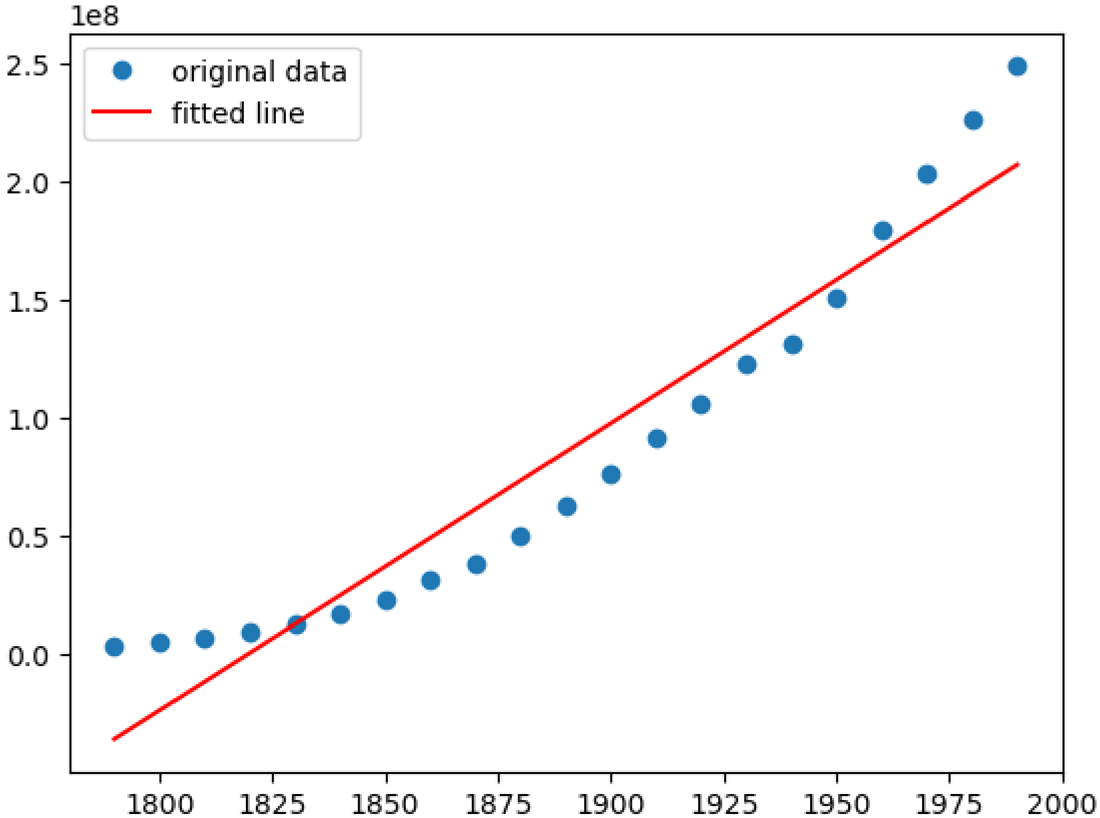
final

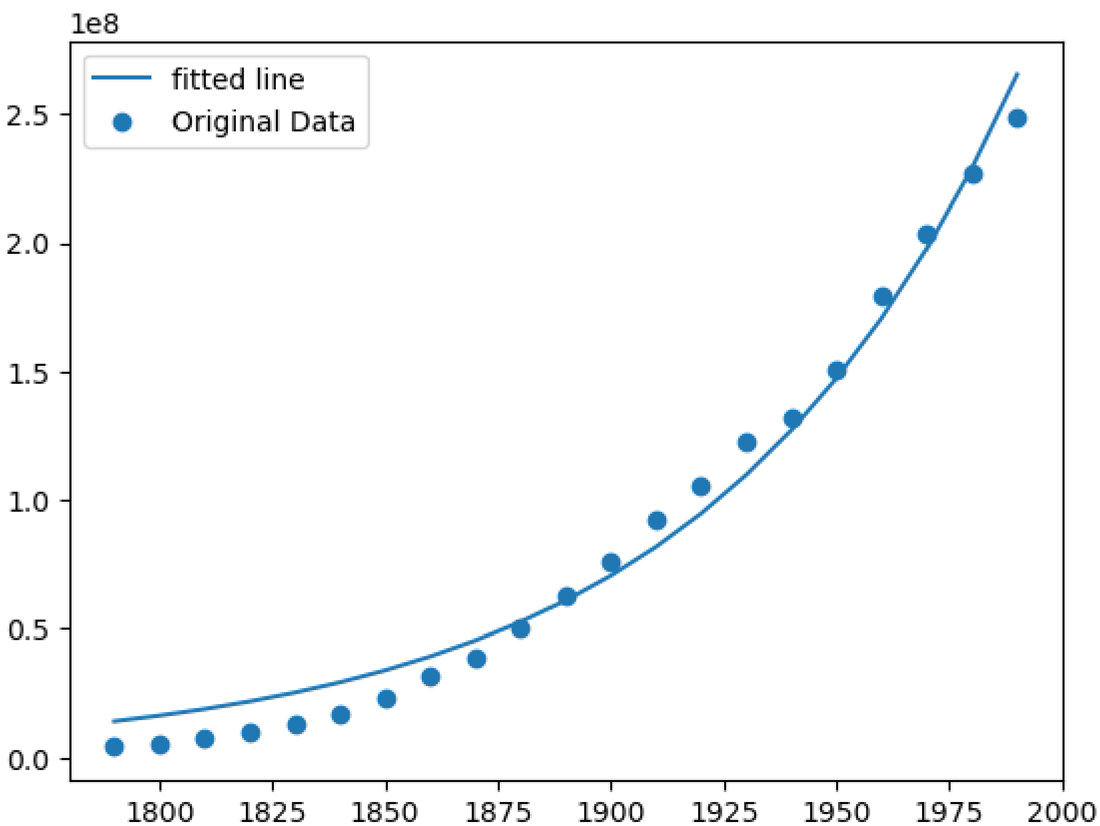
1

```
import numpy as np



data = np.loadtxt("uspop.txt")

x = data[:, 0] # 年份

y = data[:, 1] # 人口数
from scipy.stats import linregress

import matplotlib.pyplot as plt



slope, intercept, r_value, p_value, std_err = linregress(x, y)

plt.plot(x, y, 'o', label='original data')

plt.plot(x, intercept + slope*x, 'r', label='fitted line')

plt.legend()

plt.show()
```



