

```
from google.colab import files

uploaded = files.upload()
for file_name in uploaded.keys():
    print(f'Загружен файл {file_name}')
```

файлы не выбраны Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving results.csv to results.csv
Загружен файл results.csv

```
import pandas as pd
import matplotlib.pyplot as plt

S_EXACT = 0.9445171859

df = pd.read_csv("results.csv")

df = df[df["seed"] == 123456].copy()
df["abs_err"] = (df["Shat"] - S_EXACT).abs()
df["rel_err"] = df["abs_err"] / S_EXACT

plt.figure()
for rect in ["narrow", "wide"]:
    sub = df[df["rect"] == rect].sort_values("N")
    plt.plot(sub["N"], sub["Shat"], label=rect)
plt.axhline(S_EXACT)
plt.xlabel("N")
plt.ylabel("S")
plt.title("Оценка площади S от N")
plt.legend()
plt.tight_layout()

plt.figure()
for rect in ["narrow", "wide"]:
    sub = df[df["rect"] == rect].sort_values("N")
    plt.plot(sub["N"], sub["rel_err"], label=rect)
plt.yscale("log")
plt.xlabel("N")
plt.ylabel("|S - S_exact| / S_exact")
plt.title("Относительная ошибка от N")
plt.legend()
plt.tight_layout()
```

