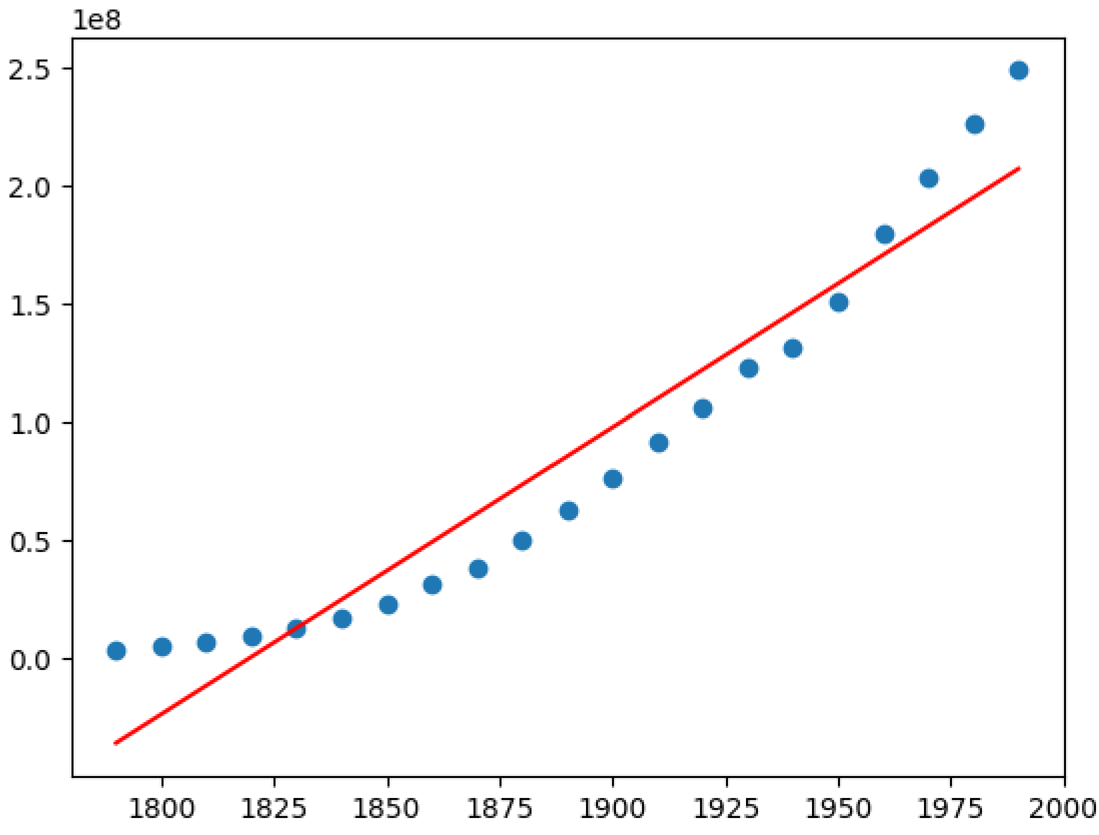
1. Python实现相关功能

i.

```
import numpy as np
import matplotlib.pyplot as plt
import scipy.stats as stats
import scipy.optimize

data = np.loadtxt('uspop.txt')
x = data[:, 0]
y = data[:, 1]
```

