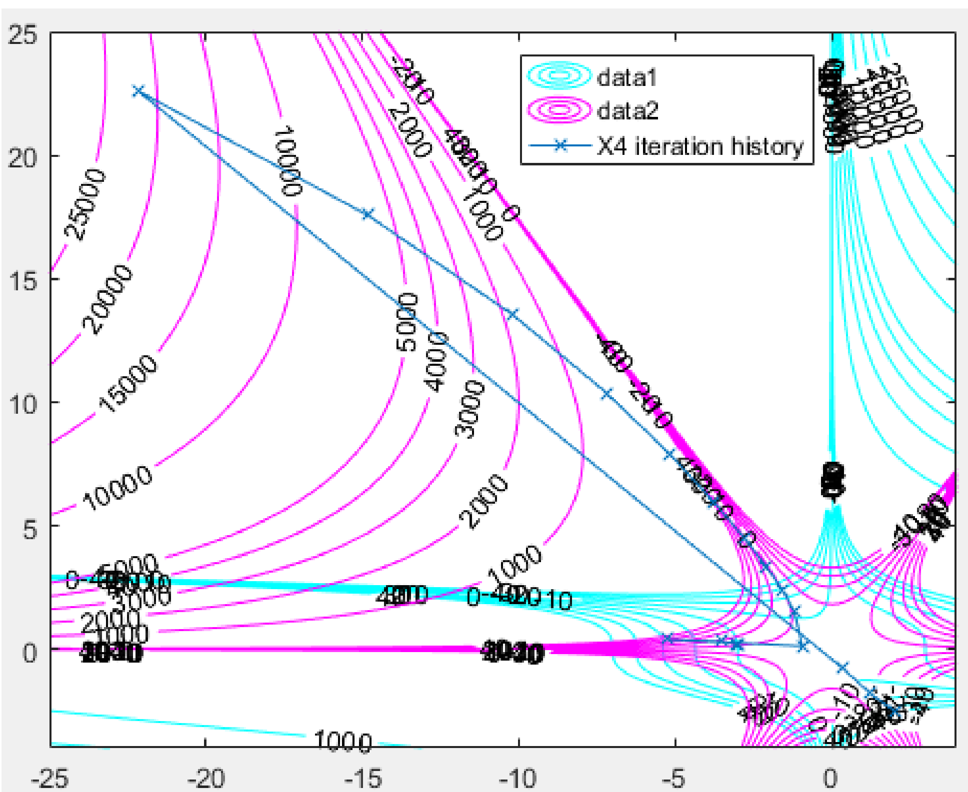
Graph Index: Q3c4

The plot of iteration history on the contour graph of the system of equation

For initial guess x1 = [1.2, 2.5], x2 = [-2, 2.5], x3 = [-1.2,-2.5]