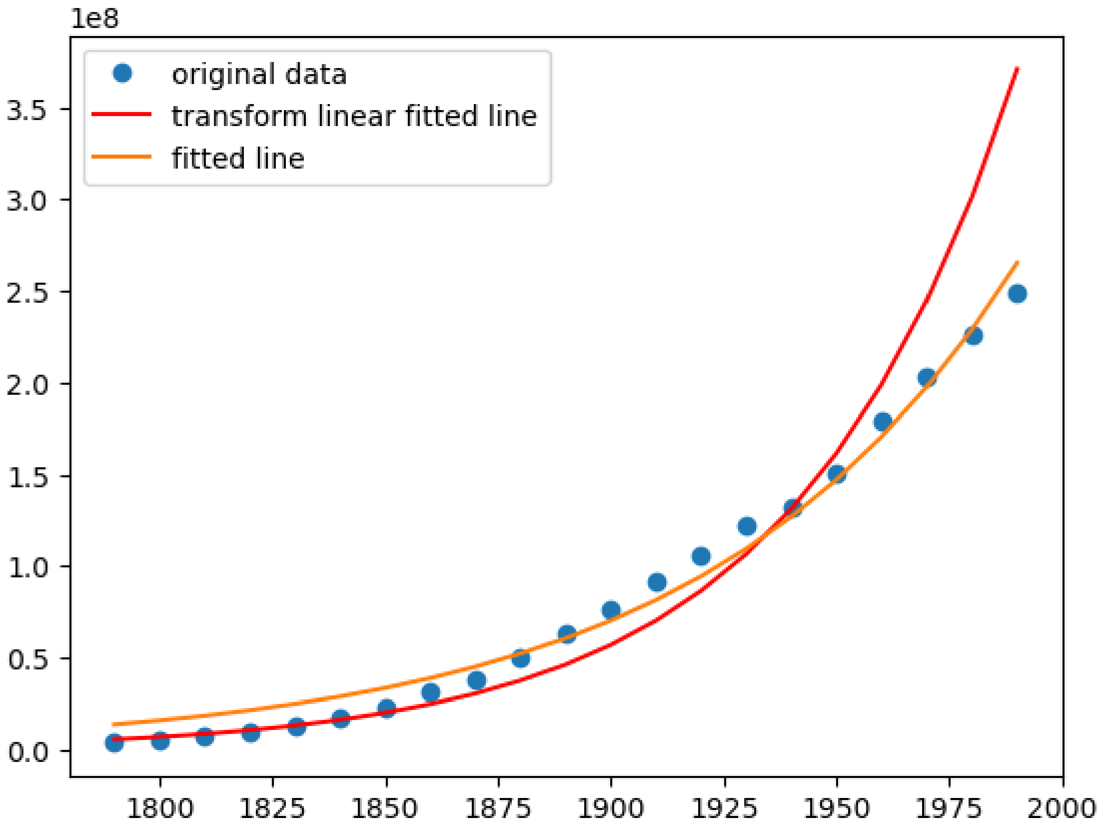

```
from scipy.optimize import curve_fit



def func(x, a, c):

    return a * np.exp(c * x)

x_scaled = x / 1000

y_scaled = y / 1e6

popt, pcov = curve_fit(func, x_scaled, y_scaled)

a_scaled, c_scaled = popt

a = a_scaled * 1e6

c = c_scaled / 1000



y_fit = func(x, a, c)
```

```
plt.plot(x, y_fit,label='fitted line')

plt.scatter(x, y, label='Original Data')

plt.legend()

plt.show()
```




```
y_log = np.log(y)

slope, intercept, r_value, p_value, std_err = linregress(x, y_log)

a = np.exp(intercept)

c = slope



plt.plot(x, y, 'o', label='original data')

plt.plot(x, a * np.exp(c * x), 'r', label='transform linear fitted line')
```

```
plt.plot(x, y_fit,label='fitted line')

plt.legend()

plt.show()
```