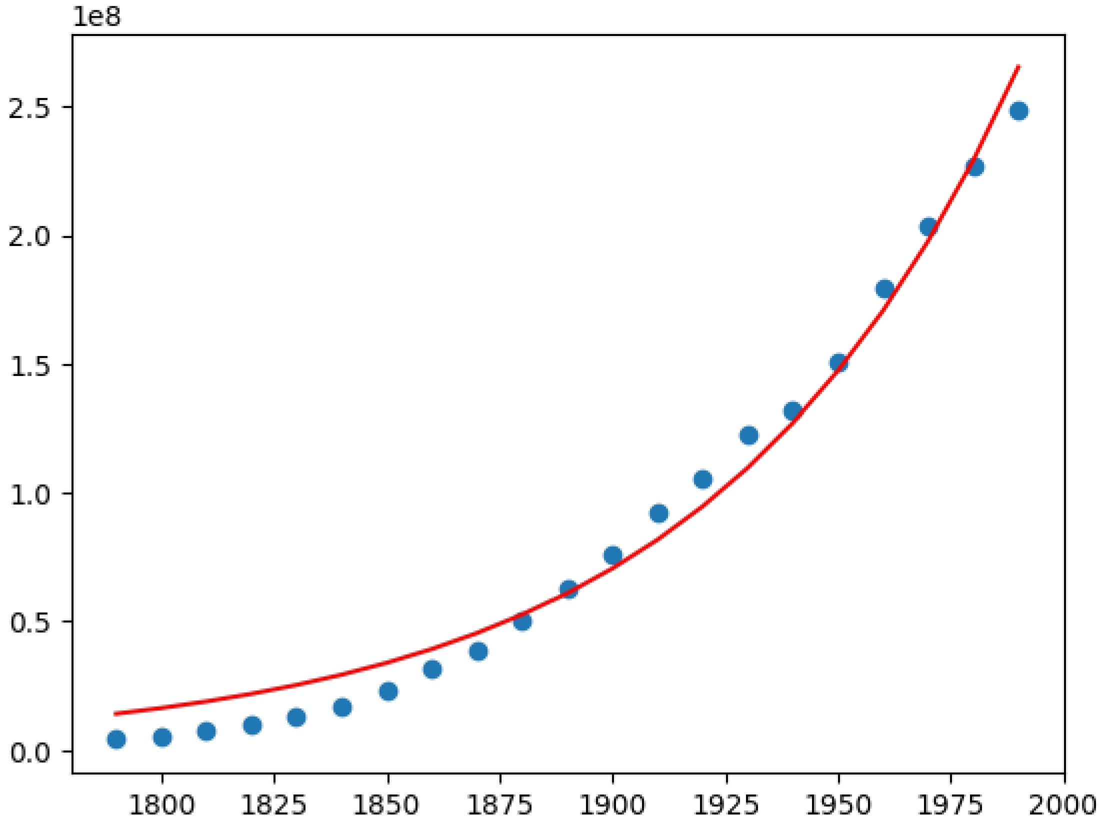
ii.

```
def y1(x, k, b):
    return k * x + b

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

plt.scatter(x, y, label='Original Data')
plt.plot(x, y1(x, slope, intercept), label=f'Linear Fit: y = {slope:.2f}x +
{intercept:.2f}', color='red')
```



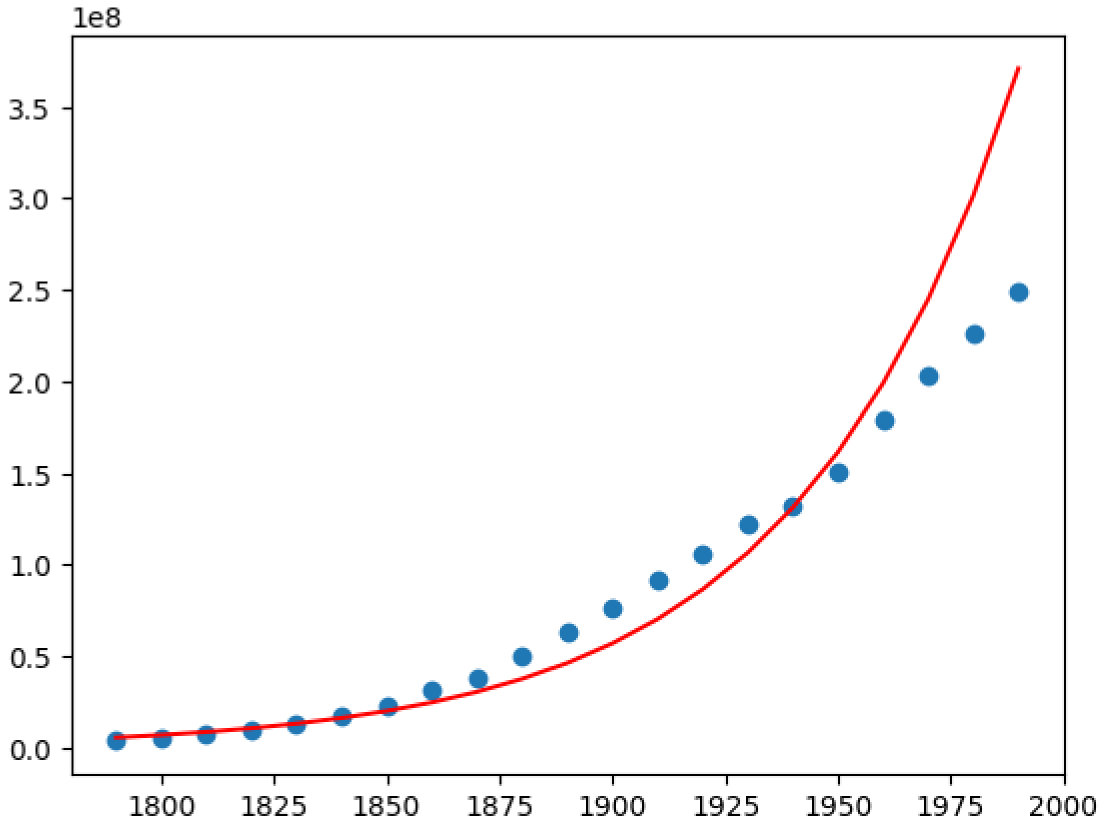
iii.

```python
def y2(x, a, c):
    return a * np.exp(c * (x - x.mean()))

params, covariance = curve_fit(y2, x, y, p0=(y.mean(), 0.01))

plt.scatter(x, y, label='Original Data')
plt.plot(x, y2(x, *params), label=f'Exponential Fit: y = {params[0]:.2f} *
exp({params[1]:.6f}(x - {x.mean()}))', color='red')
```