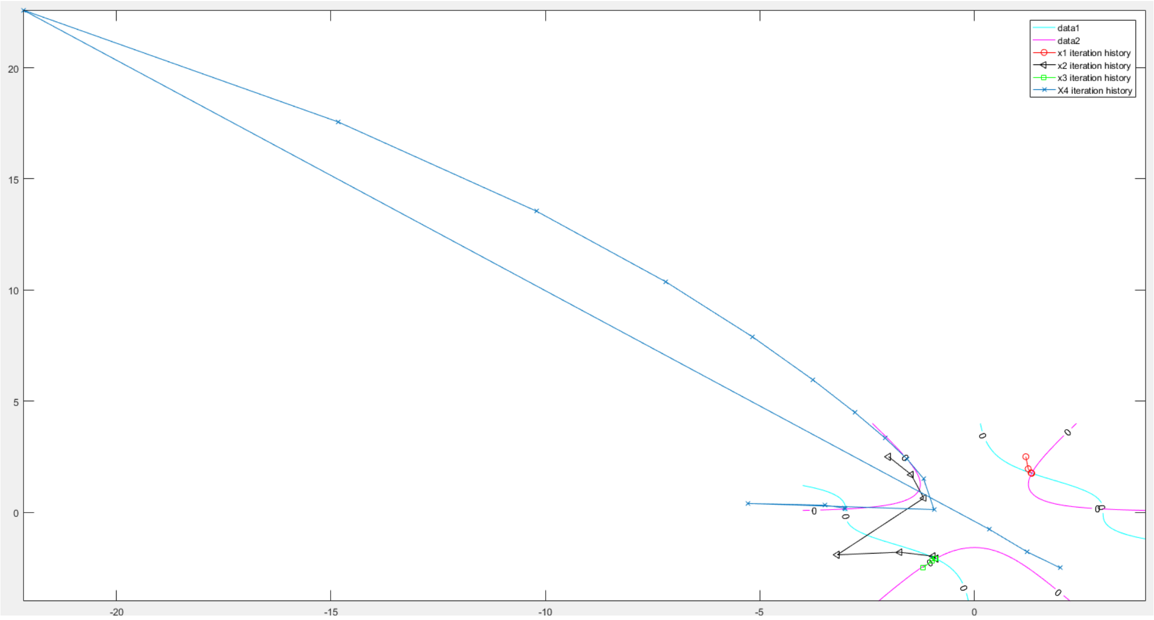


For initial guess x4 = [2, -2.5]