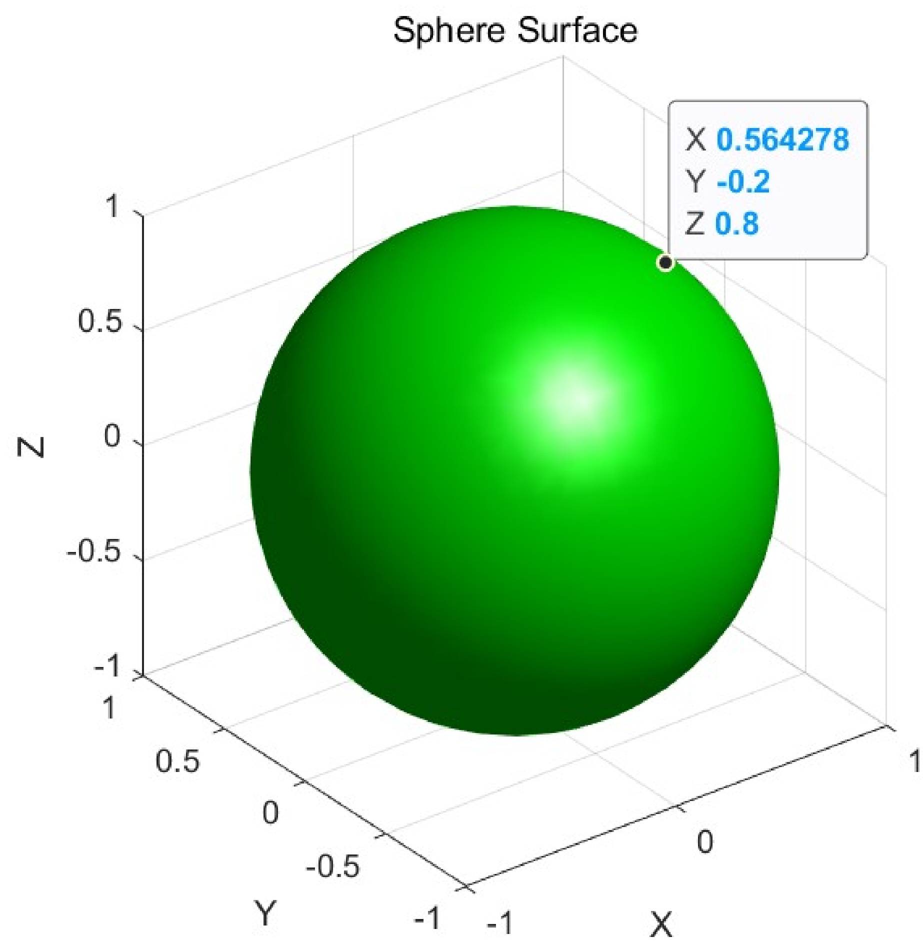


2

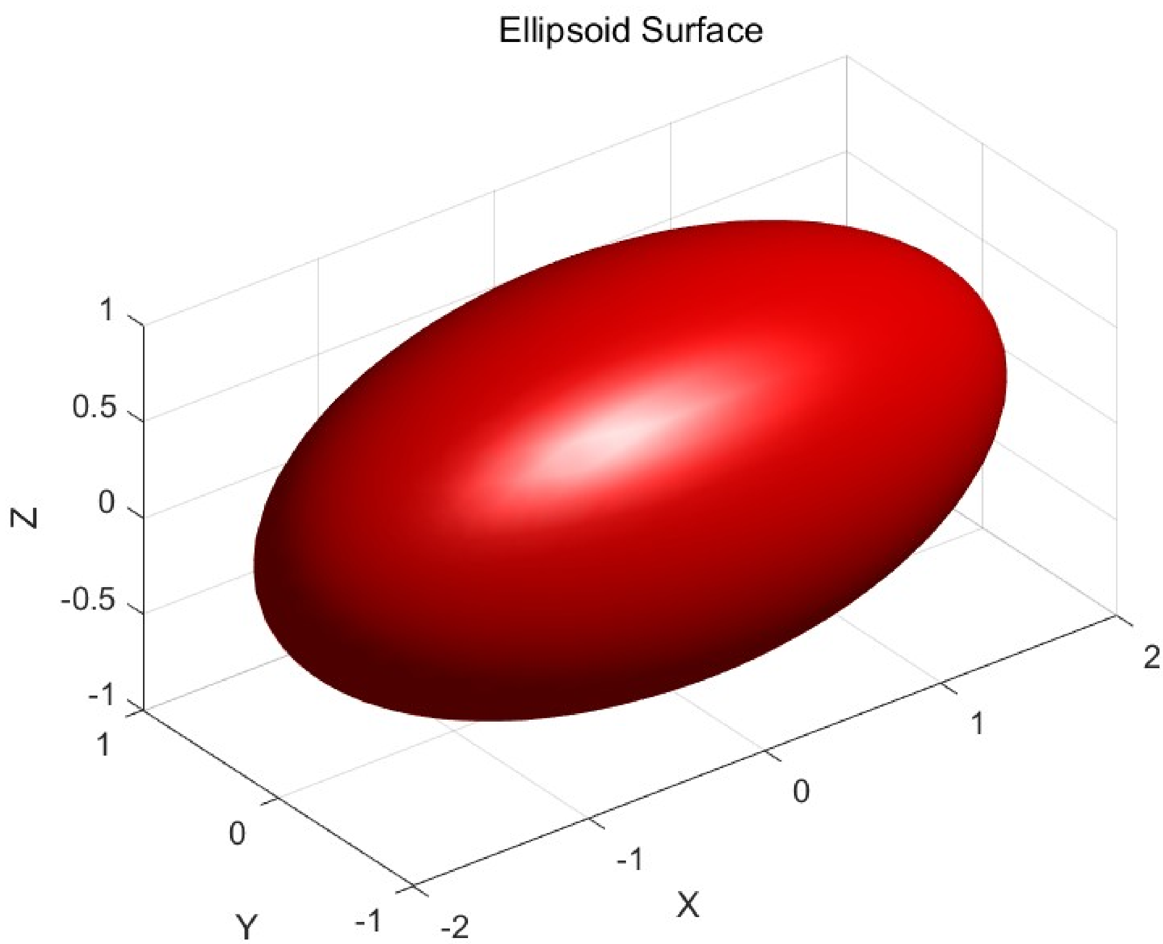
```
%球面
% 创建一个网格
[x, y, z] = meshgrid(-1:0.1:1, -1:0.1:1, -1:0.1:1);

% 计算球面的方程
radius = sqrt(x.^2 + y.^2 + z.^2);

% 创建球面
isosurface(x, y, z, radius, 1);

% 设置球面颜色为绿色
colormap([0 1 0]);

% 添加标题和标签
title('Sphere Surface');
```

```
xlabel('X');
ylabel('Y');
zlabel('Z');

% 显示图形
axis equal;
grid on;
%椭球
% 创建一个网格
[x, y, z] = meshgrid(-1:0.1:1, -1:0.1:1, -1:0.1:1);

% 计算球面的方程
radius = sqrt(x.^2 + y.^2 + z.^2);

% 创建球面
isosurface(x, y, z, radius, 1);

% 设置球面颜色为绿色
colormap([0 1 0]);

% 添加标题和标签
title('Sphere Surface');
xlabel('X');
ylabel('Y');
zlabel('Z');

% 显示图形
axis equal;
grid on;
% 椭球面
 % 创建一个网格
[x, y, z] = meshgrid(-2:0.1:2, -1:0.1:1, -1:0.1:1);

% 定义椭球的参数
a = 2; % 长轴
b = 1; % 短轴

% 计算椭球面的方程
equation = (x.^2)/(a^2) + (y.^2)/(b^2) + (z.^2)/(b^2) - 1;

% 创建椭球面
isosurface(x, y, z, equation, 0);

% 设置椭球面颜色为红色
colormap([1 0 0]);
```

```
% 添加标题和标签
title('Ellipsoid Surface');
xlabel('X');
ylabel('Y');
zlabel('Z');

% 显示图形
axis equal;
grid on;
```