iv.

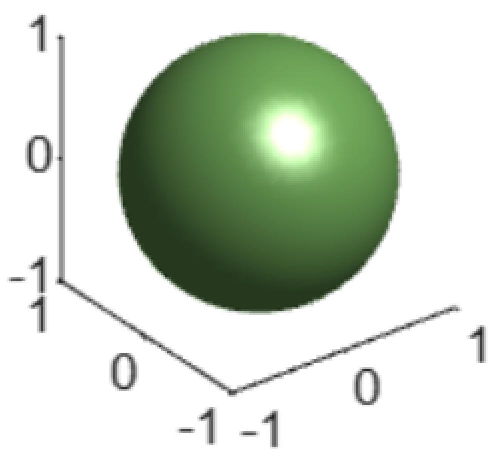
```python
B, A, _, _, _ = linregress(x, np.log(y))

plt.scatter(x, y, label='Original Data')
plt.plot(x, np.exp(A + B * x), label=f'Transformed Linear Fit: y = exp({A:.6f} +
{B:.6f}x)', color='red')
```



2. Matlab作图

i.

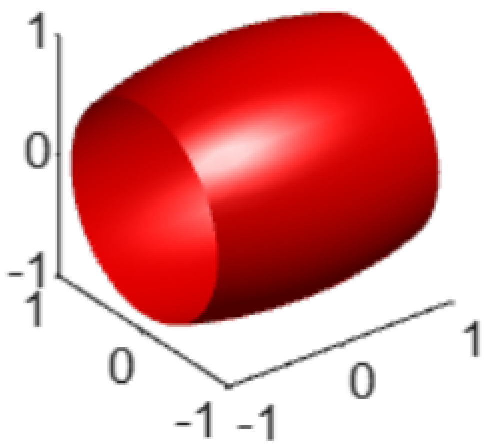
```
[x, y, z] = meshgrid(-1:0.1:1);
isosurface(x, y, z, x.^2 + y.^2 + z.^2-1, 0);
axis equal;
colormap summer;
```



ii.

```
[x, y, z] = meshgrid(-1:0.1:1, -1:0.1:1, -1:0.1:1);
a = 2; b = 1;
```

```
isosurface(x, y, z, x.^2/a^2 + y.^2/b^2 + z.^2/b^2, 1);
axis equal;
colormap([1 0 0]);
```



3. Mathematica求不定积分

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

In[3]:= Integrate[(Sin[x] - Sin[3 x] + Sin[5 x]) / (Cos[x] + Cos[3 x] + Cos[5 x]), x]
积分 正弦 正弦 正弦 余弦 余弦 余弦

Out[3]= -Log[Cos[x]]

4. LaTeX或Markdown写出文本内容

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

$$\psi = \psi_0 \sin\left(\frac{\pi a x}{H}\right) \sin\left(\frac{\pi z}{H}\right) \theta \qquad = \theta_0 \cos\left(\frac{\pi a x}{H}\right) \sin\left(\frac{\pi z}{H}\right)$$

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.

Lorenz obtained the simplified equations

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

now known as the Lorenz equations.