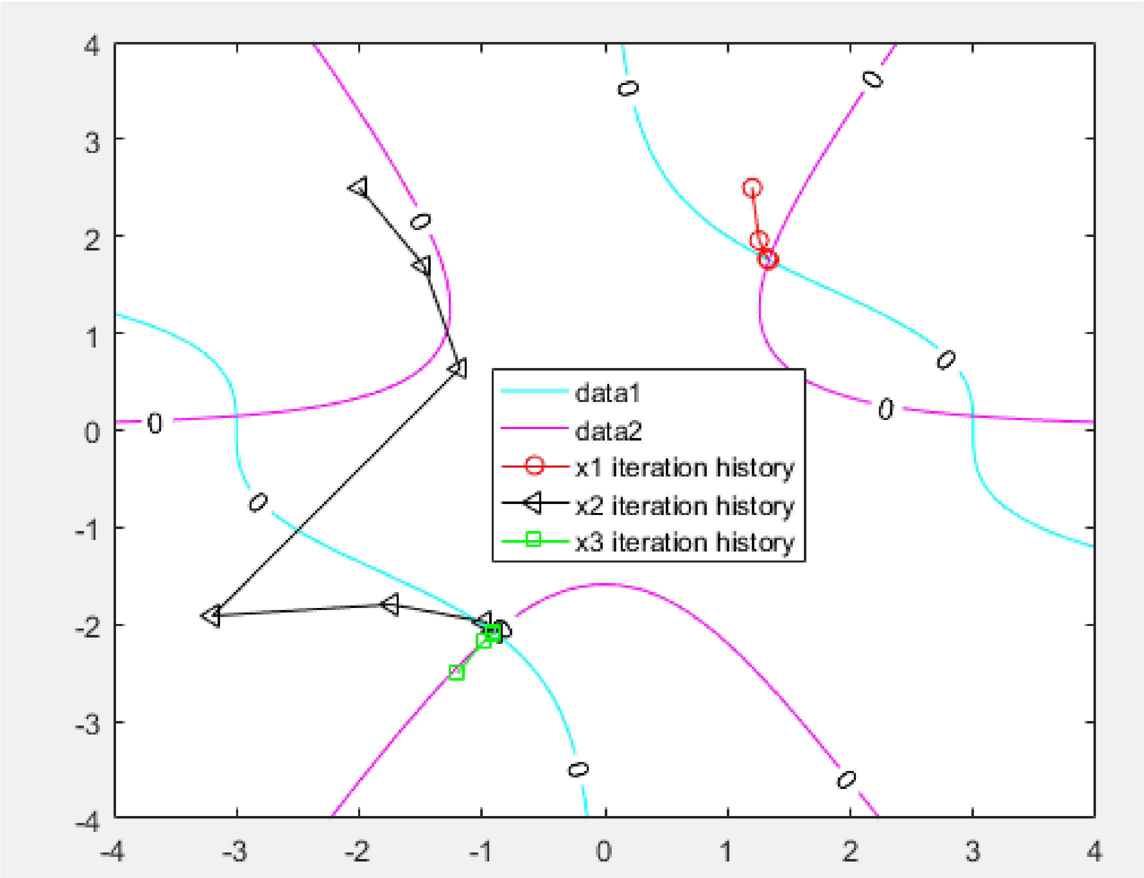
Graph Index: Q3c5

Contour of equations system at level 0 with 4 initial guesses



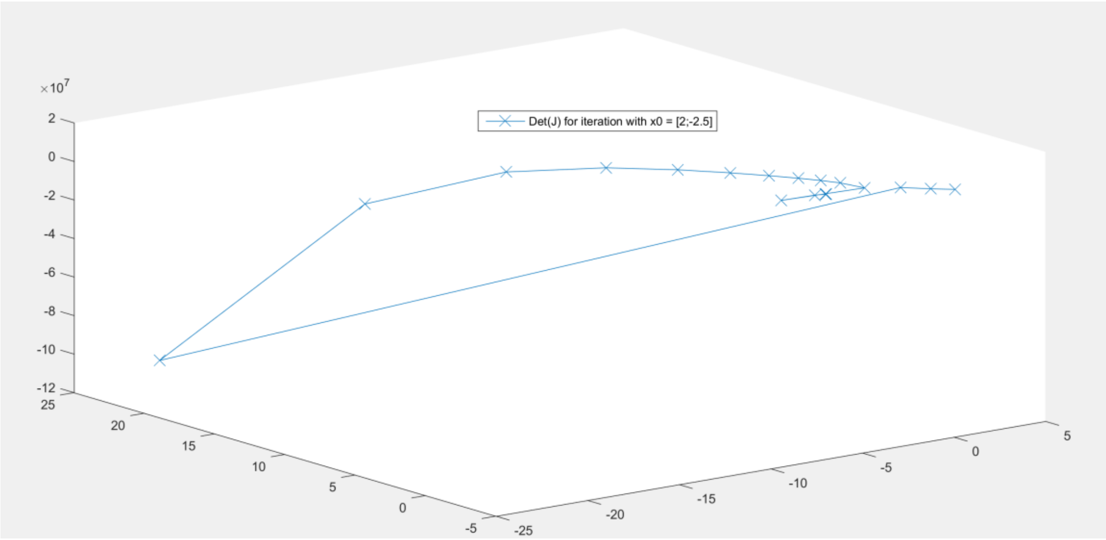
A Close up of x1, x2, x3 initial guess

Graph Index: Q3c6



The iteration history and det(J(xn)) for intial guess (2, -2.5)