Sphere Surface
X 0.564278
Y -0.2
Z 0.8
Z
X
Y
1
0.5
0
-0.5
-1



3

```
Integrate[(Sin[x] - Sin[3x] + Sin[5x]) / (Cos[x] + Cos[3x] + Cos[5x]), x]
```

```
In[1]:= Integrate[(Sin[x] - Sin[3 x] + Sin[5 x]) / (Cos[x] + Cos[3 x] + Cos[5 x]), x]
```

```
Out[1]= -Log[Cos[x]]
```

4

Lorenz Attractor

The Lorenz [attractor](#) is an attractor that arises in a simplified system of equations describing the two-dimensional flow of fluid. In the early 1960s, Lorenz accidentally discovered the chaotic behavior of this system when he found that, for a simplified system, periodic solutions of the form

$$\psi = \psi_0 sin(\frac{\pi a x}{H}) sin(\frac{\pi z}{H})$$

$$\theta = \theta_0 cos(\frac{\pi a x}{H}) sin(\frac{\pi z}{H})$$

grew for Rayleigh numbers larger than the critical value,Ra>Ra_c.Furthermore, vastly different results were obtained for very small changes in the initial values, representing one of the earliest discoveries of the so-called butterfly effect [butterfly effect].

Lorenz obtained the simplified equations

$$\begin{aligned} \dot{X} &= \sigma(Y - X) \\ \dot{Y} &= X(\rho - Z) - Y \\ \dot{Z} &= XY - \beta Z \end{aligned}$$

now known as the Lorenz equations.