SysID Lab 1: Familiarization with Matlab

Exercise 1: Some basic vector manipulations

- Create a vector containing the natural numbers from 1 to 30 in reverse, descending order.
- Replace the elements having odd indices with their sine.
- Sort the elements having even indices in ascending order (by replacing their current values with their sorted values).

Exercise 2: Function approximation

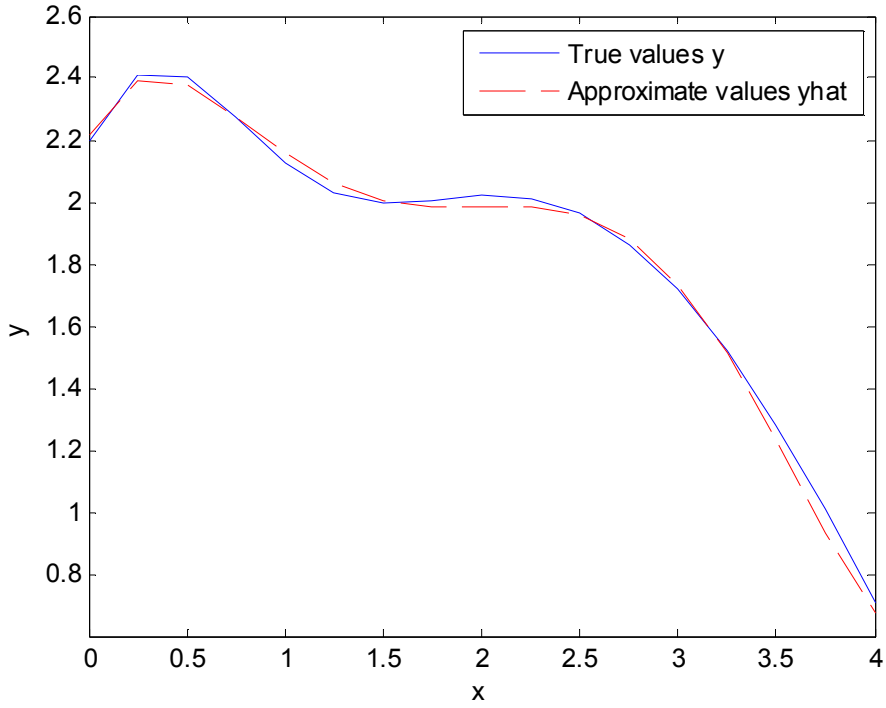
Write a script that:

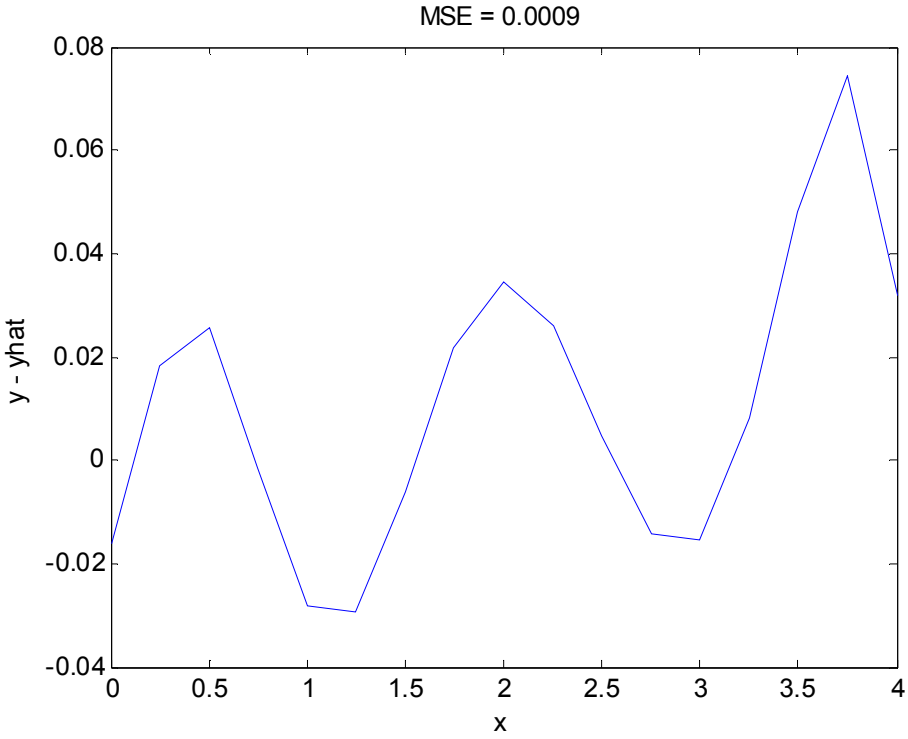
- Generates a vector of values *x* between 0 and 4, equidistantly spaced with a distance of 0.25.
- Computes a vector of corresponding *y* values, where:
  $y = f(x) = 2\exp(-x^2) + 2\sin(0.67x + 0.1)$
- Computes a vector of corresponding $\hat{y}$ values, where $\hat{y}$ are approximations computed with the polynomial *g(x):*

  $\hat{y} = g(x) = 2.2159 + 1.2430x - 2.6002x^2 + 1.7223x^3 - 0.4683x^4 + 0.0437x^5$

  (this polynomial was fitted beforehand to the function by the teacher).
- Plots the true values *y* as well as their approximations $\hat{y}$, as a function of *x.*
- Computes an error vector with the formula $e = y - \hat{y}$ and plots it on another figure.
- Computes the mean squared error of the approximation:
  $\frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y}_i)^2$
  and displays its value in the title of the error figure.

If everything works correctly, you should obtain graphs similar to those on the following page.


True values y
Approximate values yhat
y
x
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0
0.5
1
1.5
2
2.5
3
3.5
4


MSE = 0.0009
y - yhat
x
0.08
0.06
0.04
0.02
0
-0.02
-0.04
0
0.5
1
1.5
2
2.5
3
3.5
4