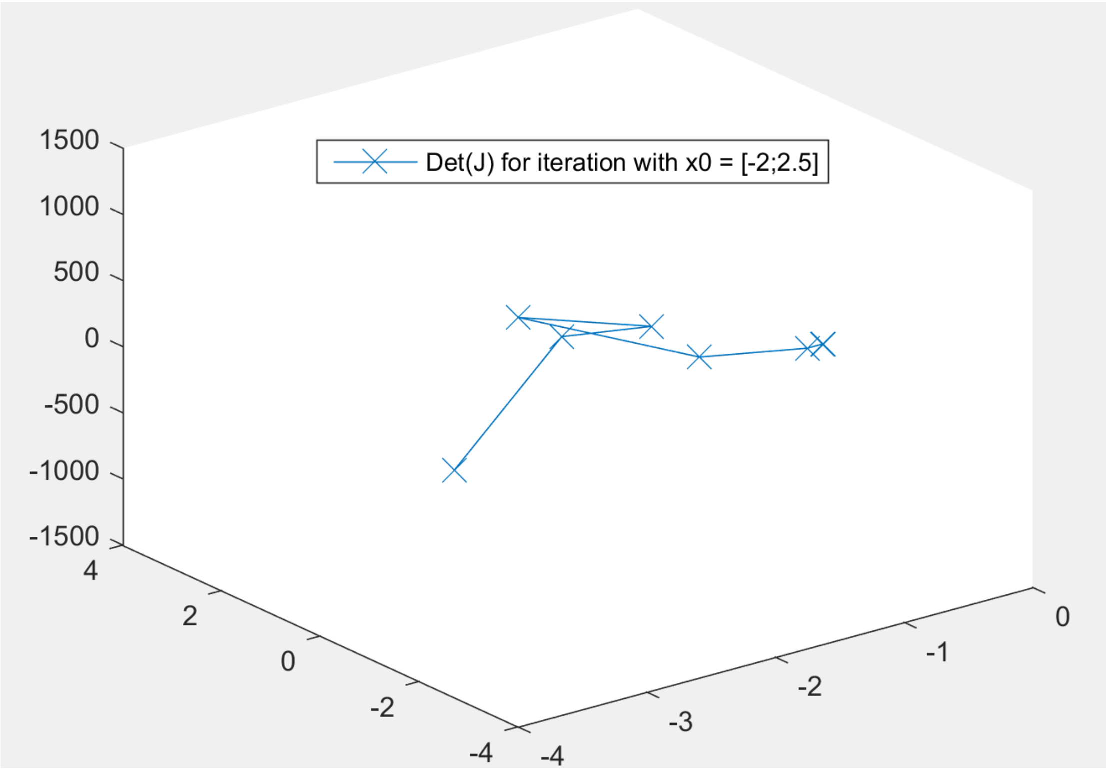
```
xn is [  2.0000  -2.5000], det(J(xn)) is 1.203469e+03, xn+1 = [  1.2241  -1.7739]
xn is [  1.2241  -1.7739], det(J(xn)) is 1.660400e+02, xn+1 = [  0.3524  -0.7698]
xn is [  0.3524  -0.7698], det(J(xn)) is 6.701244e-01, xn+1 = [-22.1753  22.5993]
xn is [-22.1753  22.5993], det(J(xn)) is -1.028194e+08, xn+1 = [-14.8322  17.5654]
xn is [-14.8322  17.5654], det(J(xn)) is -2.289309e+07, xn+1 = [-10.2022  13.5433]
xn is [-10.2022  13.5433], det(J(xn)) is -5.240514e+06, xn+1 = [ -7.1906  10.3675]
xn is [ -7.1906  10.3675], det(J(xn)) is -1.221183e+06, xn+1 = [ -5.1685   7.8894]
xn is [ -5.1685   7.8894], det(J(xn)) is -2.873558e+05, xn+1 = [ -3.7728   5.9731]
xn is [ -3.7728   5.9731], det(J(xn)) is -6.782677e+04, xn+1 = [ -2.7892   4.4958]
xn is [ -2.7892   4.4958], det(J(xn)) is -1.590548e+04, xn+1 = [ -2.0851   3.3450]
xn is [ -2.0851   3.3450], det(J(xn)) is -3.611661e+03, xn+1 = [ -1.5725   2.4071]
xn is [ -1.5725   2.4071], det(J(xn)) is -7.284361e+02, xn+1 = [ -1.1866   1.5185]
xn is [ -1.1866   1.5185], det(J(xn)) is -9.177236e+01, xn+1 = [ -0.9391   0.1214]
xn is [ -0.9391   0.1214], det(J(xn)) is -4.910221e+00, xn+1 = [ -5.2724   0.3971]
xn is [ -5.2724   0.3971], det(J(xn)) is -9.005351e+02, xn+1 = [ -3.4914   0.3166]
xn is [ -3.4914   0.3166], det(J(xn)) is -2.590642e+02, xn+1 = [ -3.0298   0.1929]
xn is [ -3.0298   0.1929], det(J(xn)) is -1.671823e+02, xn+1 = [ -3.0012   0.1490]
xn is [ -3.0012   0.1490], det(J(xn)) is -1.622495e+02, xn+1 = [ -3.0016   0.1481]
xn is [ -3.0016   0.1481], det(J(xn)) is -1.623076e+02, xn+1 = [ -3.0016   0.1481]
xn is [ -3.0016   0.1481], det(J(xn)) is -1.623076e+02, xn+1 = [ -3.0016   0.1481]
```



