```python
#Matematyka Konkretna
#Laboratorium 1
#Biegun Daniel https://github.com/S1Daniel/MK
#Wariant 2

from matplotlib.image import imread
import matplotlib.pyplot as plt
import numpy as np
import os
plt.rcParams['figure.figsize'] = [16,8]
A = imread('2.webp')
X = np.mean(A,-1)

img = plt.imshow(X)
img.set_cmap('gray')
plt.axis('off')

U, S, VT = np.linalg.svd(X,full_matrices=False)
S = np.diag(S)


r=230
Xapprox = U[:,:r]@S[0:r,:r]@VT[:r,:]
plt.figure(0)
img = plt.imshow(Xapprox)
img.set_cmap('gray')
plt.axis('off')
plt.title('r='+str(r))
plt.show()

plt.figure(1)
plt.semilogy(np.diag(S))
plt.title('Singular Values')
plt.show()

plt.figure(2)
cumulative_sum_ratio = np.cumsum(np.diag(S)) / np.sum(np.diag(S))
plt.plot(cumulative_sum_ratio)
plt.title('Singular Values: Cumulative Sum')
plt.show()
index_x = np.argmin(cumulative_sum_ratio <= 0.9)
```

r=230

Singular Values

Singular Values: Cumulative Sum