Homework 02

Prerequisites: read help about 'plot', 'linspace', and 'print'. Do not forget about test cases.

Problem 1 (2 points)

Plot the function $f(x) = \exp(-x^2/10) * \sin(x)$ for 400 linearly spaced points of x in the region from 0 to 2π. Points should be joined with solid lines.

Do not use any cycles or loops. Include the resulting figure in your report.

Problem 2 (2 points)

Plot functions x^2 and $x^3/2 + 0.5$ for 100 linearly spaced points of x in the region from -1 to $+1$. x^2 should be red solid line and x^3 should be black dashed line. Do not worry about black and white printouts as long as colors are present in pdf report file.

Do not use any cycles or loops. Include the resulting figure in your report.

Problem 3 (3 points)

Write a script which calculates

$$1 + \sum_{i=1}^{N} \frac{1}{x^i} \tag{1}$$

for $N = 10$ and $x = 0.1$

Use loops as much as you wish from now.

Problem 4 (3 points)

Write a script which calculates for $N = 100$.

$$S_N = \sum_{k=1}^{N} a_k \tag{2}$$

where $a_k = 1/k^{2k}$ for odd k and $a_k = 1/k^{3k}$ for even k.

Hint: you may find **mod** function useful to check for even and odd numbers.

Problem 5 (5 points)

Write a function `mycos` which calculates a value of a $\cos(x)$ at the given point x via the Taylor series up to N members. Define your function as

```
function cosValue = mycos(x, N)
```

Does it handle well the situation with large x values? Take $x = 10\pi$ for example. How far do you need to expand the Taylor series to get absolute precision of 10^{-4}, what value of N do you find reasonable (no need to state it beyond one significant digit), why so?

Problem 6 (5 points)

Download data file "hw02dataset.dat" from the class webpage. It represents result of someone's attempt to find the resistance of a sample via measuring voltage drop (V), which is the data in the 1st column, and current (I) listed in the 2nd column passing through the resistor at the same conditions. Judging by the number of samples it was an automated measurement.

- Using Ohms law $R = V/I$ find the resistance (R) of this sample (no need to print it out for each point at this step)
- Estimate the resistance of the sample (i.e. find the average resistance) and estimate the error bars of this estimate (i.e. find the standard deviation).

For standard deviation use the following definition

$$\sigma(x) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2} \tag{3}$$

where x is the set (vector) of data points, $\bar{x}$ its average (mean), and N is the number of the points in the set.

Do not use standard built-in `mean` and `std` functions in your solution. You need to make your own code to do it. But feel free to test against these matlab functions.

Note: read help for matlab's `std` it has an option and you might want to know about it.