Graph Index: Q3c7

The iteration history and det(J(xn)) for initial guess at (-2, 2.5)

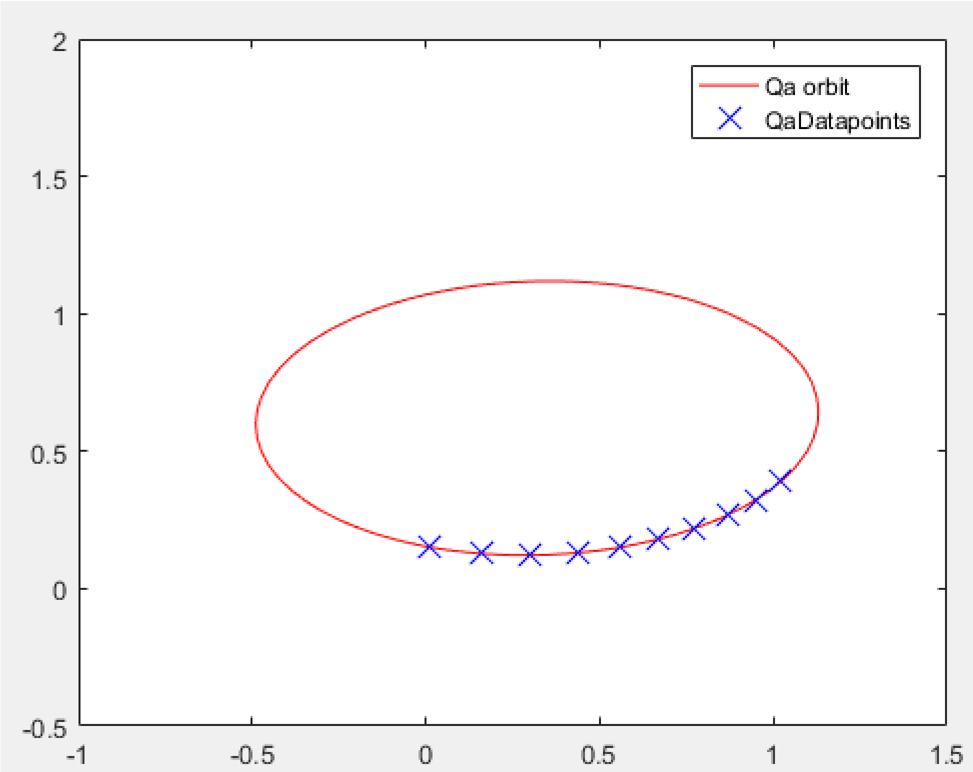
```
xn is [ -2.0000   2.5000], det(J(xn)) is -1.203469e+03, xn+1 = [ -1.4734   1.6966]
xn is [ -1.4734   1.6966], det(J(xn)) is -1.949354e+02, xn+1 = [ -1.1793   0.6391]
xn is [ -1.1793   0.6391], det(J(xn)) is -1.271647e+01, xn+1 = [ -3.1954  -1.9132]
xn is [ -3.1954  -1.9132], det(J(xn)) is 1.023911e+03, xn+1 = [ -1.7426  -1.7955]
xn is [ -1.7426  -1.7955], det(J(xn)) is 3.216148e+02, xn+1 = [ -0.9719  -1.9749]
xn is [ -0.9719  -1.9749], det(J(xn)) is 2.165019e+02, xn+1 = [ -0.8957  -2.0896]
xn is [ -0.8957  -2.0896], det(J(xn)) is 2.484668e+02, xn+1 = [ -0.9013  -2.0866]
xn is [ -0.9013  -2.0866], det(J(xn)) is 2.484964e+02, xn+1 = [ -0.9013  -2.0866]
xn is [ -0.9013  -2.0866], det(J(xn)) is 2.485011e+02, xn+1 = [ -0.9013  -2.0866]
xn is [ -0.9013  -2.0866], det(J(xn)) is 2.485011e+02, xn+1 = [ -0.9013  -2.0866]
```



Graph Index: Q3c8

Q4

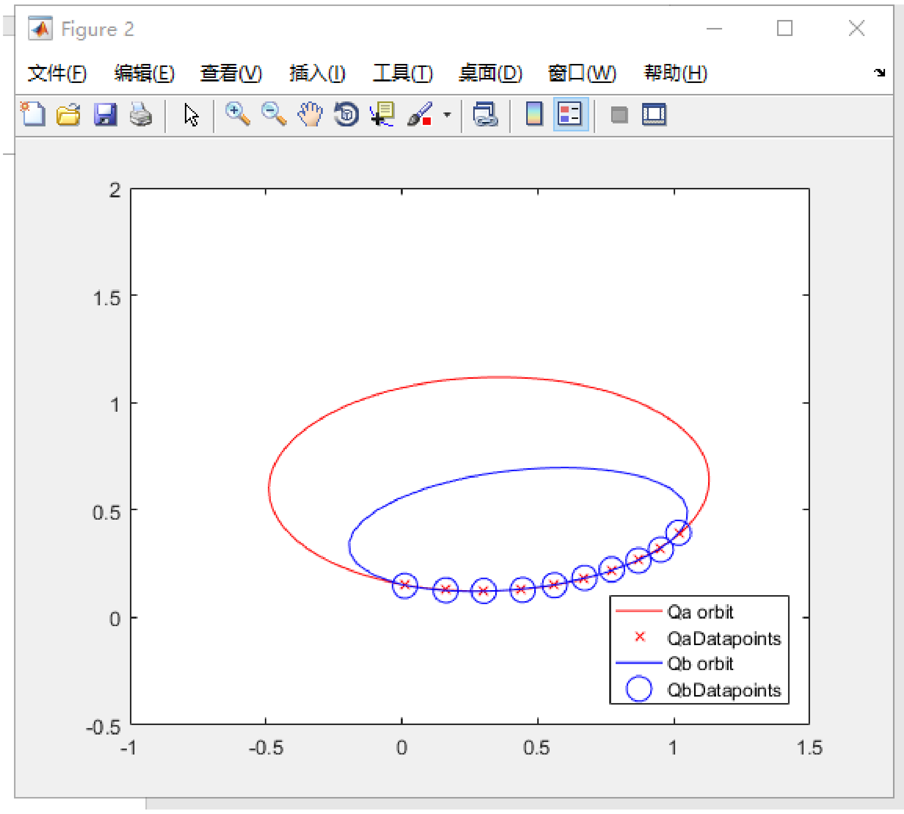
A



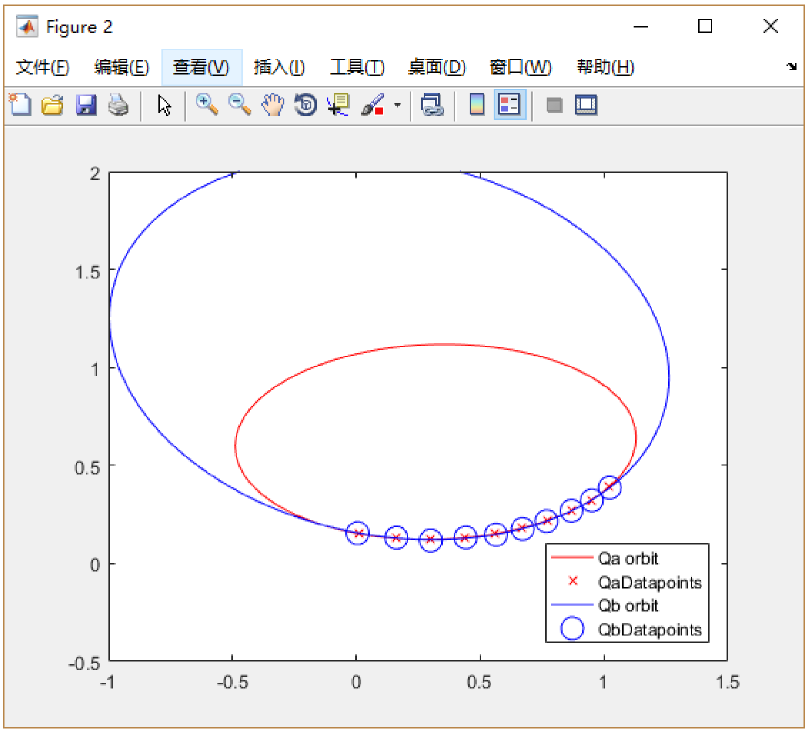

```
Sa =

    3.7860         0         0         0         0
         0    0.9449         0         0         0
         0         0    0.2089         0         0
         0         0         0    0.0230         0
         0         0         0         0    0.0055
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0


ans =

   -2.6356    0.1436    0.5514    3.2229   -0.4329
```

Note: Because we will using $x^2 = by^2 + cxy + dx + ey + f$ to find the constant, so the row in ans is correspond to the value of [b c d e f], with a = -1. Whereas Matrix A = in the form $[y^2 x * y\ x\ y\ 1]$

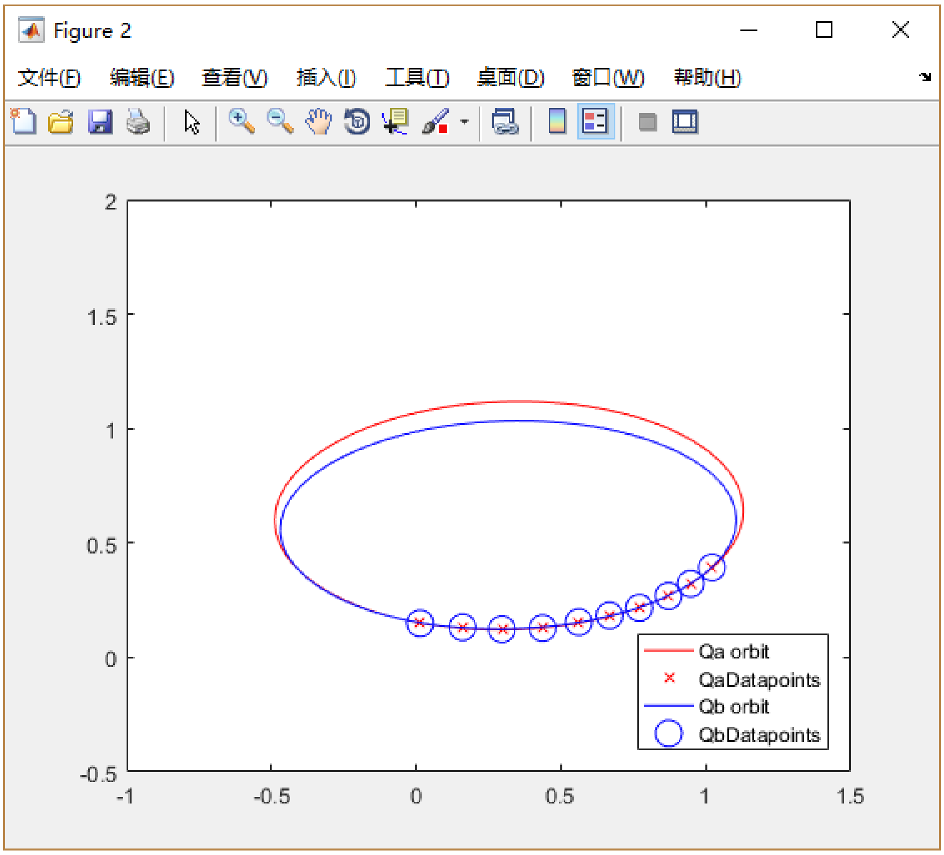
B Qa means the original data and orbit. Singular values of Matrix A and constant for equation is recorded above. The original orbit and its data points is in red color.
Here we only show the perturbed data's orbit, constant and their singular value for A.



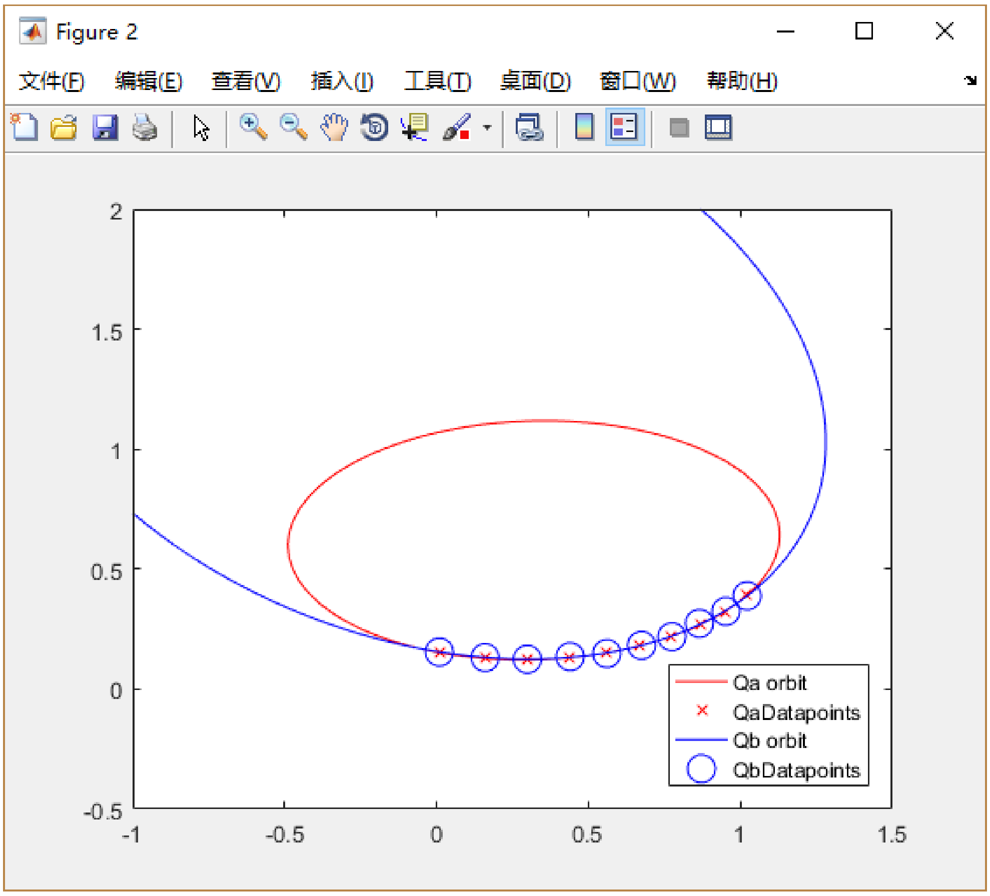

```
Sb =

    3.7874         0         0         0         0
         0    0.9430         0         0         0
         0         0    0.2093         0         0
         0         0         0    0.0224         0
         0         0         0         0    0.0064
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0


ans =

   -4.6459    1.1415    0.3889    3.3106   -0.3985
```




```
Sb =

    3.7858         0         0         0         0
         0    0.9455         0         0         0
         0         0    0.2130         0         0
         0         0         0    0.0248         0
         0         0         0         0    0.0053
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0


ans =

   -1.3275   -0.3557    0.6567    2.9701   -0.4331
```




```
Sb =

    3.7860         0         0         0         0
         0    0.9452         0         0         0
         0         0    0.2095         0         0
         0         0         0    0.0220         0
         0         0         0         0    0.0053
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0


ans =

   -2.9945    0.1585    0.5434    3.4177   -0.4559
```




```
Sb =

    3.7891         0         0         0         0
         0    0.9462         0         0         0
         0         0    0.2094         0         0
         0         0         0    0.0230         0
         0         0         0         0    0.0051
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0         0


ans =

   -1.1716   -0.6043    0.6799    3.1862   -0.4694
```